SCHOOL OF COMPUTING SCIENCE AND ENGINEERING

GALGOTIAS UNIVERSITY

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COURSE BOOK
SCSE -2020
Volume-I

Curriculum and syllabus for School of Computing Science and Engineering

GALGOTIAS UNIVERSITY
(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

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GALGOTIAS UNIVERSITY
(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

School of Computing Science and Engineering

Program: B. Tech (Hons) in Computer Science & Engineering

Scheme: 2020 – 2021

Galgotais University												
School: SCSE												
Program Name: B. TECH CSE												
Academic Session 2020-24												
Year :	2020-24 batch					Semester						I
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continuous Assessment)	ETE	Marks
1	Energy Sources and Audit	1	0	0	1	1	20	30	50			100
2	Data Analytics /(Excel and Tableu)	1	0	0	1	1	20	30	50			100
3	AI Fundamentals	2	0	0	2	2	20	30	50			100
4	Differential / Vector calculus and Matrices	3	0	0	3	3	20	30	50			100
5	Programming for Problem Solving C	1	0	4	3	3	20	15	30	15	20	100
6	Communication Skill (BEC-1)	3	0	0	3	3	20	30	50			100
7	Engineering Physics	2	0	0	2	2	20	30	50			100
8	Bio Systems in Engineering	2	0	0	2	2	20	30	50			100
9	AC DC Circuits	2	0	2	4	3	20	15	30	15	20	100
Practical/Training												
10	Engineering Physics-lab	0	0	2	2	1				70	30	100
	Total	17	0	8	23	21	180	240	410	100	70	1000

Year :	2020-24 batch						Semester					II
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continous Assessment)	ETE	Marks
1	Integral and Multiple Calculus	2	0	0	2	2	20	30	50			100
2	Partial Differential Equations	1	0	0	1	1	20	30	50			100
3	Embedded Technology and IoT	1	0	2	2	2	20	15	30	15	20	100
6	Creativity, Innovation and Entrepreneurship	1	0	2	3	2	20	15	30	15	20	100
7	Introduction to Digital System	2	0	2	3	3	20	15	30	15	20	100
8	Data Structure Using C	2	0	2	3	3	20	15	30	15	20	100
9	Electrical- AC/DC Machine	2	0	2	4	3	20	15	30	15	20	100
Practical/Training												
10	Liberal and Creative Arts	0	0	1	1	0.5				70	30	100
11	Environmental Science	0	0	1	1	0.5				70	30	100
12	Waste Management	0	0	2	2	1				70	30	100
13	Application of Python Programming	0	0	2	2	1				70	30	100
14	Digital Fabrication	0	0	2	2	1				70	30	100
	Total	11	0	12	20	20	140	135	250	145	130	800

Year :	2020-24 batch						Semester					III
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continous Assessment)	ETE	Marks
1	Data Structures & Algorithms	2	0	2	4	3	20	15	30	15	20	100
2	Data Communication and Networking	2	0	2	4	3	20	15	30	15	20	100
3	Data Base management System	2	0	2	4	3	20	15	30	15	20	100
4	Discrete Mathematics	3	1	0	4	4	20	30	50			100
5	Java Programming	0	0	4	4	2				70	30	100
Elective												
PE-I (6)	Cryptographic Fundamentals	2	0	2	4	3	20	15	30	15	20	100
	Software Project Management	2	0	2	4	3	20	15	30	15	20	100
	Cyber Security	2	0	2	4	3	20	15	30	15	20	100
	Optimization Techniques	2	0	2	4	3	20	15	30	15	20	100
	Artificial Intelligence	2	0	2	4	3	20	15	30	15	20	100
Practical/Training												
7	English Profiency and Aptitude Building -2	0	0	4	4	2				70	30	100
8	Technical Training-I	0	0	4	4	2				70	30	100
9	Project-I	0	0	0	0	1				70	30	100
10	Industrial/Summer Training -I	0	0	0	0	2				70	30	100
	Total	11	1	20	32	25	100	90	170	410	230	1000

Year :	2020-24 batch					Semester						IV
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continuous Assessment)	ETE	Marks
1	Operating System	2	0	2	4	3	20	15	30	15	20	100
2	Computer Graphics	2	0	2	4	3	20	15	30	15	20	100
3	Analysis and Design of Algorithms	3	0	0	4	3	20	30	50			100
4	Maths (elective)	3	0	0	3	3	20	30	50			100
5	Python Programming	0	0	4	4	2				70	30	100
Elective												
PE-II (6)	Internet of Things	2	0	2	4	3	20	15	30	15	20	100
	Data Sciences	2	0	2	4	3	20	15	30	15	20	100
	Data Mining and Warehousing	2	0	2	4	3	20	15	30	15	20	100
	Bio Informatics	2	0	2	4	3	20	15	30	15	20	100
	Network Design and Management	2	0	2	4	3	20	15	30	15	20	100
Practical/Training												
7	English Profiency and Aptitude Building -3	0	0	4	4	2				70	30	100
8	Technical Training-II	0	0	4	4	2				70	30	100
9	Project-II	0	0	0	0	2				70	30	100
	Total	12	0	18	31	23	100	105	190	325	180	900

Year :	2020-24 batch								Semester			V
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continous Assessment)	ETE	Marks
1	Maths (elective)	3	0	0	3	3	20	30	50			100
2	Theory of Computation	3	0	0	3	3	20	30	50			100
3	Software Engineering & Testing Methodologies	2	0	4	6	4	20	15	30	15	20	100
Programme Elective -II												
PE-III (4)	Microprocessor & Interfacing	2	0	2	4	3	20	15	30	15	20	100
	Quantum Computing	2	0	2	4	3	20	15	30	15	20	100
	Soft Computing	2	0	2	4	3	20	15	30	15	20	100
	Machine Learning	2	0	2	4	3	20	15	30	15	20	100
	Modeling and Simulation	2	0	2	4	3	20	15	30	15	20	100
Programme Elective -III												
PE-IV (5)	Cloud Application Development	2	0	2	4	3	20	15	30	15	20	100
	Adhoc & Sensors Netwoks	2	0	2	4	3	20	15	30	15	20	100
	Statistical Analysis using R	2	0	2	4	3	20	15	30	15	20	100
	Block Chain	2	0	2	4	3	20	15	30	15	20	100
	Software Defined Network	2	0	2	4	3	20	15	30	15	20	100
Practical/Training												
6	Technical Training-III	0	0	4	4	2				70	30	100
7	Project-III	0	0	0	0	1				70	30	100
8	English Profiency and Aptitude Building -4	0	0	4	4	2				70	30	100
9	Industrial/Summer Training -II	0	0	0	0	2				70	30	100
TOTAL		12	0	16	28	23	100	105	190	325	180	900

Year :	2020-24 batch								Semester			VI
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continous Assessment)	ETE	Marks
1	Math-Ele-4 (Basket)	3	0	0	3	3	20	30	50			100
2	Web Technology	1	0	2	3	2	20	15	30	15	20	100
3	Compiler Design	3	0	0	3	3	20	30	50			100
Programme Elective -V												
PE-V (4)	Digital Signal Processing	2	0	2	4	3	20	15	30	15	20	100
	Object Oriented Analysis & Design	2	0	2	4	3	20	15	30	15	20	100
	E-Business	2	0	2	4	3	20	15	30	15	20	100
	Network Operating System	2	0	2	4	3	20	15	30	15	20	100
	Robotics Process automation	2	0	2	4	3	20	15	30	15	20	100
University Elective-I												
UE-I (5)	Enterpreneurship	3	0	0	3	3	20	30	50			100
	Project Management	3	0	0	3	3	20	30	50			100
	Managerial Economics	3	0	0	3	3	20	30	50			100
	Equity & Portfolio Management	3	0	0	3	3	20	30	50			100
Practical/Training												
6	Technical Training-IV	0	0	6	6	3				70	30	100
7	Project-IV	0	0	0	0	2				70	30	100
8	Campus to Corporate	0	0	4	4	2				70	30	100
TOTAL		12	0	14	26	21	100	120	210	240	130	800

Year :	2020-24 batch								Semester			VII
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continous Assessment)	ETE	Marks
Programme Elective -VI												
PE-VI(1)	Digital System Design using VHDL	2	0	2	3	3	20	15	30	15	20	100
	Advanced Computer Networks	2	0	2	3	3	20	15	30	15	20	100
	Enterprise Resource Planning	2	0	2	3	3	20	15	30	15	20	100
	Deep Learning	2	0	2	3	3	20	15	30	15	20	100
	UI&UX	2	0	2	3	3	20	15	30	15	20	100
University Elective-II												
UE-II (2)	Banking system	3	0	0	3	3	20	30	50			100
	Corporate Laws and Policy	3	0	0	3	3	20	30	50			100
	Export and Import Policy	3	0	0	3	3	20	30	50			100
Practical/Training												
3	Technical Training-V	0	0	6	6	3				70	30	100
4	Capstone Design -Phase 1	0	0	12	12	6				70	30	100
TOTAL		5	0	20	24	15	40	45	80	155	80	400

Year :	2020-24 batch									Semester		VIII
Subject	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		L	T	P	Total Hours		IA	MTE	ETE	IA (Continous Assessment)	ETE	Marks
Practical/Training												
1	Industrial Internship	0	0	12	12	6				70	30	100
2	Capstone Design -Phase 1	0	0	12	12	6				70	30	100
TOTAL		0	0	24	24	12	0	0	0	140	60	200
		Total Credits:				160						

Detailed Syllabus

Name of The Course	Computer Programming and Problem Solving			
Course Code	**CSE101**			
Prerequisite	NA			
Corequisite	NA			
Antirequisite	NA			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:
• **Provide an overview of computers and problem solving methods using 'C' language**
• **Serve as a foundation for the study of programming languages.**
• **Learn to develop program using 'C' language.**
• **To develop the software using the concept of 'C' Language.**

Course Outcomes

CO1	**The student would learn the basic concepts of Computer and acquire various problem solving techniques such as algorithms and flowchart.**
CO2	To understand the basic terminology used in programming and able to write, compile and debug programs in 'C' programming language and to develop program logics using decision structures and loop structures.
CO3	To develop program logic using the concept of arrays and arrays of characters.
CO4	To understand the modular techniques such as functions and difference between call by value and call by reference methods.
CO5	Implement and develop small projects using the concept Structures in C programming language.
CO6	Understanding of latest advances and its applications in Computer Programming and Problem Solving.

Text Book (s)

- **Alexis Leon and Mathews Leon (2001), Introduction to Information Technology, Tata McGraw-Hill.**
- **R.G. Dromey (2001), How to Solve it by Computer, Prentice Hall of India.**
- **Al Kelley and Ira Pohl (1998), A Book on C Programming in C, 4th Edition, Pearson Education.**

Reference Book (s)

- **E. Balagurusamy7th Edition, Programming ANSI C, McGraw-Hill**
- **Brian W. Kernighan and Dennis M. Ritchie, The C programming Language, Prentice-Hall in 1988**
- **Byron Gottfried, Programming with C, Schaum's Outline**

Unit-1 Introduction to Computers and Algorithms	**9 lecture hours**
Parts of a computer – Overview of operating systems, assembler, compilers, interpreters and programming languages. Algorithms for exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer, flowchart.	
Unit-2 Constructs of C	**8 lecture hours**
Lexical elements – Operators - data types – I/O statements – format specifications – control statements – decision making and Loop control structure: while loop, for loop, do-while loop, nested loop, break, continue, case control structure, go to, exit statement	
Unit-3 Arrays	**8 lecture hours**
Array handling in C – declaration – single dimensional arrays, two – dimensional arrays, multi-dimensional arrays, sorting and searching on single and two dimensional arrays. Array order reversal, string handling function, manipulation on strings.	
Unit-4 Functions	**8 lecture hours**
Prototype – declaration - arguments (formal and actual) – return types – types of functions difference between built-in and user-defined functions.	

Unit-5 Structures	**7 lecture hours**
Declarations - nested structures- array of structures - structure to functions - unions- difference between structure and union.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Introduction to Computer Science & Engineering**			
Course Code	**BCSE1001**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Objectives:
• **Provide an overview of computers and different development areas.**
• **Learn and Identify different domains emerging.**
• **Develop for student seek and idea about Internet and application.**
• **Learn about the Data Analysis, Business Process and other fields.**

Course Outcomes

CO1	Understand the Fundamental of Computer and Programming Languages.
CO2	Understand when and how to take decisions, to compare and iterate, to how chose their career and line of action for future studies.
CO3	Recognize the Domain of Computers like grid, distributed, cloud and fogg computing.
CO4	To know about the Information system gateway and terminology.
CO5	Introduction about Data and Data Analysis with business process.
CO6	Develop idea about Internet of things and its applications.

Text Book (s)
• **Computer Fundamental – By P. K. Sinha**
• **Cloud Computing: Concepts, Technology & Architecture – By ERL**
• **"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)**
• **Introduction to Information Security and Cyber Law – By Surya Prakash Tripathi, Ritendra Goel, Praveen Kumar Shukla**

Reference Book (s)
1. **E. Balagurusamy 7th Edition, Programming ANSI C, McGraw-Hill**
2. **"Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)**
3. **Cloud Computing: Business Trends and Technologies, Igor Faynberg, Kui-Lan Lu, and Dor Skuler, Wiley, 2015**

Unit-1 Introduction Computer Fundamental	**6 hours**
Block Diagram of Computer System, Component of system, Instruction, Instruction flow. Introduction of Software, Classification of software, Languages and its Generations, Flow Diagram, Algorithm, Pseudo codes. Evolution of Computer hardware and their effect in the fields with relevance of size, speed and output.	

Unit-2 Domains of Computing	**6 hours**
Computers Application, Different era and field of computation with time, Advancement in computer field, Introduction to computing-grid, distributed, cloud, fog, Virtualization Green Computing , Operating system, difference between windows and Unix family, Basic Linux command-ls, cd, mv, man, mkdir, rmdir, touch, cat. Introduction to open source software.	
Unit-3Information System	**4 Lectures**
Introduction to Standards, Types of Standards; Open Standard, Closed Standard, Information Technology, Introduction to data communication and networking, standards and protocols. SMTP, POP3, DNS, HTPS, IPV4, IPV6, cyber Security, Viruses	
Unit-4Data Analysis	**5 Lectures**
Data, Different types of Data and data Analysis, Business Analysis, Big-Data, Business and healthcare, Banking IT Infrastructure. Demonstration of Web Page analysis using goggle Page speed like pingdoom.com.	
Unit-5 Internet of Things	**5 Lectures**
Internet, Introduction to IOT, Internet technologies, Advancement and applications in IOT, Professional society and association in computing, ethics	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Engineering Chemistry Lab**
Course Code	**BCH152**
Prerequisite	

Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Outcomes

CO1	**Employ the volumetric titrations techniques used in chemistry laboratory for analysis.**
CO2	Analyse to differentiate between hard and soft water using complex metric titration.
CO3	Calculate the percentage of dissolved oxygen in water sample.
CO4	Identify the viscosity of liquid using Ostwald viscometer.
CO5	Analyse the Carbohydrate and protein in given organic compound.

List of Experiments
• **To determine the strength of ferrous ions in the given sample of Mohr'ssalt by using KMnO4 as a self-indicator.**
• **To estimate the total permanent Hardness of the given hard water sample. An approximately 0.01M solution of EDTA are provided.**
• **Estimate the amount of Nickel ion in the given sample solution by complex- metric titration.**
• **To Determine the Alkalinity of a given Water Sample.**
• **To estimate the amount of Zinc in the given solution by using a standard solution of Potassium Ferro cyanide**
• **Estimate the amount of ferrous iron in the whole of the given ferrous Solution using external indicator**
• **To estimate the amount of Copper present in the given solution using a standard solution by provided hypo solution.**
• **To find out the viscosity of a given liquid using Ostwald's viscometer.**
• **To find out the amount of dissolved oxygen in the given sample of water.**
• **(a)Identify element N, S and Halogen**
(b) Qualitative analysis of carbohydrates, lipids and proteins.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	**ENGINEERING PHYSICS LAB**			
Course Code	**BPH151**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**

Course Outcomes

CO1	Analyze the physical principle involve in the various instruments and relate them to new applications.
CO2	Operate CRO and various optical instruments such as- spectrometer, travelling microscope and speedometer.
CO3	Calculate the physical constants by various methods such as- Planck's constant, wavelength of monochromatic light, angle of prism and realize the accuracy in measurements.
CO4	Develop the individual and team work for the performance of scientific works.
CO5	Develop the skill for making scientific graphs, error analysis and measurement technology used in engineering.

Engineering Physics Lab (PHYS BPH 151)

LIST OF EXPERIMENTS
• **To draw the hysteresis curve (B-H curve) of a given sample of ferromagnetic material and to determine retentivity, coercivity and hysteresis loss.**
• **To determine the frequency of alternating current (AC) mains using Sonometer.**

• **To determine Planck's constant using Light Emitting Diode (LED).**
• **To find the wavelength of monochromatic light with the help of a plane transmission diffraction grating and spectrometer.**
• **To Verify the Stefan's law by electrical method.**
• **To determine the wavelength of sodium light by Newton's rings.**
• **To determine the wavelength of He-Ne laser source using diffraction grating.**
• **To determine the resolving power of telescope and to verify the Rayleigh's criterion of resolution.**
• **To determine the low resistance by Carrey Foster's bridge.**
• **To study the characteristics of solar cell.**
• **To calibrate the ammeter and galvanometer with the help of Galvanometer.**
• **To study the polarization of light by reflection and to verify the Brewster's law.**
• **To find the wavelength of monochromatic light with the help of Fresnel's Biprism.**

Name of The Course	**Basic English**				
Course Code	SLBT 1001				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**

	2	0	0	2

Course Objectives:
1. To enhance knowledge of English grammar.
2. To help improve English communication skills.
3. To use quantitative methods for problem solving.

Course Outcomes

CO1	**Construct grammatically correct sentences for effective communication.**
CO2	Construct grammatically correct sentences for effective communication.
CO3	Enhance self-awareness for the purpose of self-improvement.
CO4	Attaining initial knowledge of Quantitative Aptitude for problem solving.

Text Book (s):SLLL's own text book

Reference Book (s)
1. Practical English Usage - ISBN: 019431197X
2. Learning Spoken English - ©2012 by Lynn Lundquist - ASIN: B0094XNOPW
3. Essential English Grammar: A Self-Study Reference and Practice Book for Elementary
4. 4. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
5. Quicker Maths , M Tyra
6. Quantitative Aptitude, Abhijeet Guha
Unit I: Introduction and Greetings **2 lectures** ● Orientation and Ice- breaking Activities ● SWOT Analysis

Unit II: English Grammar **4 lectures** • Parts of Speech – Orientation • Parts of Speech (LSRW) • Speaking Skills
Unit III: Quantitative Aptitude **6 lectures** • Vedic Mathematics • Shortcuts to Calculations • Number Systems

Course Outcomes

CO1	Describe **the SCILAB code for solving mathematical problem and** utilize **different function loops (if else, while , for) in SCILAB code.**
CO2	**Write** a SCILAB code of matrix with different operations and **find** a inverse & transpose of a matrix.
CO3	**Write** a SCILAB code for plotting a graph of 2 dimensional & 3 dimensional figures.
CO4	**Write** a SCILAB code of expansion of function in Taylor's series & Fourier Series with different wave forms.
CO5	**Write** a SCILAB code for computing double and triple integrals in Cartesian coordinates and **identifying** the critical points of 2-D and 3-D. surface.

List of Experiments

Introduction to Scilab and Basic syntax, Mathematical Operators, Predefined constants, Built in functions at SCILAB platform.

SCILAB -CODE for find addition, subtraction, multiplication and division of two matrices , transpose of a matrix and inverse of a non singular matrix.

SCILAB -CODE for programming -Functions - Loops - Conditional statements - Handling .sci files.

SCILAB -CODE for 2-D : circle, parabola, ellipse and hyperbola and 3-D surfaces: Planes, Sphere, Cylinder, Paraboloid, Ellipsoid, Hyperboloid, cone.

SCILAB -CODE to find expansion of functions in Taylor series.

SCILAB -CODE for Fourier series expansion of different wave forms and comparison with the original function.

SCILAB -CODE for identifying the critical points of 2-D and 3-D. surface.

SCILAB -CODE for computing double integrals in Cartesian coordinates.

SCILAB -CODE for computing triple integrals in Cartesian coordinates.

SCILAB –CODE for computing and plotting grad of scalar point function .

SCILAB –CODE for computing and plotting divergence of vector point functions.

SCILAB –CODE for computing and plotting curl of Vector point functions.

• **To determine the strength of ferrous ions in the given sample of Mohr'ssalt by using KMnO4 as a self-indicator.**
• **To estimate the total permanent Hardness of the given hard water sample. An approximately 0.01M solution of EDTA are provided.**
• **Estimate the amount of Nickel ion in the given sample solution by complex- metrictitration.**
• **To Determine the Alkalinity of a given Water Sample.**
• **To estimate the amount of Zinc in the given solution by using a standard solution of Potassium Ferro cyanide**
• **Estimate the amount of ferrous iron in the whole of the given errors Solution using external indicator**
• **To estimate the amount of Copper present in the given solution using a standard solution by provided hypo solution.**
• **To find out the viscosity of a given liquid using Ostwald's viscometer.**
• **To find out the amount of dissolved oxygen in the given sample of water.**

• **(a)Identify element N, S and Halogen**
(b) Qualitative analysis of carbohydrates, lipids and proteins.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	Product Design using Graphics			
Course Code	**BTME1002**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Outcomes

CO1	**Understand the concept and principles of engineering graphics in product design.**
CO2	Make isometric and orthographic projection of solids along with free hand sketching
CO3	Develop a solid model using AutoCAD
CO4	Make a solid model for a given assembly using AutoCAD.
CO5	Apply the concepts and techniques learnt in the course to make hands-on project.

COURSE CONTENT
Unit I: Introduction – Understanding the Concept of Product Design 10 lab hours
Fundamentals of Design : Design by Evolution and Design by Innovation, Principles that govern any design, Morphology and Process of Design, Application of Graphics in Design, Engineering Graphics: An Overview, Introduction to Computer Aided Drafting, Lettering, Numerals and Dimensioning.

Unit II: Projection of Solids **13 lab hours**
Concept of Projection, Object in four quadrant, 2-D description of quadrants, Orthographic Projection of Solids, Isometric Projection of Solids, Free-hand sketching
Unit III: Solid Modeling **12 lab hours**
Division of Engineering Solids- Polyhedra, Regular and Irregular polyhedral, solids of revolution, Geometric Modeling – Wireframe, B-Rep and Solid Modeling, Solid Modelling using AutoCAD
Unit IV: Introduction to Assembly **11 lab hours**
Types of assembly drawings, Accepted Norms for Assembly Drawings, Sequences of Preparing the Assembly Drawing, Solid Modeling of assembly
Unit V: Application of Design Concepts for Product Design **10 lab hours**
Hands-on Project in Groups: Choose a specific objective for Product Design, Design the Product and Model it using AutoCAD, presentation.

Name of The Course	German-I
Course Code	GERN-1001
Prerequisite	

Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Objectives:
• **This course focuses on basic linguistic and communicative structures of the German language.**
• **Students will be introduced to various aspects of German culture and learn to communicate in simple everyday situations and personal interaction.**
• **The module will adopt an integrated approach to language learning and will emphasize equally all four skills of reading, writing, listening and speaking as well as the acquisition of grammar structures and vocabulary.**

- Audio and video materials will also be used to supplement the textbook and to provide students with a better insight into Germany, her culture and the life of her people.

Course Outcomes

CO1	**Interpret simple sentences, and read short sentences and,paragraphs.**
CO2	Apply simples sentences to discuss about their family members, friends etc
CO3	Develop an understanding of German society and culture.
CO4	Assess all the four skills viz. reading, writing ,listening and speaking.

Text Book (s)
• **Dengler, Stefanie, Netzwerk A1: 2015**
• **Hieber, Wolfgang. Lernziel Deutsch. München: 2005**
Reference Book (s)
• **Gick, Cornelia, Momentmal, Grundstufenlehrwerk Deutsch als Fremdsprache.M: 2003**
• **Maria Dallapiazza, Eduard von Jan, Til Schonherr.Tangram, Deutsch als Fremdsprache.Berlin: 2005**
• **Griesbach, Schulz. Deutsche Sprachlehre für Ausländer. München: 2005.**

Unit-1 Introduction	**4 hours**
Begrüssung / Greeting, Nummern/numbers Monate, Wochentage/ Name of months, days	
Unit-2	**2 hours**
Sich vorstellen – Introduction Interviewspiel mit Fragen und Antworten	
Unit-3	**2 hours**
Information zu Ländern, Nationalitäten und ihre Sprachen/Name of countries, nationalities and languages.	
Unit-4	**6 hours**
W-fragen/ Questions Nominativ Kasus/ Nominative case Pronomen / pronouns Nominative)	
Unit-5	**6 hours**
Regelmäβige Verben / Regular Verbs Verbkonjugation/ Verb conjugation (sein und haben) Landeskunde /History Film –Spielzeugland	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	COMMUNICATIVE FRENCH-I			
Course Code	**FREN1001**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Outcomes

CO1	**Interpret simple sentences, and read short sentences and,paragraphs.**
CO2	Apply simples sentences to discuss about their family members, friends etc.
CO3	Develop an understanding of French society and culture.
CO4	Assess all the four skills viz. reading, writing, listening and speaking.

Text Book (s)
« Tech French » :Ingrid Le Gargasson, Shariva Naik, Claire Chaize. Goyal Publishers and Distributors Private Ltd, Delhi, 2012. Units 1 & 2.
Reference Book (s)
• **CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2004**
• **CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau Les Éditions Didier, 2004**
• **ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique Waendendries Hachette livre 2006**
• **ALTER EGO 1, Le cahier d'activités, Annie Berthet, Catherine Hugo, Béatrix Sampsonis, Monique Waendendries Hachette livre 2006**

Unit-1 Introduction Saluer **08 Lectures**
Saluer - se présenter – demander et dire le prénom et le nom – identifier une personne – demander des nouvelles d'une personne – demander l'age, l'adresse, le numéro de téléphone – Formes de politesse – parler de ses gouts (Audio tape)
Unit-2Nommer des objets **08 Lectures**
Nommer des objets – montrer et situer des objets – exprimer la possession – indiquer les couleurs – caractériser un objet – demander et indiquer le prix – montrer et situer des personnes
Unit-3 Situer un lieu sur un plan **08 Lectures**
Situer un lieu sur un plan – s'informer sur un lieu – demander son chemin – indiquer la direction – indiquer le moyen de transport – situer un lieu sur une carte – donner un conseil – week-end à la mer. (Audio tape)
Unit-4 Demander et donner l'heure **08 Lectures**
Demander et donner l'heure – indiquer une date – faire une demande polie – demander la profession de quelqu'un – demander des informations. (Audio tape).

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	COMMUNICATIVE JAPANESE-I			
Course Code	**JAPA1001**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Objectives:
• **This course is designed for students who have little or no knowledge of Japanese.**
• **It is aimed at developing basic oral and written communicative skills through the study of vocabulary, grammar, and culture.**
• **Japanese is spoken in class as much as possible.**

Course Outcomes

CO1	**Interpret simple sentences, and read short sentences and, paragraphs.**
CO2	Apply simples sentences to discuss about their family members, friends etc.
CO3	Develop an understanding of Japanese society and culture.
CO4	Assess all the four skills viz. reading,writing,listening and speaking.

Text Book (s)
• **Shokyuu Nihongo, Japanese Language Center for International Students, Tokyo University of foreign Studies, Japan.**
• **Nihongo Kana nyuu mon, Japan foundation, Japan.**
• **Shin Nihongo no KISO-1, AOTS, 3A Corporation, Japan.**
Reference Book (s)
• **Random House Japanese-English Dictionary**

• **Japanese for Busy people, Video CD , AJALT, Japan.**

Unit-1 Introduction KANA NYUUMON 08 Lectures
Introduction to Japanese syllabary. Vowels and Consonants, Hiragana, Katakana,& Romaji. Japanese Numerals, Demonstrative pronoun, Greetings, Set phrases – Onegaishimasu – Sumimasen, wakarimasen, Parts of body (look and learn)
Unit-2IIKATA NO NYUUMON 08 Lectures
1.Hajimemashite. 2.Hon no Kimochi.
Unit-3 OREI TO SHITSUMON 08 **Lectures**
3.kore wo kudasai. 4.Sochira wa nanjikara nanji made desu ka.
Unit-4 BUNPOO NO KATA 08 Lectures
5.Kooshi en e ikimasu ka. 6.Isshou ni ikimasen ka.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Universal Human Values and Ethics			
Course Code	**UHVE1001**			
Prerequisite	NA			
Corequisite	NA			
Antirequisite	NA			
	L	**T**	**P**	**C**
	0	0	4	2

Course Objectives:
1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Outcomes

CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO3	Understand the value of harmonious relationship based on trust and respect in their life and profession
CO4	Understand the role of a human being in ensuring harmony in society and nature.
CO5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Text Book (s)
• **R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.**
Reference Book (s)
• **Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA**
• **E. F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.**
• **Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991**

• **Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W.**

Unit-1	
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	
	1. Understanding the need, basic guidelines, content and process for Value Education 2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels
Unit-2	**Understanding Harmony in the Human Being - Harmony in Myself**
	7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Swasthya

Unit-3 Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction

14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!

Unit-4 Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence

Unit-5 Implications of the above Holistic Understanding of Harmony on Professional Ethics

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in Professional Ethics:

a) Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to Universal Human Order:
a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

II SEM

Name of The Course	**Psychology and Sociology**			
Course Code	BLE201			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	2

Course Outcomes

CO1	**Understanding of the basic facts of psychology and their application**

CO2	develop an ability to work in the work groups and communicate effectively
CO3	Develop sociological understanding of Social process, Social Institutions, Social inequality, stratification, mobility, Social change and Movement.
CO4	Demonstrate scientific understanding of major social themes & social phenomena of industrial society, that impact engineer's various realms of life.
CO5	Develop leadership quality, potential to analyze and address social issues and to transform young engineers as a very good human being and successful technocrat.

Text Book (s)

1. Bottomore, T B .,Sociology: A Guide to Problems and Literature, London: George Allen & Unwin1962
2. .Robbins Stephens, Organizational Behaviour. P. Printice Hall International ,Inc. Eaglewood cliffs, 2005,ISBN: 0-13-191435,11th Edition
3. Giddens, A. ., Sociology, Cambridge; Polity ,2000.
4. Horton P B & Hunt C L Sociology, New York: McGraw-Hill Co., 1964.
5. *The Sociology of Social Problems*. Authors, Paul B. Horton, Gerald R. Leslie, Richard F. Larson. Edition, 10, illustrated. Publisher, Prentice Hall, 1991

Reference Book (s)

1. Clifford T. *Morgan*, Richard A *King*, John R Weisz and John Schopler; Introduction to Psychology Published: 19/02/2001; Edition: 7; ISBN: 9780074622506
2. Haralambos, M and Holborn., M. Sociology, London: HaperCollins,2000.

Unit-1 Industrial Psychology **8 hours**

Psychology: Meaning, Definition, nature and Scope. Relevance for engineers.
Personality: Definition and types, theories.
Memory: Types, and models, strategies to improve memory
Motivation: Motivational theories and job satisfaction,
Learning: Types, classical conditioning, operand conditioning & observational learning

Unit-2	**8 hours**
Group dynamics and leadership: skills and various types, **Stress ,Stress management** Definition, types, causes, strategies to cope with stress **Work Environment**: Fatigue and boredom, , accidents and safety	
Unit-3	**8 hours**
Introduction To Industrial Sociology: Sociology , Industrial Sociology: Meaning definition, Nature , scope, Importance of Sociology for Engineers, **Basic concepts:** Interaction, Group, community, Society, **Social Processes:** Associative & Dissociative, social process and organizational goals. **Social Institutions:** Family ,Marriage, Religion: Functions and dysfunctions & Impact of Industrialization	
Unit-4	**8 hours**
Social and Industrial Concerns : Social Inequality, Stratification & Mobility, Impact of Industrialization on Sanskritization Urbanization, Westernization, & Modernization , **Social Change and Social Movements:** Meaning Definition, Genesis, Types, Functions, role in Social transformation. **Industrialization in India and Industrial** policy resolution 1956., **Industrial Disputes:** Strikes and lockouts,	
Unit-5	**8 hours**
Industrial relations machinery Bi-partite & Tripartite agreement, Labour courts, Industrial tribunals, code of Discipline, Standing orders., **Social Problems:** - Social Disorganization, Unemployment, Deviance, Delinquent behaviour amongst youth, Crime, , Gender injustice, Child Abuse, Terrorism.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Exploration with CAS-II**
Course Code	BMA252
Prerequisite	
Corequisite	
Antirequisite	

	L	T	P	C
	0	0	2	1

Course Outcomes

CO1	**Demonstrate knowledge of SciLabfor solvingsimple problems.**
CO2	Apply commands of SciLab for solving system of equations including eigen value problems.
CO3	Write a program in SciLab to solve ainitial value problems.
CO4	Solve domain related problems using SciLab

List of Experiments	
1	Review of working with Scilab
2	Using Scilab for basic operations on matrices including inverse, rank, trace and determinant of a matrix.
3	Using Scilab to determine LI of vectors and determining solution of system of linear equations.
4	Use of Scilab to find the Kernel, range and verification of rank and nullity theorem.
5	Matrix representation of any linear transformation, using Scilab to find inverse of a linear transformation.
6	Using Scilab to compute the Eigen Values and Vectors and check whether a given matrix is symmetric, skew-symmetric, orthogonal.
7	Develop a code in Scilab for Gram-Schmidt orthogonalization process.
8	Solving an initial value problem of II order and plotting the solution.
9	Solving an initial value problem of first and second order (domain specific) and plotting the solution of problem
10	Using Scilab to Solve one dimensional wave equation under specified conditions and graphing the solution.
11	Using Scilab to solve one dimensional heat equation under specified conditions and graphing the solution.
12	Using Scilab to Solve a Laplace equation to find the steady state temperature in the square plate satisfying specific boundary conditions and graphing isotherms

Continuous Assessment Pattern:

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	Application Oriented Programming using Python
Course Code	BCS252
Prerequisite	
Corequisite	
Antirequisite	

L	T	P	C
0	**0**	**2**	**1**

Course Outcomes

CO1	**Gain knowledge of Basic Programming with Python**
CO2	Learn to create and use functions and modules.
CO3	Familiarize with python string handling techniques and user defined functions
CO4	Understand and use data structures like Lists, tuples and dictionaries.
CO5	Understand text and csv File handling

List of Experiments	
1	Implement Python script to read person's age from keyboard and display whether he is eligible for voting or not.
2	Implement Python script to find biggest number between two numbers.
3	Implement Python Script to generate prime numbers series up to n
4	Implement Python Script to check given number is palindrome or not.
5	Implement Python script to print factorial of a number.
6	Implement Python Script to perform various operations on string using string libraries
7	Implement Python Script to check given string is palindrome or not.
8	Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.
9	Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000.

10	Define a function which generates Fibonacci series up to n numbers
11	a) Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number.
12	Suppose the following input is supplied to the program:34,67,55,33,12,98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34', '67', '55', '33', '12', '98').
13	a) Write Python script to display file contents. b) Write Python script to copy file contents from one file to another.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	**Basic Electrical and Electronics Engineering Lab**			
Course Code	BEC151			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Outcomes

CO1	**Apply and verifying basic electrical laws.**
CO2	Realize and apply basic theorems in electrical network and circuits.
CO3	Verify the truth tables of logic Gates.
CO4	Analyze characteristics of basic diodes and transistors.
CO5	Realize and verify the working of transformer.

List of Experiments	
1	To verify (i) Kirchoff's current law (ii) Kirchoff's voltage law.
2	Verification of Thevenin's Theorem
3	Verification of Norton's Theorem
4	Verification of Maximum power transfer Theorem
5	Verification of Truth table for logic Gates- AND , OR, NOT, NAND, NOR and XOR and Half adder Circuit.
6	Study of P-N Junction Diode characteristics.
7	Study of ZENER Diode characteristics.
8	Study of CE characteristics of a Bipolar Junction Transistor.
9	Study of characteristics of FET.
10	Study of open circuit and short circuit tests on a single phase transformer and obtaining its equivalent circuit parameters.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	**Basic Workshop**			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Outcomes

CO1	**Develop a product using Welding Process.**
CO2	Develop a product out of a given sheet.
CO3	Assemble a product of wood in carpentry shop.

CO4	Create a product using casting and then machining.
CO5	Assemble different components to get final product with the help of welding.

Course Content	
1	**Unit-1 : Welding Shop** a.InstructionofBIstandardsandreadingofweldingdrawings. b.T-Joint c.LapJoint d.TIGWelding e.MIGWelding
2	**Unit-2 : Sheet Metal Shop** 1.Making of Cylinder 2.Making of Cylinder using development of surface. 3. Making of Square box using development to surface
3	**Unit-3 : Soldering Shop** Any one of the following SolderinganddesolderingofResistorinPCB. a.SolderinganddesolderingofICinPCB. b.SolderinganddesolderingofCapacitorinPCB
4	**Unit-4 : BOSCH TOOLS** Demonstration ofallBOSCHTOOLS

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

III SEM

Name of The Course	Discrete Mathematics
Course Code	MATH2007

Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	4

Course Objectives:
1. This course is aimed at helping students build up an understanding.
2. Cultivate clear thinking and creative problem solving.
3. Thoroughly train in the construction and understanding of mathematical proofs.
4. Exercise common mathematical arguments and proof strategies.
5. Cultivate a sense of familiarity and ease in working with mathematical notation and common concepts in discrete mathematics.
6. Teach the basic results in set theory, logic, combinatorics, and graph theory.
7. Thoroughly prepare for the mathematical aspects of other computer science course.

Course Outcomes

CO1	Explain at high levels concepts and implement basic operations in discrete mathematics.
CO2	Perform combinatorial analysis to solve counting problems.
CO3	Develop mathematical models from computation theory to programming languages through combinatorics, graphs.
CO4	Use mathematical reasoning to comprehend and construct mathematical arguments.
CO5	Develop techniques for counting, permutations and combinations.

CO6	Understanding of latest advances and its applications in Discrete Mathematics

Text Book (s)
1. Seymour lipschutz, Marc Lars Lipson, Theory and Problems of Discrete Mathematics Third Edition, Schaum's Outline Series McGRAW-HILL.
2. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, PHI
3. Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill

Reference Book (s):
1. Swapan Kumar Sarkar, A Textbook of Discrete Mathematics, S.Chand Publication
2. Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Application to Computer Science, McGraw-Hill
3. J.L. Mott, A. Kandelad T.P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, PHI, 2nd Edition, 1999.
4. Liu and Mohapatra, "Elements of Distcrete Mathematics", McGraw Hill

Unit I: MATHEMATICAL LOGIC: **10 lecture hours**
Introduction, Propositions, Connectives, Truth tables, Tautologies and Contradictions, Equivalences implications, Normal forms, Methods of proof rules of inference for quantified propositions, Mathematical induction.
Unit II: COMBINATORICS: **6 lecture hours**
Basics of counting, Combinations of permutations, Enumeration of combination and permutation, Pigeonhole principle, Inclusion, Exclusion principle, Ordered and unordered portions.
Unit III: RECURRENCE RELATIONS: **8 lecture hours**
Generating function of sequences, Calculating coefficients of generating functions, Recurrence relations, solving recurrence relations by substitutions and generating functions, Method of characteristic roots, Solution of homogenous recurrence relations
Unit IV: GRAPH THEORY: **8 lecture hours**

Basic concepts of graph theory, Diagraph, Paths, Reachability connectedness, Matrix representation of graphs, Subgraphs, Isomorphism trees, Properties, Directed tress, Binary trees.
Unit V: BOOLEAN ALGEBRA: **8 lecture hours**
Post, Hasse diagrams, Lattices, Types of Lattices, Boolean Algebra, Basic theorems, Applications.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Data Structures and Algorithms				
Course Code	BCSE2361				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	2	0	2	3	

Course Objectives:
1. Introduce the fundamentals and abstract concepts of Data Structures.
2. Introduce searching, sorting techniques
3. Learn how concepts of data structures are useful in problem solving.

Course Outcomes:

CO1	Understand the comparison and use of Recursion and Loops
CO2	Understand the application of linear data structure(s) to solve various problems
CO3	Understand the application of non linear data structure(s) to solve various problems
CO4	Understand the shortest path algorithms involving complicated data structures like Graphs.
CO5	Become expert in calculating and comparing complexities of various searching and sorting algorithms.
CO6	Understanding of latest advances and its applications in Data Structure and Algorithms

Text Books
1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication
Reference Books
1. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data Structures
Using C and C++” , PHI
2. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill

3. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
4. Lipschutz, "Data Structures" Schaum's Outline Series, TMH
5. G A V Pai, "Data Structures and Algorithms", TMH

Unit I:Introduction: Basic Terminology	**9 lecture hours**
Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, Time-Space trade-off. Abstract Data Types (ADT)Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.	
Unit II: Stacks and Queues: Abstract Data Type	**8 lecture hours**
Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion	
Unit III: Trees: Basic terminology	**8 lecture hours**
Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.	
Unit IV: Graphs	**7 lecture hours**
Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal : Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Dijikstra Algorithm	
Unit V: Sorting and Searching	**8 lecture hours**
Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Shell sort.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggested Experiments
• **Arrays –Stacks-Recursion:**
• **Write and test a function that transposes a square matrix.**
• **Write and test a recursive function that prints all the permutations of the first n characters of a string.**
• **Write and test a recursive function that returns the power xn**
• **Write a program to implement a stack of strings (illustrate the operations push (), pop(), size(), empty() and top()).**
• **Write a program to show the linked implementation of the Stack class.**
Binary Trees :
• **Write a program to implement Binary Search Tree.**
• **Write a program to create a binary tree and find the height of a binary tree.**
• **Write a program to perform the binary tree traversals.**
• **Write a program to perform a deletion from a Binary Tree (using a delete () function).**
• • **Graphs:**
• **Matrix representation of graphs:**
• **DFS traversal**
• **BFS traversal**
• **Sorting – Searching:**
• **Write a program to implement Bubble Sort.**
• **Write a program to implement selection sort.**
• **Write a program to implement Quick Sort.**

Guidelines: Laboratory assignments will be based on the implementation of the basic operations and application algorithms using various data structures. Programs are to implemented using any preferable language such as C, C++, Java.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Database Management Systems			
Course Code	BCSE2073			
Prerequisite	"Data Structures and Algorithms", "Discrete Mathematics"			
Corequisite	"C-Programming"			
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:
1. Develop the ability to design, implement and manipulate databases.
2. Introduce students to build data base management systems.
3. Able to store and analyze data into normalized format.
4. Apply DBMS concepts to various examples and real life applications

Course Outcomes

CO1	Learn knowledge of ER Modeling.
CO2	Apply programming concepts using DDL and DML commands in SQL.
CO3	Understand the storage system in Relational Database and imposing security.
CO4	Able to remove various anomalies from databases.
CO5	Understanding of transaction process.
CO6	Understanding of latest advances and its applications in Databases

Text Book (s)
1. "Database system concepts" Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill

Reference Book (s):
1. T2. Date C J, " An Introduction to Database Systems", Addision Wesley
2. T3. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
3. T4: O'Neil, Databases, Elsevier Pub.
4. T5: Leon & Leon,"Database Management Systems", Vikas Publishing House
5. T6: Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
6. T7: Majumdar & Bhattacharya, "Database Management System", TMH (14)
7. T8: Ramkrishnan, Gehrke, " Database Management System", McGraw Hill

Unit I: Introduction	**9 lecture hours**

Introduction: An overview of database management system, database system Vs file system, Database system concept and architecture, data model schema and instances, data independence and database language and interfaces, data definitions language, DML, Overall Database Structure.

Module II: Relational data Model and Language **9 lecture hours**

Relational data model concepts, integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus. Introduction on SQL: Characteristics of SQL, advantage of SQL. SQl data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

Module III: Data Base Design & Normalization **10 lecture hours**

Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

Module IV: Transaction Processing Concept **6 lecture hours**

Transaction system, Testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling. Distributed Database: distributed data storage, concurrency control, directory system.

Module V: Concurrency Control Techniques **6 lecture hours**

Concurrency control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction, case study of Oracle.

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments

Write the queries for Data Definition and Data Manipulation Language.
Write SQL queries using Comparison operators (=,<,>,etc).
Write SQL queries using Logical operators.
Write SQL query using SQL Operators.
Write SQL queries for relational algebra.
Write SQL queries for extracting data from more than one table.
Write SQL queries for sub queries, nested queries.
Write programme by the use of PL/SQL.
Concepts for ROLL BACK, COMMIT & CHECK POINTS.
Create VIEWS, CURSORS and TRGGERS & write ASSERTIONS.
Create FORMS and REPORTS

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Data Communication and Networking**			
Course Code	**BCSE2370**			
Prerequisite	Basic Knowledge of Networking and communication			
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:	
1.	Understand the fundamental concepts of data communications and networking.
2.	Identify the basic components/instrument/equipment and their respective roles in data communication system
3.	Understand the structure of computer networks, factors affecting computer network deployment.
4.	Describe emerging technology in the net-centric computing area and assess their current capabilities, limitations and potential applications.
5.	Program and analyse network protocols, architecture, algorithms and other safety critical issues in real-life scenario.

Course Outcomes

CO1 Understand the different networking sub-systems and their functions in a telecommunication system.

CO2 Understand and configure the different types of network topologies and protocols.

CO3 Understand the different protocols layers of the OSI model.

CO4 Examine and analyze the network-layer concepts like Network-Layer services –Routing -IP protocol -IP addressing

CO5 Examine and analyze the different link-layer and local area network concepts like Link-Layer services –Ethernet -Token Ring -Error detection and correction -ARP protocol

CO6 Understanding of latest advances and its applications in Data Communication and Networking

Text Book (s)

1. Frozen, Data Communications and Networking, McGraw Hill, 4th ed.
2. Tanenbaum, Computer Networks, Pearsoned Education.

Reference Book (s):

1. William Stallings, Data and Computer Communications, Pearsoned Education
2. Hykins, Analog and Digital Communications, Wiley Publications.

Unit I:Introduction Concepts **8 lecture hours**

Data and Signal fundamentals, Ana log Signals, Digital Signals, Transmission Media: Guided and Unguided Media, Transmission Impairments, Categories of Networks, Network Topology Design - Delay Analysis, Switching methods, ISDN, The OSI reference model ,TCP/IP Protocol Suite, Comparison of OSI and TCP/IP.

Unit II: Digital and Analog Transmission **8 lecture hours**

Digital Transmission: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Pulse Code Modulation, Delta Modulation, Digital-to-Analog Conversion, ASK, FSK,PSK, Analog-to-Analog Conversion, Modulation Techniques.

Unit III: Medium Access sub layer	**8 lecture hours**
Medium Access sub layer - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Detection and Correction: Block coding, cyclic codes, Linear block codes, checksum.	
Unit IV: Network and Transport Layer	**8 lecture hours**
Network Layer - Point - to Pont Networks, routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6. Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management.	
Unit V: Application Layer	**8 lecture hours**
Electronic mail, WWW, HTTP, SMTP, POP3, IMAP, FTP, SSH.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggested Experiments

1	Introduction to basic Linux networking commands. (Commands like ipconfig, getmac, tracert, path ping, arp, ping, netstat, finger etc.)
2	Implement bit stuffing and de-stuffing.
3	Write a program for hamming code generation for error detection and correction.
4	Implement cyclic redundancy check (CRC).
5	Write a program for congestion control using the leaky bucket algorithm.
6	Implement Dijkstra's algorithm to compute a shortest path through graph.
7	Take a 64-bit plain text and encrypt the same using DES algorithm.
8	Using RSA algorithm encrypts a text data and decrypts the same.

9	Implementation of the link state routing protocols.
10	Implementation of LZW compression and decompression algorithms.

Continuous Assessment Pattern

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Java Programming				
Course Code	**BCSE2333**				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	4	2	

CO1: outline the fundamentals of object-oriented programming in Java
CO2: create applications using thread and exception handling
CO3: understand I/O streams and applet programming in Java
CO4: experiment with Java packages and collections.
CO5: construct the GUI based application with AWT controls
CO6 Understanding of latest advances and its applications in Java Programming

UNIT – I Introduction to Java, Classes and Objects: History and Evolution of Java – Overview – Data Types - Variables - Arrays – Operators - Control Statements – Classes – Fundamentals – Declaring Objects - Assigning Object Reference Variables - Methods – Constructors - this keyword - Garbage collection - finalize method - Stack Class.
UNIT – II Reusability, Packages, Interfaces and Exception Handling: Overloading Methods - Objects as Parameters - Argument Passing - Returning Objects – Recursion -Access Control – Static – Nested and Inner Classes - Command Line Arguments – Variable Length Arguments. Inheritance – Basics – Super keyword - Multilevel Hierarchy - Method Overriding - Dynamic Method Dispatch - Abstract Classes - final with Inheritance. Packages - Access Protection - Importing Packages – Interfaces. Exception Handling – Multiple catch Clauses- Nested try Statements - Java‘s Built-in Exceptions –User defined Exception – Chained exceptions.
UNIT – III :Multithreading, I/O, Applet and String Handling: Java Thread Model - Creating a Thread - Priorities – Synchronization – Inter thread Communication – Suspending - Resuming, and Stopping Threads – Multithreading. Enumerations - Wrappers – Auto boxing – Annotations. I/O Basics - Reading and Writing Console I/O - Print Writer Class - Reading and Writing Files - Applet – Architecture – Skeleton – Display methods - Repainting – Applet tag – Passing parameters - transient and volatile modifiers. String Handling – String Class – methods – String Buffer Class – Methods – String Builder.
UNIT – IV: Generics, Collections and Event Handling: Generics – Example – Parameters - General Form- Bounded Types - Wildcard Arguments - Generic Method and Interfaces – Raw Types and Legacy Code - Generic Class Hierarchies. Collection Classes – Array List – Linked List – Hash Set and Maps. Event Handling – Mechanisms -Delegation Event Model - Event Classes - Sources of Events - Event Listener Interfaces – Mouse and Keyboard events - Adapter Classes - Inner Classes.
UNIT – V : AWT: AWT Classes - Window Fundamentals - Frame Windows - Frame Window in an Applet – Graphics –Color – Fonts - Font Metrics. AWT Controls - Layout Managers - Menu Bars and Menus -Dialog Boxes - File Dialog - Handling Events by Extending AWT Components.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

TEXT BOOKS: 1. Scheldt, Herbert. —Java: The Complete Reference‖, 9th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCE BOOKS:

1. Buyya Rajkumar., Thamarai Selvi S. and Xingchen Chu., —Object Oriented Programming with Java Essentials and Applications‖, Tata McGraw Hill, 2009.
2. Deitel, Paul and Deitel, Harvey. —Java How to Program‖, 8th Edition, Eastern Economy Edition, 2009. 3. www.javatpoint.com
4. https://www.w3schools.in/java-tutorial/

Suggested Experiments
1. Simple java programs using operators, arrays and control statements
2. Develop a stack data structure using class and object
3. Program to demonstrate inheritance & polymorphism
4. Develop an application using interfaces and packages
5. Program to illustrate exception handling in java and creation of user defined exception
6. Program to illustrate multithreads and Inter thread Communication
7. Program to copy the contents of one file into another file.
8. Develop and configure a simple banner applet
9. Program to demonstrate the features of generics types
10. Program to demonstrate the use of Array List, Linked List, HashSet and Map classes.
11. Program to capture the various keyboard and mouse events.
12. Develop a scientific calculator using event-driven programming paradigm of Java
13. Develop a simple text editor with basic file and edit functionalities

ELECTIVE

Name of The Course	**Cryptographic Fundamentals**			
Course Code	**BCSE2350**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:
The primary objective of this course is to understand Cryptography Theories, Algorithms and Systems. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes

CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Apply the different cryptographic operations of public key cryptography
CO4	Apply the various Authentication schemes to simulate different applications
CO5	Understand various Security practices and System security standards
CO6	Understanding of latest advances and its applications in Cryptographic Fundamentals

Text Book (s)

1	William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

Reference Book (s)

1	C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2	BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3	Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

Course Contents:

Unit-1: INTRODUCTION **9 hours**
Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, Steganography.
Unit II: SYMMETRIC KEY CRYPTOGRAPHY **9 hours**
Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher mode of operation – Advanced Encryption Standard - RC4 – Key distribution.
Unit III : PUBLIC KEY CRYPTOGRAPHY **9 Hours**
Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.
Unit IV : MESSAGE AUTHENTICATION **9 Hours**
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos.

Unit V : SECURITY PRACTICE	**9 Hours**
Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggested Experiments	
1	Demonstration of Symmetric conventional cryptographic techniques.
2	Demonstration of Symmetric classic cryptographic techniques
3	Demonstration of Asymmetric cryptographic techniques
4	Demonstration of Hashing and Message digest techniques
5	Design and implementation of new cryptographic algorithms
6	Demonstration and implementation of secure communication using standard crypto libraries
7	Implementation of smart card based server/client applications
8	Demonstration of authentication techniques
9	Developing cryptographic algorithms for innovative applications

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Software Project Management**
Course Code	**BCSE2351**

Prerequisite				
Co requisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:
1. Define and highlight importance of software project management.
2. Describe the software project management activities
3. Train software project managers and other individuals involved in software project.
4. Planning and tracking and oversight in the implementation of the software project management process

Course Outcomes:

CO1	Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project.
CO2	Compare and differentiate organisation structures and project structures.
CO3	Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.
CO4	Understand the Concept of Software Quality Assurance and Testing.
CO5	Develop the Ability to apply Project Management and Project Management Tools.
CO6	Understanding of latest advances and its applications in Software Project Management

Text Book (s)
Clifford F. Gray, Erik W. Larson, "Project Management: The Managerial Process with MS", Mc Graw Hill

Reference Book (s):

1. M. Cottrell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press
4. S. A. Kelkar, Software Project Management, PHI Publication.

Course Contents:

Unit I: Introduction and Software Project Planning	**8 lecture hours**
Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.	
Module II: Project Organization and Scheduling	**8 lecture hours**
Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.	
Module III: Project Monitoring and Control	**8lecture hours**
Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: 23 Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Desk checks, Walk through, Code Reviews, Pair Programming.	
Module IV: Software Quality Assurance and Testing	**8 lecture hours**
Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Clean room process.	
Module V: Project Management and Project Management Tools	**8 lecture hours**
Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.	

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments
1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables
. 3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.
5. Design Test Script/Test Plan(both Black box and White Box approach) 6. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	CYBER SECURITY
Course Code	BSCS2380

Prerequisite	Network security, System security			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:
1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime, detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic
5. Infer legal Perspectives in cyber security

Course Outcomes

CO1	Define cyber security, cyber law and their roles
CO2	Identify cyber security cybercrime and forensics.
CO3	Apply tools and methods used in cyber crime.
CO4	Integrate the tools and methods used in Cyber Forensics.
CO5	Comprehend the Security Policies and Cyber Laws.
CO6	Understanding of latest advances and its applications in Cyber Security

Text Book (s)

1	Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265- 21791, Publish Date 2013
2	Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dreamtech Press. ISBN: 9789351194736, 2015

Reference Book (s)

1	Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1- 118 - 84965 -1
2	James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15- Dec 2010.
3	Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.

Course Contents:

Unit-1: INTRODUCTION TO CYBERCRIME **9 hours**
I Cybercrime- Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.
Unit II: CYBERCRIME **9 hours**
Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.
Unit III : TOOLS AND METHODS USED IN CYBERCRIME: **9 Hours**
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction to Phishing, Identity Theft (ID Theft).

Unit IV : UNDERSTANDING COMPUTER FORENSICS **9 Hours**
Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.
Unit V : SECURITY POLICIES AND CYBER LAWS **9 Hours**
Need for An Information Security Policy, Information Security Standards – ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the IT Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property – Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Practical
1. Implementation to gather information from any PC's connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4. Implementation of MITM- attack using wireshark/ network sniffers
5. Implementation of Windows security using firewall and other tools
6. Implementation to identify web vulnerabilities, using OWASP project
7. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.

8. Implementation of OS hardening and RAM dump analysis to collect the Artifacts and other information's.
9. Implementation of Mobile Audit and generate the report of the existing Artiacts.
10. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery

Continuous Assessment Pattern

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Optimization Techniques**			
Course Code	**BCSE2353**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:
The primary objective of this course is to introduce the topic of optimization techniques as a precise mathematical concept, and study how to apply in engineering design, establish their correctness, study their efficiency and performance analysis. The course consists of a strong mathematical component in addition to the design of various techniques for constrained and unconstrained problems.

Course Outcomes

CO1	Study and analyze different techniques of optimization and its applications
CO2	Formulate the design problem in mathematical form which can be solved by suitable optimization algorithm
CO3	Optimize the constrained and unconstrained design problem
CO4	Compare the efficiency of different optimization techniques
CO5	Formulate and solve constrained optimization problems of linear and non-linear programming
CO6	Understanding of latest advances and its applications in Optimization Techniques

Text Book (s)

1	Raju, N.V.S. (2014) Optimization methods for Engineers, PHI Publications, ISBN-978-81-203-4744-1.

Reference Book (s)

1	Bhavikatti S.S. (2010), Fundamental of Optimum Design IN Engineering, New Age International Publishers, ISBN-978-81-224-2591-8
2	Deb Kalyanmoy (2012) Optimization for Engineering Design, PHI Publications, ISBN-978-81-203-4678-9
3	Rao S. S. (2013) Engineering Optimization Theory and Practice, ISBN: 978-81-265-4044-0

Course Contents:

Unit I:Unit -I: Origin & Development of Operations Techniques 4 lecture hours
Nature & Characteristic feature of operation research, Modeling in operation research, Methodology of operation research, Application, use & limitations of operation research.
Unit I Unit-II: Linear Programming Problems 8 lecture hours
Definition of LPP, Canonical and Standard forms of linear programming problems, Mathematical formulation of LPP, Graphical solutions of Linear Programming Problems, Graphical solution of LPP, Simplex method and Artificial method, Two phase method, Big-M Method, Duality theory, Dual Simple method
Unit III: Transportation Problem & Assignment Problem 8 lecture hours
Introduction to Transportation Model, Application of TP Models, Basic feasible solution of a TP, Degeneracy in TP, Different Methods for obtaining initial Basic Feasible solutions, Matrix Minima Method, Row Minima Method, Column Minima Method, Vogel's Approximation Method, Techniques for obtaining Optimal basic feasible solution, Assignment Problems, Assignment Model Formulation, Mathematical Formulation of Assignment Problems, Hungarian Method, Unbalanced Assignment Problems, Multiple Optimum Solution, Travelling-salesman problem.
Unit IV: Network Analysis 04 lecture hours
CPM & PERT-Network minimization, shorter route problem, maximal – flow problem, Project scheduling, critical path calculation, PERT Calculation
Unit V: Non-Linear Programming 06 lecture hours
Kuhn-Tucker Method with Necessary Conditions and Sufficient Conditions, Constrained Optimization techniques for Nonlinear Programming Problems, Factors Affecting a Constrained Problem, Normalization of Constraints, Exterior Penalty Function Method, Interior Penalty Function Method, Introduction to AI in optimization

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggestive Experiment:
Familiarization with Suitable Programming Languages:
Linear Programming (Transportation, Assignment, Duality, Simplex)

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Artificial Intelligence**			
Course Code	**BCSE2354**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives: **The objective of this course is to:**

1. **Develop the ability to design and implement agents.**
2. **Introduce students to search concepts for complex AI problem.**
3. **Apply AI concepts to various real life applications** exploration of research problems..

Course Outcomes: **At the end of the course student will be able to:**
1. Analyze the dimensions along which agents and environments.
2. Implement agents using search algorithms
3. Develop strategies for agents in games of perfect and imperfect information
4. Ability to handle knowledge representation.
5. Understand Bayesian network to make quantitative (probabilistic) and qualitative inferences
6. Understanding of Pattern Recognition and network.

Text Books:
1. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill

Reference Books
References:
1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson
Education
3. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India,

Unit – I: **Scope of AI:** Introduction to AI Foundations and History. Intelligent Agents- application domains - natural language processing, vision and speech processing, robotics, expert systems, AI techniques- Agent types

Unit –II: **Problem solving State space search:** Production systems, search space control: depth first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End

Unit –III:.**Knowledge Representation & Logical Agents**: Knowledge-Based Agents, Wumpus WorldNet, Propositional Logic, Propositional Theorem, Propositional Model Checking, Agents Based on Propositional Logic. First-Order Logic: Representation, Syntax and Semantics, Using First-Order Logic and Knowledge Engineering. Inference in First-Order Logic: Unification and Lifting, Forward and Backward Chaining, Resolution.

Unit–IV: **Uncertain Knowledge and Reasoning**: Acting under Uncertainty, Probability Notation, Inference, Independence and Bayes' Rule. Probabilistic Reasoning: Semantics and Inference of Bayesian Networks, Relational and First-Order Probability Models, Probabilistic Reasoning over Time: Inference, Hidden Markov Models, Kalman Filters and Dynamic Bayesian Networks. Making Simple Decisions: Utility Theory and Functions and Decision Networks.

Unit – V: **Learning from Examples**: Forms, Decision Trees, Theory of Learning, Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning. Knowledge in Learning: Logical Formulation, Explanation-Based Learning, Reinforcement Learning: Passive and Active Reinforcement Learning and Generalization.

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

SUGGESTED PRACTICALS
1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3.Write a program of depth first search

4. Write a programme to construct a Bayesian network from given data.
5. Write a programme to infer from the Bayesian network.
6. Write a program to solve travelling salesman problems.
7.Write a program for 8-queen problem
8. Write a programme to do reinforcement learning in a grid world.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**English Proficiency and Aptitude Building 3**				
Course Code	LLL213				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	

	0	0	4	2

Course Objectives:
1. To understand soft-skills pertaining to the industry
2. Enhance formal writing skills
3. To enhance mathematical reasoning skills and apply them for problem solving

CO1	**Demonstrate corporate skills required in a real life scenario using simulated environment.**
CO2	Enabling the students to germinate ideas, nurture them and take them to logical conclusion with the help of various resources and real life situations.
CO3	Demonstrate skills required to participate in a simulated environment that helps learners build knowledge and deliver collaboratively.
CO4	Demonstrate effective writing skills for a variety of professional and corporate settings.
CO5	Develop logic framing techniques and various possible solutions
CO6	Stimulating creative and mathematical thinking.

Text Book (s)
SLLL's own text book

Reference Book (s)
1. Communication Skills for Engineers, Mishra, Sunita & C. Muralikrishna, , Pearson
2. Corporate Soft skills, Sarvesh Gulati, 2006.
3. Effective Communication, John Adair , Macmillan Ltd.1997.
4. Developing Communication Skills, Krishna Mohan and Meera Bannerji, Macmillan India Ltd. 1990
5. Quicker Maths , M Tyra

6. Quantitative Aptitude, Abhijeet Guha

Unit I: Thematic Activity 15 lectures • Industry Expectations from graduates for employability • Presentation Skills • Team Skills • Dressing Etiquettes • Creativity And Leadership skills • Interactive Communicative Skills • Assessment
Unit II: Quantitative Aptitude 9 lectures • Data Interpretation • Coding, decoding and Direction • Blood Relation • Binary Logic • Cube and Dice • Seating Arrangement

Continuous Assessment Pattern

BCSE2392	Technical Training - I	L	T	P	C
Version No. 1.0		0	0	4	2

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50		50	100

Course Objectives

The objective of this course is to:
1. Provide an overview of computers and problem solving methods using 'C' language
2. Serve as a foundation for the study of programming languages.
3. Learn to develop program using 'C' language.
4. To develop the software using the concept of 'C' Language.
5. OOPs concepts using C++

Course Outcomes
At the end of this course students will be able:
1. The student would learn the basic concepts of Computer and acquire various problem solving techniques such as algorithms and flowchart.
2. To understand the basic terminology used in programming and able to write, compile and debug programs in C programming language and to develop program logics using decision structures and loop structures.
3. To develop program logics using the concept of arrays and arrays of characters.
4. To understand the modular techniques such as functions and difference between call by value and call by reference methods.
5. To understand the working and usage of Structures in C.
6. Apply the concepts of OOPs using C++.

Course Content
Unit I: Introduction to Computers and Algorithms
Parts of a computer – Overview of operating systems, assembler, compilers, interpreters and programming languages. Algorithms for exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer, flowchart.
Unit II: Constructs of C
Lexical elements – Operators - data types – I/O statements – format specifications – control statements – decision making and Loop control structure: while loop, for loop, do-while loop, nested loop, break, continue, case control structure, go to, exit statement

Unit III: Arrays
Array handling in C – declaration – single dimensional arrays, two – dimensional arrays, multi-dimensional arrays, sorting and searching on single and two dimensional arrays. Array order reversal, string handling function, manipulation on strings.
Unit IV: Functions
Prototype – declaration - arguments (formal and actual) – return types – types of functions difference between built-in and user-defined functions.
Unit V: Structures
Declarations - nested structures- array of structures - structure to functions - unions- difference between structure and union.
Unit VI OOPs concept using C++
Defining Classes in C, Member Functions, Object, Constructor, Object, Encapsulation and abstraction, Inheritance, types of inheritance, polymorphism, static,

SEMESTER IV

Name of The Course	**English Proficiency and Aptitude Building 4**
Course Code	SLBT
Prerequisite	
Corequisite	
Antirequisite	

	L	T	P	C
	0	0	4	2

Course Objectives:
1. Enable students to develop effective Presentation Skills
2. Enable students to develop creative writing skills
3. Enable students to use their aptitude knowledge in decision making

.

Course Outcomes

CO1	**Enhance skills to effectively deliver formal and informal presentations to a variety of audience in multiple context.**
CO2	Construct grammatically correct and complex sentences and articulate thoughts and interpretations effectively.
CO3	Become accomplished and active readers who appreciate ambiguity and complexity of thoughts and ideas on variety of topics.
CO4	Developing the skill of skimming irrelevant information from a large data set.
CO5	Drawing out useful inferences from different types of problem.

Text Book (s)
SLLL's own text book
Reference Book (s)
1. Communication Skills for Engineers, Mishra, Sunita & C. Muralikrishna, , Pearson
2. Corporate Soft skills, Sarvesh Gulati, 2006.
3. Effective Communication, John Adair , Macmillan Ltd.1997.
4. Developing Communication Skills, Krishna Mohan and Meera Bannerji, Macmillan India Ltd. 1990
5. Quicker Maths , M Tyra
6. Quantitative Aptitude, Abhijeet Guha.

Unit I: Presentation Skills **6 lectures**

- Presentation Skills – Concepts
- Presentation Skills – Team work
- Presentation Skills – Practice Session.

Unit II: Grammar **7 lectures**

- Phrasal Verbs
- Subject Verb Agreement
- Parallelism and Modifiers
- Idioms and Phrases
- Tenses
- Common errors in English.

Unit III: Reading Skills and Creative Writing **5 lectures**

- Reading Comprehension
- Story Writing
- Creative Writing

Unit IV: Quantitative Aptitude **6 lectures**

- Time, Speed, Work
- Seating Arrangement
- Logical Reasoning
- Mensuration

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50		50	100

Name of The Course	**Operating Systems**			
Course Code	BCSE2010			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:
1. To understand the services provided by and the design of an operating system.
2. To understand the structure and organization of the file system.

3. To understand what a process is and how processes are synchronized and scheduled.
4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.
6. Students should understand the data structures and algorithms used to implement an OS.

Course Outcomes

CO1	**Remember the classification and diversification of Operating system**
CO2	Understand the classical problems in Concurrent Processes and their solutions.
CO3	Implement different types of CPU Scheduling Algorithm along with the understanding of the concept of Deadlock in system and its methods of handling deadlocks.
CO4	Analyze the concept of memory management and paging concept in operating system.
CO5	Demonstrate the learnt knowledge with a optimized solution in the functions like memory management, I/O management and various scheduling algorithms and take care of deadlocks.
CO6	Understanding of latest advances and its applications in Operating System

Text Book (s)
1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley, Ninth Edition, 2013.
2. D M Dhamdhere, "Operating Systems: A Concept based Approach", McGraw Hill Education, 3 edition, 2012

Reference Book (s)
1. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education India, 2014.
2. Harvey M Dietel, "An Introduction to Operating System", Pearson Education, 1990.

Unit-1 OPERATING SYSTEMS OVERVIEW **6 hours**
Introduction to Operating System, System Calls, Types of system call, Structure of Operating Systems, Operations of Operating System.

Unit-II PROCESS MANAGEMENT **6 hours.**
Process Concept, Process Scheduling, Inter process Communication, Process Synchronization.

Unit-III SCHEDULING AND DEADLOCK MANAGEMENT **6 hours**
CPU Scheduling Algorithms, Deadlock Prevention, Deadlock Avoidance, Recovery from Deadlock.

Unit-IV STORAGE MANAGEMENT **6 hours**
Swapping, Contiguous Memory Allocation, Segmentation, Paging, Demand Paging, Page Replacement.

Unit-V STORAGE STRUCTURE **6 hours**
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggestive Experiments
Simulate the following CPU scheduling algorithms. a) FCFS b) SJF c) Round Robin d) Priority.
Write a C program to simulate producer-consumer problem using Semaphores
Write a C program to simulate the concept of Dining-philosophers problem.
Simulate MVT and MFT.
Write a C program to simulate the following contiguous memory allocation Techniques a) Worst fit b) Best fit c) First fit.
Simulate all page replacement algorithms a)FIFO b) LRU c) OPTIMAL
Simulate all File Organization Techniques a) Single level directory b) Two level directory
Simulate all file allocation strategies a) Sequential b) Indexed c) Linked.
Simulate Bankers Algorithm for Dead Lock Avoidance.

Simulate Bankers Algorithm for Dead Lock Prevention.

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Design & Analysis of Algorithms**			
Course Code	**BCSE3031**			
Prerequisite	Data Structure & Algorithms			
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:

The primary objective of this course is to introduce the topic of algorithms as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

Course Outcomes

CO1	Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
CO2	Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
CO3	Solve the problems through graph algorithms.
CO4	Justify that a certain problem is NP-Complete

CO5	Understand and apply linear programming concepts to real time applications.
CO6	Understanding of latest advances and its applications in Design and Analysis of Algorithms

Text Book (s)

1	Michael T. Goodrich and Roberto Tamassia: Algorithm Design: Foundations, Analysis and Internet examples (John Wiley &Sons, Inc., 2002).
2	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran. Fundamentals of Computer
3	Algorithms, MIT Press, Second Edition (Indian reprint: Prentice-Hall), 2008.

Reference Book (s)

1	Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", The MIT Press, 3rd edition, 2009.
2	RCT Lee, SS Tseng, RC Chang and YT Tsai, "Introduction to the Design and Analysis of Algorithms", Mc Graw Hill, 2005.
3	Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education.

Course Contents:

Unit-1: Introduction	**9 hours**
Introduction: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements, Sorting and order Statistics - Shell sort, Quick sort, Merge sort, Heap sort, Comparison of sorting algorithms, Sorting in linear time.	
Unit II: Tree	**9 hours**
Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps.	
Unit III : Algorithm	**9 Hours**

Divide and Conquer with examples such as Sorting, Matrix Multiplication, Convex hull and Searching. Greedy methods with examples Huffman Coding, Knapsack, Minimum Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's and Bellman Ford algorithms.

Unit IV : Dynamic Programming **9 Hours**

Dynamic programming with examples such as Knapsack, All pair shortest paths – Warshal's and Floyd's algorithms, Resource allocation problem. Backtracking, Branch and Bound with examples such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.

Unit V : Computations **9 Hours**

Selected Topics: Algebraic Computation, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments:

1. Write a program to sort given set of numbers in ascending/descending order using Bubble sort and also search a number using binary search.
2. Write a program to sort given set of numbers in ascending/descending order using Insertion sort and also search a number using linear search.
3. Write a program to sort given set of numbers in ascending/descending order using Quick sort and any other sorting algorithm. Also record the time taken by these two programs and compare them.
4. Write a program to sort given set of numbers using Heap sort.
5. Write a program to sort given set of numbers Merge Sort.

6. Write a program to sort given set of numbers Counting Sort.
7. Write a program to implement Strassen's Matrix Multiplication by Divide and Conquer
8. Write a program to implement Knapsack using Greedy technique.
9. Write a program to implement Knapsack using Dynamic programming.
10. Write a program to implement Dijkstra's Algorithm.
11. Write a program to implement n-Queen Problem using backtracking.
12. Write a program to implement String Matching using Rabin-Karp algorithm.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Computer Graphics**				
Course Code	BCSE3069				
Prerequisite	CPPS in C				
Corequisite	NA				
Antirequisite	NA				
	L	**T**	**P**	**C**	
	2	0	2	3	

Course Outcomes

CO1	**To develop a facility with the relevant mathematics of computer graphics, e.g., 3D rotations are using vector algebra, geometrical transformations and projections using homogeneous co-ordinations.**
CO2	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, and Bresenham algorithm for speedy line and circle generation.
CO3	Apply computer graphics concepts in the development of computer games, information visualization, and business applications.
CO4	To develop a facility with the relevant mathematics of computer graphics, e.g., 3D rotations are using vector algebra, geometrical transformations and projections using homogeneous co-ordinations.
CO5	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, and Bresenham algorithm for speedy line and circle generation.
CO6	Understanding of latest advances and its applications in Computer Graphics

Text Book (s):

Introduction and Line Generation 9 Hours
Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Midpoint circle generating algorithm, and parallel version of these algorithms.
Unit-2: Transformations 9 Hours
Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms-Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barskyalgorithm, Line clipping against non rectangular clip windows; Polygon clipping – SutherlandHodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.
Unit-3 : Three Dimensional 9 Hours
3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.
Unit-4 : Curves and Surfaces 9 Hours
Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.
Unit-5 : Hidden Lines and Illumination models 9 Hours

Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A-buffer method, Scan line method, basic illumination models – Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments
Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes Circle (Midpoint)
2D Geometric transformations – Translation Rotation Scaling Reflection Shear Window-Viewport
Composite 2D Transformations
3D Transformations - Translation, Rotation, Scaling.
3D Projections – Parallel, Perspective.
Creating 3D Scenes.
Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
2D Animation – To create Interactive animation using any authoring tool

S.No.		**Professional Elective-II**	L	T	P	C
1	BCSE3059	Internet of Things	2	0	2	3
2	BCSE3092	Data Sciences	2	0	2	3
3	BCSE3094	Data Mining and Warehousing	2	0	2	3
4	BCSE3052	Bio Informatics	2	0	2	3
5	BCSE3082	Network Design and Management	2	0	2	3

Name of The Course	**Internet of Things (IOT)**

Course Code	**BCSE3059**			
Prerequisite	Theoretical understanding of basic electronics.			
Co requisite	Understand general theoretical concepts of Internet of Things.			
Antirequisite	None			
	L	**T**	**P**	**C**
	2	**0**	2	2

UNIT - I Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.
UNIT - II IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER.
UNIT - III Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib. R16 B.TECH CSE.
UNIT - IV IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.
UNIT - V IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs. Web server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggestive Experiments:
1. Introduction to various sensors and various actuators & its Application (Students have to prepare Report for the same).
a) PIR Motion Sensor. b) Rain Drop Sensor. c) Moisture Sensor. d) Temperature Sensor. e) Touch Sensor. f) Infrared Sensor. g) Servo Moto. h) RFID Sensor. i) Bluetooth Module j) Wi-Fi Module.
2. Perform Experiment using Arduino Uno to measure the distance of any object using Ultrasonic Sensor.
3. Create a circuit using Arduino and sensors. Perform experiment using Arduino Uno to Learn Working of Servo Motor
4. Conduct an experiment with a temperature sensor connected to Arduino which is connected to Raspberry Pi.
5.Execute a LED operation with different names remotely wireless operation using Raspberry Pi
6.Demonstrate an operation using interfacing angle rotary sensor with Intel Galileo Gen 2 Controlled Brightness of LED
7. Creating a webpage and display the values available through Arduino.
8.Experiment on interfacing temperature sensor with Intel Galileo Gen 2 Controlled when temperature above threshold
9. Experiment on Interfacing Ultrasonic sensor with Intel Galileo Gen 2 and send data to mobile phone
10. Experiment on Body health condition monitor with Raspberry Pi and BP, Glucometer etc. sensors.

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Data Science**			
Course Code	BCSE3092			
Prerequisite	PYTHON BASICS, STATISTICS, LINEAR ALGEBRA			
Co requisite	DBMS, MACHINE LEARNING.			
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:
The primary objective of this course is to develop both theoretical knowledge on data analysis skills, which can be applied to practical problems for explain how math and information sciences can contribute to building better algorithms and software. To develop applied experience with data science software, programming, applications and processes.

Course Outcomes

CO1	To acquire good introducing knowledge of the essentials in Statistical Fundamentals used in Data science.
CO2	An ability to apply algorithmic principles and Programming knowledge using Python language on Data Science.
CO3	Understand the fundamentals of statistics and probability used in data science.
CO4	To establish basic knowledge about optimization techniques in Data Virtualization.
CO5	Apply and Implement ML processing principles using Probability and Statistics **.**
CO6	Understanding of latest advances and its applications in Data Science

Text Book (s)

1	Data Science from Scratch: First Principles with Python 1st Edition, by Joel Grus , O'Reilly Publication,2020.
2	James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer, 2013.
3	Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.

Reference Book (s)

1	"Data Science for business", F. Provost, T Fawcett, 2013.
2	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services , 2015.
3	Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press, 2012

Course Contents:

Unit-1: Introduction with Statistical Fundamentals 9 hours
Introduction : Intermediate Algebra& Linear Algebra: Functions, Exponentials and Logarithm's, Polynomial's, Alternate Coordinate systems, Binomial Distribution, Poisson distribution and Normal distribution its properties, Assumption of ANOVA, Measures of Central Tendency in Data.
Unit II: Python for Data Science 9 hours
Introduction about NumPy, Different NumPy Operations, Broadcasting with NumPy, Introduction about Pandas, Reading or Loading data into Data frame, Pandas Data Frame Manipulations, Data Loading /Reading in different formats(CSV,Excel,Json,HTML).
Unit III : Data Science with R 9 Hours
Intro to R Programming, Understanding data structures in R - lists, matrices, vectors, Basic Building Blocks in R, Basic Operations Operators and Types, Matrices and Data Frames in R, Logical Statements in R, Lapply, sapply, vapply and tapply Functions. Summarizing and Visualizing the Important Characteristics of Data.
Unit IV : Data Visualizations & Data Cleaning 9 Hours

Introduction to data Visualizations, Principles Behind Data Visualizations, Histograms-Visualize, Box plots-Visualize, the Distribution of Continuous Numerical Variables (Bar Plots · Pie Chart · Line Chart). Data Visualization using R- Line Plots and Regression.
Unit V : Statistics and Probability concepts to understanding Machine learning 9 Hours
Unsupervised Learning in Python: K- Means Theory/ Implementation, Quantifying K-Means Clustering Performance, Hierarchical Clustering Theory, Principal Component Analysis (PCA) theory / Implementation. Selection criteria for number of clusters choosing.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

SUGGESTED PRACTICALS:
1. Write a programme in Python to predict the class of the flower based on available attributes.
2. Write a programme in Python to predict if a loan will get approved or not.
3. Write a programme in Python to predict the traffic on a new mode of transport.
4. Write a programme in Python to predict the class of user.
5. Write a programme in Python to indentify the tweets which are hate tweets and which are not.
6. Write a programme in Python to predict the age of the actors.
7. Mini project to predict the time taken to solve a problem given the current status of the user.

Continuous Assessment Pattern:

Theory	**Practical**	

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	(Continuous Assessment) IA	ETE	Total Marks
20	15	30	15	20	100

Name of The Course	Data Warehousing and Data Mining			
Course Code	**BCSE3094**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

COURSE OBJECTIVE: To gain knowledge on various Data Mining tasks

COURSE OUTCOME:

CO1: Knowledge in the basic concepts of data warehousing and data mining.

CO2: Ability to create large multidimensional data storage and carry out OLAP operations.
CO3: Ability to apply the concepts, algorithm, techniques and tools for developing practical applications.
CO4: Understanding Different Classification Techniques.
CO5: Ability to Understand Data Visualization and Overall Perspective.
CO6 Understanding of latest advances and its applications in Data Warehousing and Data Mining

Unit –I**: Overview**, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations.
UNIT II: **Data Warehouse Process and Technology:** Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design, 08
UNIT III **Data Mining:** Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.
UNIT IV **Classification:** Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitioned Algorithms. Hierarchical Clustering-CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method – Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.
UNIT V **Data Visualization and Overall Perspective**: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

REFRENCES:
1. Alex Berson, Stephen J. Smith “Data Warehousing, Data-Mining & OLAP”, TMH
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, “ Data Warehousing: Architecture and Implementation”, Pearson
3. I. Singh, Data Mining and Warehousing, Khanna Publishing House
4. Margaret H. Dunham, S. Sridhar,”Data Mining: Introductory and Advanced Topics” Pearson Education 5. Arun K. Pujari, “Data Mining Techniques” Universities Press
6. Pieter Adriaans, Dolf Zantinge, “Data-Mining”, Pearson Education

Suggested Experiments
It is expected that student should implement concept of Data Mining and Warehousing. The open source Data Mining Tools like Rapid Miner, Weka etc. can be used to implement the concept of Data Mining and Warehousing. Some examples are as follows (Subject Teacher may add more):
1. Implementation of OLAP operations
2. Implementation of Varying Arrays
3. Implementation of Nested Tables
4. Demonstration of any ETL tool
5. Write a program of Apriority algorithm using any programming language.
6. Create data-set in arff file format. Demonstration of pre-processing on WEKA data-set.
7. Demonstration of Association rule process on data-set contact lenses. arff /supermarket (or any other data set) using apriori algorithm.
8. Demonstration of classification rule process on WEKA data-set using j48 algorithm.
9. Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.

10. Demonstration of clustering rule process on data-set iris.arff using simple k-means.

Name of The Course	**Bioinformatics**			
Course Code	**BCSE3052**			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:
1. Impart knowledge on basic techniques of Bioinformatics and on analysis of biological data using computational methods.
2. Investigating problems in molecular and biology from a computational perspective.

Course Outcomes:

CO1	Extract information from different types of bioinformatics data (gene, protein, disease, etc.), including their biological characteristics and relationships
CO2	Employ different data representation models and formats used for bioinformatics data representation, including mark-up languages such as SBML and CellML, and ontologies such as GO ontology
CO3	Apply the different approaches used for data integration and data management, including data warehouse and wrapper approaches
CO4	Analyze processed data with the support of analytical and visualization tool

CO5	Interact with non-bioinformatics professionals, such as biologists and biomedical researchers, to better understand their bioinformatics needs for improved support and service delivery
CO6	Understanding of latest advances and its applications in Bioinformatics

Text Book (s)
1. D E Krane & M L Raymer, " Fundamental concepts of Bioinformatics", Perason Education.
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics Methods & applications, Genomics, Proteomics & Drug Discovery" PHI, New Delhi

Reference Book (s):
1. Shubha Gopal et.al. "Bioinformatics: with fundamentals of genomics and proteomics", McGraw Hill.
2. O'Reilly, " Developing Bio informatics computer skills", CBS
3. Forsdyke, "Evolutionary Bioinformatics", Springer

Course Contents:

Unit I:	Bioinformatics	**9 lecture hours**
Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools. Metadata: Summary 40 & reference systems, finding new type of data online.Molecular Biology and Bioinformatics: Systems approach in biology, Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, overview of the bioinformatics applications.		
Unit II: Quaternary structure		**8 lecture hours**
Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes- the functional elements in DNA, Analyzing DNA, DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction.		
Unit III:	Perl	**7 lecture hours**

Perl Basics, Perl applications for bioinformatics- Bioperl, Linux Operating System, mounting/ unmounting files, tar, gzip / gunzip, telnet, ftp, developing applications on Linux OS, Understanding and Using Biological Databases, Overview of Java, CORBA, XML, Web deployment concepts.
Unit IV: Genomic sequencing **8 lecture hours**
Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighbouring, application to biological data warehouses.
Unit V: Macromolecular **8 lecture hours**
Macromolecular structures, chemical compounds, generic variability and its connection to clinical data. Representation of patterns and relationships: sequence alignment algorithms, regular expressions, hierarchies and graphical models.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments
1. Get five nucleotide and five protein sequences in FASTA format from NCBI and EMBL.
2. To find out five similar sequences for any nucleotide and protein query sequence using BLAST and FASTA.
3. Access and use of different online nucleotide and protein alignment tools (Pairwise and Multiple sequence alignment).
4. Genes and Exons identification related search for a given genome sequence in order to predict the gene.
5. ORF prediction in the given nucleotide sequence.
6. Secondary structure prediction for given amino acid sequences of a given protein using Chou Fasman, GOR method and Neural Network method.
7. Visualize tertiary structure of any given protein sequence.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Network Design and Management**			
Course Code	**BCSE 3082**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:
To learn about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.

Course Outcomes

CO1	Describe Computer network topologies.
CO2	Describe the various layers of ISO-OSI model
CO3	Describe different protocols and their features.
CO4	Distinguish different security techniques.
CO5	State the various digital signature schemes.
CO6	Understanding of latest advances and its applications in Network Design and Management

Text Book (s)
Reference Book (s)
1. “Data and Computer Communication” by William Stallings
2. “Data Communication and Networking” by Behrouz A Forouzan
3. “Computer Networks” by Andrew S Tanenbaum
4. “Internetworking with TCP/IP, Volume 1” by Douglas Comer
5. “TCP/IP Illustrated” by W Richard Stevens
Suggested Experiments:
1. To Study LAN transmission Medias and Topologies.
2 To Study various commands for webpage design using HTML
3 To study ISO-OSI Model using Simulation Tools.
4 To study TCP-IP model using Simulation Tools.
5 To Study Local Area Network and its specifications (RJ45 connector).
6 To Study Design and analysis of network using Network simulation Tools

7 To study ARP and RARP protocols using Simulation Tools.
8 To study FTP, SMTP and SNMP protocols.
9 To Study Error Correction and Detection Techniques.
10 To Study digital Signatures.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

SEMESTER V

Name of The Course	**English Proficiency and Aptitude Building -5**			
Course Code	**SLBT3001**			
Prerequisite				
Co requisite				
Antirequisite				
24 sessions of 100 minutes each, 12 hours of online tests	**L**	**T**	**P**	**C**
	3	0	4	2

Course Objectives:
• **Enhance formal writing skills**
• **To understand soft-skills pertaining to industry.**

Course Outcomes

CO1	Able to develop a logical thought process related to every aspect of life
CO2	Able to widen the horizon of one's thought process and data analysis skill
CO3	Able to interpret data and convert it into information

Text Book (s)
SLLL own text book
Reference Book (s):
• Communication Skills for Engineers, Mishra,Sunita&C.Muralikrishna,,Pearson
• Corporate Softskills ,Sarvesh Gulati,2006.
• Effective Communication, JohnAdair, MacmillanLtd.1997.
• DevelopingCommunicationSkills,KrishnaMohanandMeeraBannerji,Macmillan IndiaLtd.1990

Name of The Course	**Design & Analysis of Algorithms**			
Course Code	**BCSE3031**			
Prerequisite	Data Structure & Algorithms			
L	**T**	**P**	**C**	
3	**0**	0	3	

Course Objectives:

The primary objective of this course is to introduce the topic of algorithms as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

Course Outcomes

CO1	Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
CO2	Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
CO3	Solve the problems through graph algorithms.
CO4	Justify that a certain problem is NP-Complete
CO5	Understand and apply linear programming concepts to real time applications.
CO6	Understanding of latest advances and its applications in Design and Analysis of Algorithms

Text Book (s)

1	Michael T. Goodrich and Roberto Tamassia: Algorithm Design: Foundations, Analysis and Internet examples (John Wiley &Sons, Inc., 2002).
2	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran. Fundamentals of Computer
3	Algorithms, MIT Press, Second Edition (Indian reprint: Prentice-Hall), 2008.

Reference Book (s)

1	Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, The MIT Press, 3rd edition, 2009.
2	RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis of Algorithms”, Mc Graw Hill, 2005.
3	Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education.

Course Contents:

Unit-1: Introduction	**9 hours**

Introduction: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements, Sorting and order Statistics - Shell sort, Quick sort, Merge sort, Heap sort, Comparison of sorting algorithms, Sorting in linear time.
Unit II: Tree **9 hours**
Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps.
Unit III : Algorithm **9 Hours**
Divide and Conquer with examples such as Sorting, Matrix Multiplication, Convex hull and Searching. Greedy methods with examples Huffman Coding, Knapsack, Minimum Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's and Bellman Ford algorithms.
Unit IV : Dynamic Programming **9 Hours**
Dynamic programming with examples such as Knapsack, All pair shortest paths – Warshal's and Floyd's algorithms, Resource allocation problem. Backtracking, Branch and Bound with examples such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.
Unit V : Computations **9 Hours**
Selected Topics: Algebraic Computation, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern:

Theory		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**
30	20	50

Name of The Course	Software Engineering & Testing Methodologies			
Course Code	**BCSE3032**			
Prerequisite				
	L	**T**	**P**	**C**
	2	**0**	4	3

Course Objectives: The scope of the course is concerns with the stages of the software engineering process, including requirements gathering, specification, design, implementation, and testing. Students will teach the various the testing techniques.

Course Outcomes:

CO1	Understand the key concerns that are common to all software development processes.
CO2	Able to select appropriate process models, approaches and techniques to manage a given software development process.
CO3	Able to elicit requirements for a software product and translate these into a documented design.
CO4	Recognize the importance of software reliability and how we can design dependable software, and what measures are used.
CO5	Understand the principles and techniques underlying the process of inspecting and testing software and making it free of errors and tolerable.
CO6	Understanding of latest advances and its applications in Software Engineering and Testing Methodologies.

Text Book (s)

1	Software Engineering: A practitioner's Approach, Roger S Pressman, Sixth Edition. McGraw-Hill International Edition, 2005.
2	Software Engineering: Ian Summerville, Seventh Edition, Pearson Education, 2004.

Reference Book (s)

1	Fundamentals of Software Engineering: Rajib Mall, PHI, 2005.
2	Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
3	Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.

Unit-1: Introduction to Software Engineering **9 hours**
Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.
Unit II: Software Requirement Specifications (SRS) and Design **9 hours**
Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design Data Flow Diagrams, Entity Relationship Diagrams.
Unit III : Software Testing Methods and Selection **9 Hours**
Testing Objectives ,Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behaviour and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking.
Unit IV : Software Testing Methods and Selection **9 Hours**
Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Integration Testing, , Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up, Acceptance Testing ,Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Regression testing, Regression test process, Initial Smoke or Sanity test, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.
Unit V : Software Project and Test Management **9 Hours**

Software as an Evolutionary Entity, Need for Maintenance, Categories of maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Constructive Cost Models (COCOMO). Test Planning, Management, Execution and Reporting, Software Test Automation: Testing in Object Oriented Systems.

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Sr. No.	Suggested Experiments
1.	Demonstration on Manual testing a. Write Programs in „C" Language to demonstrate the working of the following constructs: i)do…while ii) while…do iii)if…else iv)switch v)for b. Write a program in "C" language to demonstrate the working of palindrome using do…while.
2.	Demonstration on Unit testing a. Create a test plan document for any application (e.g. Library Management System). b. Study of any testing tool (e.g. Win runner). c. Create a test plan document for cellular phone.
3.	Demonstration on Integration testing Take a mini project (e.g. University admission, Placement Portal) and execute it. During the life cycle of the mini project create the various testing documents and final test report document.
4.	Demonstration on System testing a. Take any system (e.g. ATM system) and study its system specifications and report the various bugs. b. Write down the test cases for any known applications (e.g. Banking Application).

5.	Demonstration on Blackbox testing a. Design a usecase diagram for an ATM system. b. Design a class diagram for an ATM system. c. Design a use case diagram for Library system.
6.	Demonstration on White Box testing a. Create various testing document for robot control system. b.“A Program written in „C‟ Language for Matrix Multiplication fails” Introspect the causes for its failure and write down the possible reasons for its failure. c. Write a Program in „C‟ Language to demonstrate the working of Addition of diagonal elements in a matrix.
7.	Demonstration on Regression testing a. Study of any web-testing tool (eg. Selenium). b. Study of any bug-tracking tool (eg. Bugzilla, bug bit). c. Study of any test management tool (eg. Test Director). d. Compare different testing tools.
8	Demonstration on Mutation testing Write down the test cases for any known applications (e.g. Banking Application).
9	Demonstration on Alpha testing. Make a Case Based study on the experiment
10.	Demonstration on Beta testing. Make a Case Based study on the experiment
11.	Demonstration on User Acceptance testing. Make a Case Based study on the experiment

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Computer Graphics			
Course Code	**BCSE3069**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:
This course focuses on 2D and 3D interactive and non-interactive graphics. This course studies the principles underlying the generation and display of 2D and 3D computer graphics. In this course topics include geometric modeling, 3D viewing and projection, lighting and shading, color, and the use of one or more technologies and packages such as OpenGL, and Blender. Course requirements usually include exam and several programming or written homework assignments.

Course Outcomes

CO1	**To understand the principles, commonly used paradigms and techniques of computer graphics. e.g. the graphics pipeline, and Bresenham algorithm for speedy line and circle generation.**
CO2	Be able to understand 2D graphics concepts in the development of computer games, information visualization, and business applications.
CO3	To develop a facility with the relevant mathematics of 3D graphics like projection, clipping and transformation
CO4	Be able to understand the representation of non linear shapes. E. g. Curves, hidden surfaces.
CO5	Be able to develop animations like motion sequence, morphing and illustrating models for lighting/shading.
CO6	Understanding of latest advances and its applications in Computer Graphics

Text Book (s)

1	**Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education, India; 2 edition 2002.**
2	Computer Graphics Principles and Practice, Second Edition in C, James D.Foley, Andries Van Dam, Steven K.Feiner, JhonF.Hughes, Addison Wesley, Third Edition, 2014.

Reference Book (s)

1	**Steven Harrington, "Computer Graphics: A Programming Approach" , McGraw-Hill Inc.,US; 2nd Revised edition, 1983.**
2	David Rogers, "Procedural Elements of Computer Graphics", McGraw Hill Education; 2 edition, 2017.

Course Content	
Unit I: Introduction and Line Generation	**9 lecture hours**
Introduction to Computer Graphics,Computer Graphics Applications**,**Types of computer graphics, Graphic Displays- Cathode Ray Tube(CRT), Random scan displays, Raster scan displays, Points and lines, Line drawing algorithms (DDA and Bresenham s), Circle generating algorithms, Midpoint Ellipse generating algorithm	
Unit II: 2D Concepts	**9 lecture hours**
Basic transformation, Matrix representations and homogenous coordinates,Composite transformations, Reflections and shearing.Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms-Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barskyalgorithm, Line clipping against non rectangular clip windows; Polygon clipping – SutherlandHodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Textclipping.	
Unit III: 3D Concepts	**9 lecture hours**
3-D geometric primitives-Parallel Projection, Perspective Projection, Depth Cueing, Visible Line and Surface Identification, Surface Rendering, Exploded and Cutaway Views, Three-Dimensional and Stereoscopic Views, Three Dimensional graphics packages,. 3-D Transformation, 3-D viewing, projections, 3-D Clipping.	
Unit IV: Curves and Surfaces & Surface Detection	**9 lecture hours**
3-D Object representation - Polygon surfaces-Polygon Tables, Plane Equations, Polygon Meshes, curved lines and surfaces, Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductoryconcepts of Spline-,Interpolation and approximation spline, Geometric Continuity Conditions, Spline Specificalions,Parametric Continuity Conditions, B-Spline and Bezier curves. Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method.	
Unit V: Illumination Model & Animations	**9 lecture hours**

Basic illumination models – Ambient light, Diffuse reflection, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows. **Animations:** Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

S.No.		**Professional Elective-III**	L	T	P	C
1	BCSE3051	Microprocessor	2	0	2	3
2	BCSE3052	Quantum Computing	2	0	2	3
3	BCSE3053	Soft Computing	2	0	2	3
4	BCSE3054	Machine Learning	2	0	2	3
5	BCSE3061	Modeling and Simulation	2	0	2	3

S.No.	**Professional Elective-IV**	L	T	P	C
1	Cloud Application Development	2	0	2	3
2	Adhoc & Sensors Networks	2	0	2	3
3	Statistical Analysis using R	2	0	2	3
4	Block Chain	2	0	2	3

5	Software Defined Network	2	0	2	3

Name of The Course	**Microprocessor & Interfacing**			
Course Code	**BCSE3051**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:
To Familiarize the students with the architecture of 8086
To introduce the concepts of Assembly language programming of 8086.
To make the students familiar with ICs required for interfacing 8086 with I/O devices

Course Outcomes:

CO1	To understand architecture of 8086 processor
CO2	To design Assembly language program for 8086
CO3	To use advanced features of 8086
CO4	To interface 8086 with various devices and memory

CO5	To understand the architecture and principles of USART 8245
CO6	Understanding of latest advances and its applications in Microprocessor and Interfacing.

Text Book (s)

1. D.V. Hall, Microprocessors & Interfacing, TMH, 3rd edition

2. Barry B Brey, The Intel microprocessor: architecture, programming and interfacing, Prentice hall of India, New Delhi, 2003.ISBN-0138027455, 4th Edition

Reference Book (s)

1. Alan Clements, "Principles of Computer Hardware", Oxford University Press, 3rd Edition, 2003, ISBN-9780198564539

Course Contents:

Unit-1: Introduction	**9 hours**
History of microprocessors, Introduction of 8086, Functional diagram of 8086, Register Organization, Memory Segmentation, Programming Model, Memory addresses. Physical memory organization, signal descriptions of 8086- common function signals. Minimum and Maximum mode signals, Timing diagrams.	
Unit II: Assembly Language Programming (Part-I)	**9 hours**
Instruction formats, addressing modes, instruction set, assembler directives, simple programs involving logical, branch and arithmetic expressions.	
Unit III : Assembly Language Programming (Part-II)	**9 Hours**
Procedures: Near and Far procedures, Macros, String Manipulations, searching and sorting programs, Advanced features of Assembly language programming.	

Unit IV : I/O Interface	**9 Hours**
8255 PPI, various modes of operation and interfacing to 8086, Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter, 8251 USART architecture and interfacing, RS- 232.	
Unit V : Interfacing with memory & Interrupts	**9 Hours**
Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Introduction to DOS and BIOS interrupts, Interfacing 8259 Interrupt Controller, DMA Controller 8257.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggestive Experiments	
1	Arithmetic operation – Multi byte Addition and Subtraction, Multiplication and Division Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.
2	Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
3	By using string operation and Instruction prefix: Move Block, Reverse string, Sorting,
4	Inserting, Deleting, Length of the string, String comparison.
5	Reading and Writing on a parallel port.
6	Timer in different modes.
7	Serial communication implementation.

8	8259 – Interrupt Controller: Generate an interrupt using 8259 timer.
9	8279 – Keyboard Display: Write a small program to display a string of characters.
10	Traffic Controller Interface.
11	ADC & DAC Interface.
12	8255- Interface.
13	8251- UART Interfacing

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Machine Learning**				
Course Code	**BCSE3004**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**

	2	**0**	2	3

Course Objectives
The objective of this course is to introduce the students about the knowledge of basic concepts of machine learning systems, types of learning etc.
Course Outcomes
At the end of the course students will be able to:
1. Understand learning systems.
2. Apply learning and classification algorithms.
3. Use regression techniques.
4. Apply unsupervised learning algorithms.
5. Understand reinforcement learning techniques
CO6 Understanding of latest advances and its applications in Machine Learning

Text Books
1. Tom M Mitchell, Machine Learning, McGraw Hill Education, McGraw Hill Education; First edition, 2017.
2. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
3. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Inderscience, 2000. ISBN: 9780471056690.
Reference Books

1. **Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.**
2. **Introduction to Machine Learning – Ethem Alpaydin, MIT Press, Prentice hall of India.**
4. **Patrick Henry Winston, Artificial Intelligence, 3rd Edition, AW, 1999.**
5. **Elaine Ric, Kevin Knight and Shiv Shankar B. Nair, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2009.**

Course Content

Unit I: Introduction **8 Lecture hours**

Basic concepts: Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation

Unit 2 Learning and Classification 8 Lecture hours

Types of Learning: Supervised learning and unsupervised learning. Overview of classification: setup, training, test, validation dataset, over fitting. Classification Families: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbour.

Unit 3 Regression 8 Lecture hours

Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines: Optimal hyper plane, Kernels. Model selection and feature selection. Combining classifiers: Bagging, boosting (The Ada boost algorithm), Evaluating and debugging learning algorithms, Classification errors.

UNIT4 Unsupervised learning 9 Lecture hours

Clustering, K-means, EM Algorithm, Mixture of Gaussians, Factor analysis, PCA (Principal components analysis), ICA (Independent components analysis), latent semantic indexing, Spectral clustering, Markov models Hidden Markov models (HMMs).
UNIT-5 Reinforcement Learning 9 Lecture hours
MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR). LQG, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments
1. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 4.
2. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
4. Write a program to construct Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Simulation & Modelling**			
Course Code	**BCSE3061**			
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives
Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs. This course focuses on what is needed to build simulation software environments, and not just building simulations using pre-existing packages.

Course Outcomes:

CO1	understand the techniques of modeling in the context of hierarchy of knowledge about a system

CO2	Related to systems development, originating the basic source requirements and goals.
CO3	Analyze and fit the collected data to different distributions
CO4	Develop skills to apply simulation software to construct and execute goal-driven system models.
CO5	Interpret the model and apply the results to resolve critical issues in a real world environment
CO6	Understanding of latest advances and its applications in Simulation and Modeling

Text Books:

1. Jerry Banks, John S Carson II, Berry L Nelson, David M Nicol, Discrete Event system Simulation, Pearson Education, Asia, 4th Edition, 2007, ISBN: 81-203-2832-9.
2. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978, ISBN: 81-203-0140-4.

References :

1. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions – Industrial Engineering series, 4th Edition, ISBN: 0-07-100803-9.
2. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004, ISBN: 0-87692-028-8.
3. Banks C M , Sokolowski J A, Principles of Modeling and Simulation, Wiley
4. Kelton, W. David, Sadowski, Randall P., and Sweets, Nancy B. (2010). Simulation with Arena, Fifth Edition. McGraw-Hill Higher Education (ISBN: 978-0-07-337628-8)

Course Content

Unit – I Introduction to Discrete Event System Simulation	**8 hours**
System Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System, Other simulation examples.	
Unit – II General Principles and Queuing model	8 hours
Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. Queuing Model theory, Simulation of single-server queue, Simulation of two-server queue	
Unit – III Analysis of Simulation Data	8 hours
Input Modeling - Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models.	
Unit – IV Output Analysis for a single model	8 hours
Types of Simulations with Respect to Output Analysis, Stochastic Nature of output data, Measures of Performance and their estimation, Output analysis of terminating simulation, Output analysis of steady state simulations. Simulation Software's: MAT Lab, NS2, Data Processing tools, Etc.,	
Unit - V Case Study	8 hours
Simulation of Computer networks, Simulation of Computer Systems	

Suggestive Experiments
1. Computer Generation of Random Numbers.
2. Chi-square goodness-of-fit test.
3 One-sample Kolmogorov-Smirnov test
4. Test for Standard Normal Distribution.
5. Testing Random Number Generators.
6. Monte-Carlo Simulation.
7. Simulation of Single Server Queuing System.
8. Simulation of Two-Server Queuing System.
9.Simulate and control a conveyor belt system
10. Two-sample Kolmogorov-Smirnov test.

Name of The Course	**Cloud Application Development**			
Course Code	**BCSE3096**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:

The primary objective of this course is to introduce the topic of algorithms as a precise mathematical concept and studies how to design algorithms establish their correctness study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

Course Outcomes

CO1	Develop cloud based applications
CO2	To analyze and trouble shoot the problems while deploying application on cloud
CO3	Use web application based technologies for developing application using cloud
CO4	Use public cloud like IBM Blue mix, Amazon AWS, Google cloud platform or Microsoft Azure for developing an application
CO5	Deploy the application on real cloud
CO6	Understanding of latest advances and its applications in Cloud Application and Development.

Text Book (s)

1	Chris Hay, Brian Prince, "Azure in Action" Manning Publications [ISBN: 978-1935182481], 2010.
2	Henry Li, "Introducing Windows Azure" Apress; 1 edition [ISBN: 978-1- 4302-2469-3],2009
3	Eugenio Pace, Dominic Betts, Scott Densmore, Ryan Dunn, Masashi Narumoto, MatiasWoloski, Developing Applications for the Cloud on the Microsoft Windows Azure Platform [ISBN: 9780735656062]

Reference Book (s)

1	Eugene Ciurana, Developing with Google App Engine [ISBN: 978-1430218319]
2	Charles Severance, Using Google App Engine [ISBN: 978-0596800697]

Course Contents:

Unit-1: Cloud Based Applications	**9 hours**
Introduction, Contrast traditional software development and development for the cloud. Public v private cloud apps. Understanding Cloud ecosystems – what is SaaS/PaaS, popular APIs, mobile.	
Unit II: Designing Code For The Cloud	**9 hours**
Class and Method design to make best use of the Cloud infrastructure; Web Browsers and the Presentation Layer: Understanding Web browsers attributes and differences. Building blocks of the presentation layer: HTML, HTML5, CSS, Silverlight, and Flash.	
Unit III : Web Development Techniques And Frameworks	**9 Hours**
Building Ajax controls, introduction to JavaScript using JQuery, working with JSON, XML, REST. Application development Frameworks e.g. Ruby on Rails , .Net, Java API's or JSF; Deployment Environments – Platform As A Service (PAAS) ,Amazon, vmForce, Google App Engine, Azure, Heroku, AppForce	
Unit IV : USE CASE 1	**9 Hours**
Building an Application using the LAMP stack: Setting up a LAMP development environment. Building a simple Web app demonstrating an understanding of the presentation layer and connectivity with persistence.	

Unit V : USE CASE 2	**9 Hours**
Developing and Deploying an Application in the Cloud : Building on the experience of the first project students will study the design, development, testing and deployment of an application in the cloud using a development framework and deployment platform	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

SUGGESTED EXPERIMETN
1. Install Oracle Virtual box and create two VMs on your laptop.
2. VIRTUALIZATION Install Turbo C in guest OS and execute C program.
3. VIRTUALIZATION Test ping command to test the communication between the guest OS and Host OS.
4. HADOOP Install Hadoop single node setup.
5. HADOOP Develop a simple hadoop application called Word Count. It counts the number of occurrences of each word in a given input set.
6. HADOOP Develop hadoop application to count no of characters, no of words and each character frequency.
7. HADOOP Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.
8. CLOUD PROGRAMMING Design a protocol and use Simple Queue Service (SQS) to implement the barrier synchronization after the first phase.
9. CLOUD PROGRAMMING Use the Zookeeper to implement the coordination model in Problem 10.
10.CLOUD PROGRAMMING Develop a Hello World application using Google App Engine
11. CLOUD PROGRAMMING Develop a Guestbook Application using Google App Engine.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Adhoc & Sensor Networks**			
Course Code	**BCSE3097**			
Prerequisite	**Wireless Sensor Networks**			
Corequisite	**Interfacing Methods - Protocols**			
Antirequisite	**Requisite Organization**			
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:

- The student should be made to:
  · Learn Ad hoc network and Sensor Network fundamentals
  · understand the different routing protocols
  · have an in-depth knowledge on sensor network architecture and design issues
  · understand the transport layer and security issues possible in Ad hoc and Sensor networks
  · Have an exposure to mote programming platforms and tools

- **Course Outcomes**

CO1	Know the basics of Ad hoc and Sensor Networks

CO2	Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
CO3	Apply the knowledge to identify appropriate physical and MAC layer protocols
CO4	Understand the transport layer and security issues possible in Ad hoc and sensor networks.
CO5	Be familiar with the OS used in Sensor Networks and build basic modules
CO6	Understanding of latest advances and its applications in Adhoc and Sensor Networks.

Text Book (s)

1	Ad Hoc and Sensor Networks — Theory and Applications, Car/os Corderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March 2018
2	Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp 2017.
3	C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2016.

Reference Book (s)

1	Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2016
2	Wireless Sensor Networks — Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2017
3	Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2018.

Course Contents:

Unit-1: Introduction	**9 hours**
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.	

Unit II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9 hours
Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11
Unit III : ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS 9 Hours
Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.
Unit IV : WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS 9 Hours
single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.
Unit V : WSN ROUTING, LOCALIZATION & QOS 9 Hours
Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

SUGGESTED EXPERIMENTS
1. Implementation of Stop and Wait Protocol and sliding window
2. Implementation and study of Goback-N and selective repeat protocols
3. Implementation of High Level Data Link Control

4. Study of Socket Programming and Client – Server model.
5. To create scenario and study the performance of token ring protocols through simulation.
6. Implementing a wireless sensor network
7. Simulate a Mobile Adhoc Network
8. Implement Transport Control Protocol in Sensor Network

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Statistical Analysis using R				
Course Code	BCSE3086				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	2	**0**	2	3	

Course Objectives: This is an introductory course on how to use the R programming language and software environment for data manipulations and munging exploratory data analysis and data visualizations.

Course Outcomes

CO1	Understand the basic R programming.
CO2	Understand the basic frequency distribution.
CO3	Students will be familiar to the R ecosystem and learn how to use R for the most common data analysis tasks, including loading, cleaning, transforming, summarizing and visualizing data.
CO4	Interpretation of different error detection and correction.
CO5	Apply an advanced R programming ecosystem.
CO6	Understanding of latest advances and its applications in Statistical Analysis using R.

Text Book (s)

1	Ugarte, M.D., Militino, A.F., Arnholt, A.T. (2008). Probability and Statistics with R. CRC Press.
2	Peter Daalgard (2008). Introductory Statistics with R, Springer.
3	Thomas Rahlf (2017). Data Visualization with R: 100 Examples, Springer.

Reference Book (s)

1	The R statistical software program. Available from: https://www.r-project.org/.
2	RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/

Course Contents:

Unit-1: Introduction	**9 hours**
The basics of R- first steps in writing code; variables; functions; vectors; simple calculations. Working directory, reading and writing, loading and saving data, data frames. Vectors; matrices; indexing, Built-in Commands and Missing Data Handling.	

Unit II: Frequency Distribution	**9 hours**
Objectives, Steps and Basic Definitions, Variables and Types of Data, Absolute Frequency, Relative Frequency and Frequency Distribution. Frequency Distribution and Cumulative Distribution Function.	
Unit III : Visualization	**9 Hours**
Subdivided Bar Plots and Pie Diagrams, 3D Pie Diagram and Histogram-Kernel Density and Stem - Leaf Plots- Arithmetic Mean- Median- Quantiles-Mode, Geometric Mean and Harmonic Mean.	
Unit IV: Error detection and correction.	**9 Hours**
Absolute Deviation and Absolute Mean Deviation- Range, Inter quartile Range and Quartile Deviation-Mean Squared Error, Variance and Standard Deviation-Coefficient of Variation and Box plots. Raw and Central Moments-Skewness and Kurtosis. Univariate and Bivariate Scatter Plots.	
Unit V: R ecosystem.	**9 Hours**
Least Squares Method - R Commands and More than One Variables-Extending R with add-on packages and the R-ecosystem. Dynamic and web reporting: Knitr and Shiny. Running R as part of a business pipeline—the R terminal. Simulation I.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggested Experiments
1. Download and install R-Programming environment and install basic packages using install. Packages () command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3. Write a program to find list of even numbers from 1 to n using R-Loops.
4. Create a function to print squares of numbers in sequence.
5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write a program to read a csv file and analyze the data in the file in R. Semester - VII 123 G V P College of Engineering (Autonomous) 2017 CSE

9. Create pie chart and bar chart using R.
10. Create a data set and do statistical analysis on the data using R.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Block Chain Technology			
Course Code	BCSE3099			
Prerequisite	Programming and Data structures, Advanced Data structures and Algorithm			
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:

The primary objective of this course is to cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus. The potential applications for Bit coin-like crypto currencies are enormous. The course will enable an individual to learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

Course Outcomes

CO1	Familiarise the functional/operational aspects of crypto currency ECOSYSTEM

CO2	Understand emerging abstract models for Block chain Technology
CO3	Analyse the concept of bit coin and mathematical background behind it
CO4	Apply the tools for understanding the background of crypto currencies
CO5	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain
CO6	Understanding of latest advances and its applications in Block Chain Technology.

Text Book (s):

1. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming"
2. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
3. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing
5. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing
6. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018

Reference Book (s)

1	Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and crypto currency, IEEE Symposium on security and Privacy, 2015
2	J.A.Garay et al, The bit coin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310.

Course Contents:

Unit I: Introduction	**9 hours**
The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS) .	
Unit II: Cryptographic fundamentals	**9 hours**
cryptographic basics for crypto currency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography	
Unit III: Bit coin	**9 Hours**
Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin.	
Unit IV: Ethereum	**9 Hours**
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts.	
Unit V: Block chain-Recent trend	**9 Hours**
Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

SUGGESTED PRACTICALS
1. Install and understand Docker container, Node.js, Java and Hyper ledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud to run. https://github.com/hyperledger/ https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block chain/index.html.

2.Create and deploy a block chain network using Hyper ledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your block chain network (https://developer.ibm.com/patterns/create-and-deploy-block chain-network-using-fabric-sdk-java/)
3. Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules (https://developer.ibm.com/patterns/interacting-with-a-block chain-network/)
4. Deploy an asset-transfer app using block chain. Learn app development within a Hyper ledger Fabric network (https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block chain/).
5. Use block chain to track fitness club rewards Build a web app that uses Hyper ledger Fabric to track and trace member rewards (https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and-retail-integration/)
6. Car auction network: A Hello World example with Hyper ledger Fabric Node SDK and IBM Block chain Starter Plan. Use Hyper ledger Fabric to invoke chain code while storing results and data in the starter plan (https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk-starter-plan/)
7. Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device to improve a supply chain by using Block chain, IoT devices, and Node-RED (https://developer.ibm.com/patterns/develop-an-iot-asset-tracking-app-using-block chain/)
8. Secure art using block chain digital certificates. Node.js-based auction application can help democratize the art market (https://developer.ibm.com/patterns/securing-art-using-block chain-digital-certificates/)

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of the Course	Cyber Security

Course Code	**BCSE3540**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objective
This course provides knowledge on the various cyber threats and attacks. To learn the cyber security policies and crime laws.

Course Outcome

CO1	**Know the fundamental mathematical concepts related to security.**
CO2	Understand and implement the cryptographic techniques and know the real time applications of various cryptographic techniques.
CO3	Comprehend the authenticated process and integrity, and its implementation.
CO4	Know fundamentals of cybercrimes and the cyber offenses.
CO5	Understand the cyber threats, attacks and vulnerabilities and its defensive mechanism.
CO6	Understanding of latest advances and its applications in Cyber Security.

Text Book (s)

1	**Cryptography and Network security, William Stallings, Pearson Education, 7th Edition, 2016.**
2	Cyber Security, Understanding cyber crimes, computer forensics and legal perspectives, Nina Godbole, Sunit Belapure, Wiley Publications, Reprint 2016.
3	Writing Information Security Policies, Scott Barman, New Riders Publications, 2002.

Reference Book (s)

1	**Cybersecurity for Dummies, Brian Underdahl, Wiley, 2011**

2	Cryptography and Network security, Behrouz A. Forouzan , Debdeep Mukhopadhyay, Mcgraw Hill Education, 2 nd Edition, 2011.

Unit-1 Introduction 9 hours
Finite Fields and Number Theory: Modular arithmetic – Euclidian Algorithm – Primality Testing – Fermat's and Euler's theorem –Chinese Reminder theorem – Discrete Logarithms
Unit-2Cryptographic Techniques 9 hours
Symmetric key cryptographic techniques: Introduction to Stream cipher – Block cipher: DES – AES- IDEA. Asymmetric key cryptographic techniques: principles – RSA – ElGamal - Elliptic Curve cryptography – Key distribution and Key exchange protocols.
Unit-3 Authentication and Cybercrimes 9 hours
Hash functions – Secure Hash Algorithm (SHA) Message Authentication – Message Authentication Code (MAC) – Digital Signature Algorithm: RSA & ElGamal based Classification of cybercrimes – planning of attacks – social engineering: Human based – Computer based – Cyber stalking – Cybercafé and Cybercrimes
Unit-4 Cyber Threats, Attacks and Prevention 9 hours
Phishing – Password cracking – Key loggers and Spywares – DoS and DDoS attacks – SQL Injection. Identity Theft (ID) : Types of identity theft – Techniques of ID theft.
Unit-5Cybersecurity Policies and Practices 9 hours
What security policies are – determining the policy needs – writing security policies – Internet and email security policies – Compliance and Enforcement of policies- Review
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

SUGGESTIVE PRACTICALS
1. Implementation to gather information from any PC's connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4. Implementation of MITM- attack using wire shark/ network sniffers
5. Implementation of Windows security using firewall and other tools.

6. Implementation to identify web vulnerabilities, using OWASP project
7. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.
8. Implementation of OS hardening and RAM dump analysis to collect the Artifacts and other information's.
9. Implementation of Mobile Audit and generate the report of the existing Artiacts.
10. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Software Defined Network			
Course Code	BCSE3088			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:

This course introduces software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behaviour of an entire network.

Course Outcomes

CO1	Differentiate between traditional networks and software defined networks
CO2	Understand advanced and emerging networking technologies
CO3	Obtain skills to do advanced networking research and programming.
CO4	Learn how to use software programs to perform varying and complex networking tasks
CO5	Expand upon the knowledge learned and apply it to solve real world problems.
CO6	Understanding of latest advances and its applications in Software Defined Networks.

Text Book (s)

1	Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014
2	SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013
3	Software Defined Networking with Open Flow By SiamakAzodolmolky, Packt Publishing, 2013.

Reference Book (s)

1	Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
2	Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76..

3	Nunes, Bruno AA, et al. "A survey of software-defined networking: Past, present, and future of programmable networks." Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617-1634
4	Lantz, Bob, Brandon Heller, and Nick McKeown. "A network in a laptop: rapid prototyping for software-defined networks." Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks. ACM, 2010
5	Monsanto, Christopher, et al. "Composing software defined networks." Presented as part of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI 13). 2013.
6	https://www.coursera.org/learn/sdn# http://www.cs.fsu.edu/~xyuan/cis5930/

Course Contents:

Unit I: Introduction to SDN	**9 hours**
SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN	
Unit II: SDN Abstractions	**9 hours**
How SDN Works - The Open flow Protocol - SDN Controllers: Introduction - General Concepts - VMware - Nicira - VMware/Nicira - Open Flow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK	
Unit III : Programming SDN'S	**9 Hours**
Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing.	
Unit IV : SDN Applications And Use Cases	**9 Hours**
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3	
Unit V : SDN'S Future And Perspectives	**9 Hours**
SDN Open Source - SDN Futures - Final Thoughts and Conclusions.	

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggestive Lab:

Custom Topologies in POX, ODL, Floodlight 3 Click, ONOS,
Northbound – Southbound Interfacing,
ONOS deployment ONOS – OPNFV – SDN Application development 3

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

SEMESTER – VI

Name of The Course	**English Proficiency and Aptitude Building 6**				
Course Code	LLL312				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	

	2	0	0	2

Course Objectives:
1. Enable students to develop verbal reasoning skills.
2. Enable students to effectively participate in Group Discussions.
3. Enable students to implement logical approach in problem solving..

Course Outcomes

CO1	**Interpret the logical structure of an argument and apply the influence of emotional and figurative persuasion in the given argument.**
CO2	Evaluate an argument objectively and skilfully by analyzing and assessing it.
CO3	Appreciate and employ the thinking for self, and the development of confidence in one's own thinking.
CO4	Contribute in dialogue in a way that enables the students to experience and reflect upon their own thinking as it is expressed in communication with others.
CO5	Interpret the data and develop a deeper understanding of the problems.
CO6	Improves on one's managerial skills by interpreting the ideas effectively.
CO7	Develop advanced level techniques in problem solving and decision-making ability.
CO8	Gaining useful insight into the "why" and "how" of a problem and also differentiating between relevant and irrelevant information.

Reference Book (s)
1. Communication Skills for Engineers, Mishra, Sunita & C. Muralikrishna, , Pearson
2. Corporate Soft skills, Sarvesh Gulati, 2006.
3. Effective Communication, John Adair , Macmillan Ltd.1997.
4. Developing Communication Skills, Krishna Mohan and Meera Bannerji, Macmillan India Ltd. 1990
5. Quicker Maths , M Tyra
6. Quantitative Aptitude, Abhijeet Guha

Unit I: Verbal Reasoning • Paragraph Jumbles • Analogies • Critical Reasoning	5 lectures
Unit II**:** Group Discussion • Group Discussion- Concepts • Group Discussion - Practice	3 lectures
Unit III: Quantitative Aptitude • Crypto Mathematics • Introduction to Algebra • Set Theory • Permutation & Combination • Probability • Pie Chart & Mixed Graphs • Logical Reasoning • Data Sufficiency • Calendar and Clocks	10 lectures

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50		50	100

Name of The Course	**Web Technology**				
Course Code	**BCSE3012**				
Prerequisite	CSE121 - Object Oriented Programming, CSE312 – Database Management Systems				
Corequisite	CSE101 – Computer Programming and Problem Solving				
Antirequisite					
	L	**T**	**P**	**C**	
	2	0	2	3	

Course Objectives:
Acquire knowledge and skills for creation of web site considering both client and server side.
Gain ability to develop responsive web applications.
Acquire the knowledge to develop dynamic web pages.
Obtain the ability to develop server side application.

Course Outcomes

CO1	Understand the web development strategies and identify the problem
CO2	Develop the SRS document of the project
CO3	Design a visual representation of web application
CO4	Implement and establish database connectivity with front end.
CO5	Validate the web page using testing methodology
CO6	Understanding of latest advances and its applications in Web Technology.

Text Book (s)
T1. Xavier, C, “Web Technology and Design”, New Age International Publishers.
T2. Uttam/Roy,” WEB Technology”, Oxford Publication.
Reference Book (s)
R1. Ivan Bayross -Web Enabled Commercial Application Development Using HTML, DHTML, Java Script, Perl, CGI-2000.
R2. Raj Kamal, “Internet and Web Technologies”, McGraw Hill Education.
R3. Jackson, “Web Technologies” Pearson Education
R4. Patel and Barik, ”Introduction to Web Technology & Internet”, Acme Learning.
R5. Steve Suehring, Tim Converse, Joyce Park, "PHP 6 and My SQL 6" WILLEY.

Unit-1 : Introduction to web and HTML	**8 hours**

Introduction to web, web development strategies, web team. HTML introduction: basic tag, elements, attributes, formatting, comments, marquee, list, table, images, frames, forms; Links: text, image and email. XHTML: Syntax and Semantics.
Unit-2: CSS and XML **8 hours**
CSS: color, background, fonts, images, link, table, margins, lists, border, paddings, scroll, class.CSS3: border Image, round corner, text shadow, layers. XML: DTD, XML schemes, presenting and using XML.
Unit-3: JAVA SCRIPT **8 hours**
Java script: Introduction, documents, forms, statements, functions, objects; Event and event handling; Error handling; validation.
Unit-4: JSP **8 hours**
Java server pages (JSP), JSP application design, declaring variables and methods, debugging, sharing data between JSP pages, JSP objects, Session, development of java beans in Jsp, data base action with JSP.
Unit-5: PHP **8 hours**
PHP (Hypertext Pre-processor): Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form ,mail, file upload, session, error, exception, filter, PHP-ODBC.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

	Compiler Design	L	T	P	C
Version No.	Course Code: BCSE3085	3	0	0	3
Prerequisite	Discrete Structure, Data Structure and Algorithm, Theory of Automata and Formal Languages				
Co-requisites	C-Programming				
Course Coordinator					

Course Objectives
The objective of this course is to:
1. Provide an understanding of the fundamental principles in compiler design
2. Provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.
3. Learn the process of translating a modern high-level language to executable code. Grasp of compiler construction.

Course Outcomes
At the end of the course student will be able to:
1. Use language specifications behind the design of compiler.
2. Construct LL, SLR, CLR and LALR parsing table.
3. Evaluate different intermediate codes.
4. Implement different data structure and allocation schemes for symbol table.
5. Develope optimized codes.
6. Apply modern tools and technologies for designing new compiler.

Text Books

1. **ALFRED V AHO, JEFFREY D ULLMAN "Principles of Compiler Design".**
2. **V Raghvan, " Principles of Compiler Design", TMH**
3. **Kenneth Louden," Compiler Construction", Cengage Learning**
Reference Books
1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education 2
2. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

Course Content

Unit I: Introduction	**8 lectures**
Introduction to Compiler, Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers, implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	
Unit II: Basic Parsing Techniques	**8 lectures**
Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR (0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, and implementation of LR parsing tables.	
Unit III: Syntax Directed Translation	**8 lectures**

Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declaration sand case statements.
Unit IV: Symbol Table **8 lectures**
Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.
Unit V: Code Generation **8 lectures**
Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

S.No.		**Professional Elective-V**	L	T	P	C
1	BCSE4021	Digital Signal Processing	2	0	2	3
2	BCSE4022	Object Oriented Analysis & Design	2	0	2	3
3	BCSE4023	E-Business	2	0	2	3
4	BCSE4024	Network Operating System	2	0	2	3
5	BCSE9011	Robotics Process Automation	2	0	2	3

Name of The Course	**Digital Signal Processing**
Course Code	**BCSE4021**

Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:
The primary objective of this course is to introduce the topic of Digital Signal Processing. Introduction to digital signal processing and application, discrete time signals and structure of discrete time system. Analysis of LTI systems, Filter designing techniques, DFT and FFT, Architecture of DSP Processors and Multi-rate Signal Processing and applications.

Course Outcomes

CO1	Formulate engineering problems in the field of digital signal processing
CO2	Analyse digital and analog signals and systems
CO3	Analyse discrete time signals in frequency domain and Design digital filters
CO4	Identify the need of adaptive filters in communication applications.
CO5	Apply Architectural features of Digital Signal Processor in various areas.
CO6	Understanding of latest advances and its applications in Digital Signal Processing.

Text Book (s)

1	"Discrete Time Signal Processing": Oppenheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.
2	Digital Signal Processing fundamentals and Applications, Li Tan , Jean Jiang, Academic Press,2nd edition,2013

3	"Digital Signal Processing: Principles, Algorithm & Application", 4th edition, Proakis, Manolakis, Pearson

Reference Book (s)

1	Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,3rd edition,2006
2	Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill
3	Digital Signal processing-A Practical Approach, second edition, Emmanuel I. feacher, and BarrieW..Jervis, Pearson Education

Course Contents:

Unit-1: Introduction 9 hours
Overview: Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples.
Unit II: Discrete-Time Signals and Analysis of Linear Time Invariant System 9 hours
Discrete-Time Signals and Systems (Frequency Domain analysis): Z-transform & Inverse z-transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems.
Unit III Structures for Discrete Time Systems and Filter Design Techniques 9 Hours
Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference equations, Effects of Co-efficient quantization. Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIR filters by windowing techniques.`
Unit IV : Discrete-Fourier Transform & Fast Fourier Transform 9 Hours
Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm.

Unit V : **Advance DSP Techniques**	**9 Hours**
MultiMate Signal Processing: Decimation, Interpolation, Sampling rate conversion by rational factor **Adaptive filters:** Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation. Architecture of DSP Processors & applications.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggestive Experiments
▪ **Introduction to Code Composer Studio-I**
▪ **Introduction to Code Composer Studio-II**
▪ **Introduction to the Addressing Modes**
▪ **FFT and Bit Reversal Operation**
▪ **FFT and its Applications**
▪ **Audio Codec and its Applications**
▪ **Real Time Data Exchange**
▪ **FIR filtering by interfacing Matlab with Code Composer Studio**
▪ **Introduction to Interrupts**
▪ **Digital communication using Binary Phase Shift Keying**

Name of The Course	**Object Oriented Analysis & Design**
Course Code	**BCSE4022**

Prerequisite	Before you start proceeding with this tutorial, it is assumed that you have basic understanding of computer programming and related programming paradigms.			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:
To understand the fundamentals of object modeling
To understand and differentiate Unified Process from other approaches.
To design with static UML diagrams.
To design with the UML dynamic and implementation diagrams.
To improve the software design with design patterns.
To test the software against its requirements specification

Course Outcomes

CO1	be able to use an object-oriented method for analysis and design
CO2	be able to analyse information systems in real-world settings and to conduct methods such as interviews and observations
CO3	know techniques aimed to achieve the objective and expected results of a systems development process
CO4	know different types of prototyping
CO5	know how to use UML for notation

CO6	Understanding of latest advances and its applications in Object Oriented analysis and Design.

Text Book (s)

1	Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
2	Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.
3	Mark Priestley: Practical Object-Oriented Design with UML,TATA McGraw-Hill

Reference Book (s)

1	Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2	Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3	Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Course Contents:

Unit I: UML DIAGRAMS **9 hours**
Introduction to OOAD – Unified Process - UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams.
Unit II: DESIGN PATTERNS **9 hours**
GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller - Design Patterns – creational - factory method - structural – Bridge – Adapter - behavioural – Strategy – observer.
Unit III : CASE STUDY **9 Hours**

Case study – the Next Gen POS system, Inception -Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition.
Unit IV : APPLYING DESIGN PATTERNS **9 Hours**
System sequence diagrams - Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams - UML interaction diagrams - Applying GoF design patterns
Unit V : CODING AND TESTING **9 Hours**
Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments
Draw the Use Cases and define all the classes for Employee Management System.
Draw the Use Cases and define all the classes for Automatic Teller Machine.
Draw the Use Cases and define all the classes for Library Management System.
Draw the Sequence and Collaboration diagrams for Automatic Teller Machine.
Draw the Sequence and Collaboration diagrams for Employee Management System.
Draw the Sequence and Collaboration diagrams for Library Management System
Draw the state Transition Diagrams and Class Diagrams for Automatic Teller Machine.
Draw the state Transition Diagrams and Class Diagrams for Employee Management System.
Draw the state Transition Diagrams and Class Diagrams for Library Management System.

Draw the Component Deployment Model for Automatic Teller Machine.
Draw the Component Deployment Model for Employee Management System.
Draw the Component Deployment Model for Library Management System

Note: Teacher/Lab Instructor may suggest other software management system also.

Name of The Course	**Network Operating System**			
Course Code	BCSE4024			
Prerequisite	Operating Systems			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives: To understand the advanced topics in the computer networks

with more emphasis on the Internet architecture. To analyse the performance of different network functionalities.

Course Outcomes

CO1	**To understand basic operating systems features, setup and management.**
CO2	To understand the concepts involved in network operating system: REDHAT
CO3	To design network configuration by installing tools and packages.
CO4	Analyze various file systems and understand file server concepts.
CO5	Apply file server concepts in configuring server and its services

CO6	Understanding of latest advances and its applications in Network Operating Systems.

Text Book (s)

1	**Cisco™ Networking Academy Program: HP IT Essentials II: Network Operating Systems, Second Edition, 2004.**
2	Cisco™ Networking Academy Program: HP IT Essentials II: Network Operating Systems Journal and Workbook, Second Edition, 2004.
3	Bharat Bhusan, Understanding Linux , Khanna Publishing , Nai Sarak , New Delhi.

Reference Book (s):

1	**Wale Soyinka, Linux Administration: A Beginner's Guide, McGraw-Hill Osborne Media.**

Unit-1	**9 hours**
Introduction to Operating Systems (Microsoft Windows, UNIX and Linux on the Desktop. Network Operating Systems Overview). Network Setup and Management including Hardware/Software configuration of Gateway, Routers, and Switches.	
Unit-2	**9 Hours**
Network Operating System: Red Hat Linux, Installing Red Hat Linux. Preparing for installation. Booting from CD. Graphical Installation Launch. Setting disk partition levels. Setting Boot Loader, First Boot. Creation of User Account.	
Unit-3	**9 Hours**
Connecting to Internet: Network Configuration Tool. Connecting to LAN. DNS. Installing Software: RPM. Meaning, RPM Management Tool. Adding & Removing Packages. Querying RPM Packages.	
Unit-4	**9 Hours**
File System: What is File System. Anatomy of File System. File Permissions and Directories permissions. File Search Utilities. User Accounts: Super User Vs. Normal User. RedHat User Manager. Creating Groups. Server Role: Linux as Web Server. Apache Web Server. Installing Apache. Starting Apache. Configuring Web server. Setting up First Web Page.	

Unit-5	**9 Hours**
FTP Server: Meaning, FTP Protocol. Installing vsftpd FTP Server. Starting FTP server. Testing FTP server. Using FTP server. Using FTP Client to Test Anonymous Read Access. File Server: Overview of Samba Server. Installing SAMBA server. Starting and Stopping the SAMBA server. SAMBA configuration with SWAT. Starting SWAT Service. Adding SAMBA User. Creating and Configuring SAMBA Share.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggestive Experiments

Linux/UNIX Single User

The necessary skills for students to develop both GUI and command line skills for using and customizing a Linux workstation. Experiments include Linux file system and access permissions, GNOME Interface, VI editor, X Window System expression pattern matching, I/O redirection, network and printing utilities.

Windows Single User

An experiment includes hardware management, file and memory management, system configuration/optimization, and utilities. Upon completion, students should be able to perform operating systems functions at the support level in a single-user environment.

Windows Administration

Installation and configuration of a Windows Server operating system. Emphasis is placed on the basic configuration of core network services, Active Directory and group policies. Upon completion, students should be able to install and configure a Windows Server operating system.

Continuous Assessment Pattern

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Robotic Process Automation			
Course Code	BCSE9011			
Prerequisite	None			
	L	**T**	**P**	
	2	0	2	

The objective of this course is to:
1. Familiarize the students with the basic of Robotics & Automation
2. Design how to automate the process using RPA

Course Outcomes:

CO1	**Understand Basic Programming concepts and the underlying logic/structure.**
CO2	Learn how to install UiPath community edition and Analyze the different types of variables.
CO3	Control Flow and various activities used for it.
CO4	Develop understanding and application of Data Manipulation & recording techniques.
CO5	Understand Selectors, Image, Text and Data Tables Automation and how they are used in UiPath Studio.

CO6	Understanding of latest advances and its applications in Robotic Process Automation.

Text Book (s)
Alok Mani Tripathi, “Learning: Robotic Process Automation”, Kindle Edition.
Reference Book (s)
Richard Murdoch, "Learning: Robotic Process Automation”, Kindle Edition.

Module I
Programming Concepts Basics –: Understanding the application, Basic Web Concepts, Data Structures, Control structures and functions, Variables & Arguments.RPA Basics: History of Automation, RPA, Robot VS Automation, Processes & Flowcharts, What process can be automated, Types of Bots, Robotic control flow architecture,
Module II
Introduction to UiPath: Installing UiPath Studio community edition, The user Interface, Keyboard Shortcuts, Automation Debugging, Variables: Managing Variables, Naming Best Practice, The Variables Panel, Data Types, Managing Arguments, The Arguments Panel, Using Arguments, and About Imported Namespaces. Activities: Message Box, Input Dialog, Type into, Click, Send HotKey, Write line, Read text File, Write Text File. Types of Button.
Module III
Control Flow: Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity
Module IV
Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data, Recording Introduction, Basic and Desktop Recording, Web Recording, Input/output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques
Module V
Selectors, Image, Text & Advanced Citrix Automation, Excel Data Tables & PDF, Email Automation, Exceptional Handling, Introduction to Orchestrator.

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

SEMESTER –VII

S.No.		**Professional Elective-VI**	L	T	P	C
1	BCSE4026	Digital System Design using VHDL	2	0	2	3
2	BCSE4027	Advanced Computer Networks	2	0	2	3
3	BCSE4028	Enterprise Resource Planning	2	0	2	3
4	BCSE4029	Deep Learning	2	0	2	3
5	BCSE4030	UI&UX	2	0	2	3

Name of The Course	**Digital System Design using VHDL**
Course Code: BCSE4026	
Prerequisite	
Corequisite	

Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	2	3

Course Objectives:

This course instructs the students in the use of VHDL (Very High Speed Integrated Circuit Hardware Description Language) for describing the behaviour of digital systems. VHDL is a standardized design language used in computer/ semiconductor industry. This course will teach students the use of the VHDL language for representation of digital signals, design description, design of arithmetic, combinational, and synchronous sequential circuits.

Course Outcomes

CO1	Students must be able to simulate and debug digital systems described in VHDL
CO2	Program any VHDL code for practical implementation
CO3	Students must demonstrate the use and application of Boolean Algebra in the areas of digital circuit reduction, expansion, and factoring.
CO4	Students must be able to synthesize complex digital circuits at several level of abstractions
CO5	Students must be able to implement logic on an FPGA and a CPLD
CO6	Understanding of latest advances and its applications in Digital System Design using VHDL.

Text Book (s)

1	Fundamental of Digital Logic with VHDL Design, 3th edition, Stephen Brown and Zvonko Vranesic, McGraw-Hill, 2008.
2	Mark Zwolinski, Digital System Design with VHDL, Second Edition, Pearson Education.2007

Reference Book (s)

1	A Anandakumar, Digital Electronics, Prentice Hall India Feb 2009.
2	John F Wakerly, Digital Design, Pearson Education, Delhi, 2002. Digital systems design using VHDL, Charles H. Roth, JR.

3	Morris Mano, Digital Design, Pearson Education, Delhi, 2002

Course Contents:

Unit-1 Introduction **8 hours**
VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.
Unit-2 : Designing With Programmable Logic Devices **9 hours**
Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. Static RAM, A simplified 486 bus model, Interfacing memory to a microprocessor bus.
Unit-3 : Design Of Networks For Arithmetic Operations **9 hours**
Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider. Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations.
Unit-4 Digital Design with SM Charts **9 hours**
State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.
Unit-5 Designing With Programmable Gate Arrays And Complex Programmable Logic Devices **9 hours**
Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggested Experiments
1. Design all gates using VHDL.
2. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. half adder b. full adder
3. Write VHDL programs for the following circuits, check the wave forms and the hardware generated. a. multiplexer b. demultiplexer
4. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. decoder b. encoder
5. Write a VHDL program for a comparator and check the wave forms and the hardware generated. 6. Write a VHDL program for a code converter and check the wave forms and the hardware generated.
7. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated .
8. Write a VHDL program for a counter and check the wave forms and the hardware generated.
9. Write VHDL programs for the following circuits, check the wave forms and the hardware generated. a. register b. shift register 10. Implement any three (given above) on FPGA/CPLD kit

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Advanced Computer Networks**
Course Code	BCSE4027
Prerequisite	Computer Networks
Corequisite	

Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:
To understand the advanced topics in the computer networks, with more emphasis on the Internet architecture. To analyse the performance of different network functionalities.

Course Outcomes

CO1	**To understand advanced concepts of physical layer transmission media.**
CO2	Analyze various implementation concepts in congestion control and error detections
CO3	To understand wireless networks and the way access is controlled in these types of networks
CO4	Analyze various fields of mobile and social networks in different perspectives.
CO5	Design of cryptographic algorithms for Enterprise networks.
CO6	Understanding of latest advances and its applications in Advanced Computer Networks.

Text Book (s)

1	**Douglas E. Commerce, Internetworking with Principles, Protocols, Architecture. 6th Edition, 2013**
2	Andrew S. Tanenbaum, J.Wetherall, “Computer Networks” 5th Edition, 2010.
3	Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks 2013

Reference Book (s)

1	**J.F. Kurose and K.W. Ross, Computer networking: A top-down approach, 6th edition, Adison Wesley.**
2	L.L. Peterson and BS. Davie, Computer Networks ISE: A System Approach, 5th edition, Morgan Kaufman.
3	B.A. Frozen, Data communication & networking, 5th Edition, Tata Mc-Graw Hills.

Unit-1	**9 hours**
Introduction: Internet architecture and performance modeling: Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, ATM reference model. Physical Layer: Different types of transmission media, and errors in transmission: attenuation, noise. Repeaters. Traffic Characterization (CBR, VBR);	
Unit-2	**9 Hours**
Switching Paradigms; Multiplexing. Error Control, Flow Control, FTH, DTH, PON, ISDN, DSL, CATV, SONET, Optical Networks. Link. layer: switching, multiple access, error recovery: Data Link Layer MAC Layer: Local Area Network Technologies: Fast Ethernet, Gigabit Ethernet, IEEE 802.11 WLAN, Bluetooth, Connecting LANs, VLANS, STP.	
Unit-3	**9 Hours**
Network Device, Routing algorithms, BGP, Advanced routing concepts, Router architectures, internetworking: Inter domain Routing, BGP, IPv6, Multicast Routing Protocols, Multi Protocol Label Switching, and Virtual Networks. Transport layer Transport protocols, TCP mechanics, congestion control, resource allocation UDP mechanics. Socket Programming.	
Unit-4	**9 Hours**
Overlay networks: RON, P2P, CDN, Web caching, cross-layer optimizations, Emerging network types: data centre, DTN, 4G mobile networks (LTE, Wi-Max), Online social networks (OSN), wireless sensor networks (WSN) – cross-layer sensor data dissemination	
Unit-5	**9 Hours**
Internet Telephony- 1st Generation Protocols, Compression Techniques, 2nd Generation Systems, H.320 Standards, Directory Systems, IRC, LDAP, Integration with the PSTN, Gateways, VoIP Consortium, ETSI TIPHON-Skype-Enterprise Network Security, SNAT, DNAT.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggestive Experiments:
1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using net stat)
5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down. 6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment
. 7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a Linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark.

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Enterprise Resource Planning			
Course Code:BCSE4028				
Prerequisite				
Co-requisite				
Anti-requisite				
	L	T	P	C
	2	0	2	3

Course Objectives:
1. Describe the concept of ERP and the ERP model; define key terms; explain the transition from MRP to ERP; identify the levels of ERP maturity.
2. Explain how ERP is used to integrate business processes; define and analyze a process; create a process map and improve and/or simplify the process; apply the result to an ERP implementation.
3. Describe the elements of a value chain, and explain how core processes relate; identify how the organizational infrastructure supports core business processes; explain the effect of a new product launch on the three core business processes.

Course Outcomes

CO1	Develop model for ERP for large project
CO2	Develop model for E-commerce architecture for any application
CO3	Describe the advantages, strategic value, and organizational impact of utilizing an ERP system for the management of information across the functional areas of a business: sales and marketing, accounting and finance, human resource management, and supply chain.
CO4	Demonstrate a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.

CO5	Evaluate organizational opportunities and challenges in the design system within a business scenario.
CO6	Understanding of latest advances and its applications in Enterprise Resources Planning.

Text Book (s)
1. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning –
Concepts and Practice", PHI.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource
Planning", Thompson Course Technology.
Reference Book (s):
1. Alexis Leon, "ERP Demystified", Tata McGraw Hill
2. Rahul V. Altekar "Enterprise Resource Planning", Tata McGraw Hill,
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – A Concepts and Practice", PHI.

Course Contents:

Unit I: **8 lecture hours**
ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP.
Unit II: **8 lecture hours**
Business Process Reengineering, 16SCSE101084, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.
Unit III: **8 lecture hours**
ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.
Unit IV: **8 lecture hours**
ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.
Unit V: **8 lecture hours**

ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study.
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggestive Experiments
This laboratory will be self-exploratory in nature with the undertaking of case studies such as by culling information from the Internet on
a) Pay roll
b) Back office accounting
c) Supply chain
d) Order Processing
e) Shipments
f) Web and Value addition to traditional business
g) Study of packages such as SAP oracle.
At the end of the laboratory a student is expected to make a presentation of his exploration in the area of e-commerce and ERP

Name of The Course	**Deep Learning**
Course Code	**BCSE4029**
Prerequisite	
Co requisite	
Antirequisite	

	L	T	P	C
	2	**0**	2	3

Unit I: Basics: Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.
UNIT-II: **Feed forward Networks & Deep Neural Networks:** Difficulty of training deep neural networks, Greedy layer wise training. Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders.
Unit –III: Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, ad delta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).
Unit –IV: Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs, Convolution Neural Networks**:** LeNet, AlexNet.
Unit –V Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. **Recent trends:** Variation Auto encoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Suggestive Experiments

1	**Implement AND gate using Neural Network.**
2	Implement XOR gate using Neural Network
3	Implement PCA to analyse a Data Table
4	Implement Singular value decomposition
5	Implement Convolution Neural Network
6	Analyse classification performance of CNN.
7	Implement Alex Net
8	Implement Google Net
9	Analyse and Compare the Performance of CNN, Alex Net and Google Net.
10	Implement Recurrent Neural Network for text.
11	Implement LSTM
12	Analyse and compare performance of RNN and LSTM.

Name of The Course	**UI UX**				
Course Code	**BCSE4030**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**0**	0	3	

Course Objectives:
By the end of this course, students will be able to:
Define the term UI UX and identify how it fits into the software development lifecycle. Conduct generative user experience design activities to creatively fill user needs when designing a new user interaction. Participate effectively in design critiques, and be able to use this experience to be a more effective design team member. Design and produce an interactive prototype of a complete design concept to present to a client for a new user interaction.

Course Outcomes:

CO1	**Understand** the definition and principles of UI/UX Design in order to design with intention.
CO2	**Achieve** a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
CO3	**Learn** the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
CO4	**Discover** the industry-standard tools and specific project deliverables in UI/UX.
CO5	**Explain** why you made design decisions, through presentations of assignments and your personal portfolio.
CO6	Understanding of latest advances and its applications in UI/UX.

Text Book (s)

1	A Project Guide to UX Design, Second Edition. Russ Unger and Carolyn Chandler. New Riders. 1249 Eighth Street. Berkeley, CA 94710. (510) 524-2178.
2	UI design from the expert web UI design best practices, Advice from UI & UX experts such as Luke Wroblewski, Jakob Nielsen, Jared Spool, and many others, Nov 20, 2014.
3	User Interface and User Experience (UI/UX) Design. Article (PDF Available), Nov 17, 2017.

Reference Book (s)

1	Interaction Design: Beyond Human-Computer Interaction, by Rogers, Sharp, and Preece, ISBN-10 # 0470665769

2	The Design of Everyday Things, by Norman, ISBN-10 # 0465050654.
3	Sketching User Experiences: Getting the Design Right and the Right Design, by Buxton, ISBN-10 # 0123740371.

Course Contents:

Unit-1: Introduction	**9 hours**
UI/UX Overview: Intro to UI/UX, The User Interface versus the User Experience, Scholarly Influences on UI/UX Design in Cartography and Visualization, Good/Bad UX, Designing the User Experience, Designing the User Interface, Interface Styles, Notion & Figma Setup, Design Thinking.	
Unit II: User Research & User Journeys	**9 hours**
How to identify stakeholders, Defining Stakeholders Figma Basics, How to identify user needs, User Research, Interaction Design, Mapping the user journey, User Journey Maps + HMW, Figma Gray scales, Finding solutions & constraint cards.	
Unit III : Gray scales & User Testing	**9 Hours**
UX Principles, Blocking Gray scales + User Flow, Figma Prototype, Understanding user testing, Gray scales + Usability Testing, Design of Everyday Things.	
Unit IV : UI Principles	**9 Hours**
UI Principles, UI Analysis, Figma UI Part 1, Color and Font, UI Design in 3 Sprints, Refactoring UI.	
Unit V : Style Guide	**9 Hours**
Non-Traditional UI, Find UI in other Technologies, Figma UI Part 2, UI Special Topics, Create UI for other Technologies, Creating UI Design, UI Components, Style Guide Analysis, Figma Advanced, Responsive Design. Style Guide for Responsive UI, Visual Display of Information.	
Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Suggestive Experiments

UX Design Module	**Research, User flow, Competitor analysis, Persona, Process models, Navigations, Information Architecture, Sketching, Prototyping, Wire framing, Testing, Google Material design etc.**

UI Design Module	Photoshop, Illustrator, XD, Sketch, Figma.
UI Development Module	Overview of HTML5, CSS3, JavaScript, Equerry, Bootstrap.

Experiments:
1: Visual design
Visual design, Creating storyboards, Product design, Colour theory, Layouts, Typography, Iconography, Info graphics, Branding design, Image editing, Web template design, Creating UI elements, UI Kits & Image widgets, Mock-up, Basic interaction.
2: HTML5 & CSS3
Design Engineering, Building web pages, Creating responsive layouts, Designing buttons, tooltips etc,. Interactive prototype, MVC pattern, Usability testing, Cross browser compatibility, Creating Visual Mock-ups.
3: JavaScript, J Query, Bootstrap
Basic principles & functionalities.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

School of Computing Science and Engineering

Program: M. Tech Computer Science and Engineering

Scheme: 2020 – 2022

Curriculum

Semester I									
Sl. No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	CENG5001	Professional Communication Skills	0	0	2	1	70	-	30
2	MATH5001	Advanced Numerical and Statistical Methods	3	1	0	4	20	30	50
3	MCSE1110	Advanced Design and Analysis of Algorithms	3	0	0	3	20	30	50
4	MCSE1120	Advanced Computer Networks	3	0	0	3	20	30	50
5	MCSE1130	Advanced Operating Systems	3	0	0	3	20	30	50
6	MCSE1150	Advanced Software Engineering	3	0	0	3	20	30	50
7	MCSE1111	Advanced Design and Analysis of Algorithms Lab	0	0	2	1	70	-	30
8	MCSE1121	Advanced Computer Networks Lab	0	0	2	1	70	-	30
9	MCSE1151	Technical Seminar	0	0	2	1	70	-	30
Semester II									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCSE1240	Artificial Intelligence & Machine Learning	3	0	0	0	20	30	50
2	MCSE9100	Data Mining & Analytics using R	3	0	0	3	20	30	50
3	MCSE1260	Research Methodology	3	0	0	3	20	30	50
4	MCSE9260	Foundations of Information Security (Elective-1)	3	0	0	3	20	30	50
5	MCSE1241	AI & ML using Python Lab	0	0	4	2	70	-	30
6	MCSE9101	Data Mining & Analytics using R Lab	0	0	4	2	70	-	30
7	MCSE1250	Python Programming	0	0	4	2	70	-	30
8	MCSE1251	Advanced Java Programming Lab	0	0	4	2	70	-	30
9	SLMC5012	English Proficiency and Aptitude Building -2	0	0	2	1	70	-	30
10	MCSE1261	Certification Course/Term Paper	0	0	2	1	70	-	30
Semester III									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCSE2320	Software Project Management	3	0	0	3	20	30	50
2		Program Elective-2	3	0	0	3	20	30	50
3		Program Elective-3	3	0	0	3	20	30	50
4	SLMT5002	Quantitative and Communication Proficiency	0	0	2	1	70	-	30
5	MCSE2321	Software Development Lab	0	0	4	2	70	-	30
6	MCSE2381	M. Tech Dissertation Part-1	0	0	0	5	50	-	50
Semester IV									

Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCSE2481	M. Tech Dissertation-Final	0	0	30	15	50	-	50

List of Electives

Basket-1

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCSE9110	IoT Technology and Applications	3	0	0	3	20	30	50
2	MCSE9120	IoT on Cloud	3	0	0	3	20	30	50
3	MCSE9130	Big Data Mining and Analytics	3	0	0	3	20	30	50
4	MCSE9260	Foundations of Information Security	3	0	0	3	20	30	50

Basket-2

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCSE9310	Formal models of software systems	3	0	0	3	20	30	50
2	MCSE9320	Embedded Software Development	3	0	0	3	20	30	50
3	MCSE9350	Social Network Analysis	3	0	0	3	20	30	50
4	MCSE9340	Bio-inspired Computing	3	0	0	3	20	30	50

Basket-3

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCSE9410	Data Visualization Techniques	3	0	0	3	20	30	50
2	MCSE9420	Reconfigurable Computing	3	0	0	3	20	30	50
3	MCSE9430	Mobile Application Development	3	0	0	3	20	30	50
4	MCSE9450	Information Storage Management	3	0	0	3	20	30	50

Detailed Syllabus

Course Code:MATH5001	Advanced Numerical and Statistical Methods	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	3	1	0	4
Prerequisite/Exposure					
Co-requisites					

Unit -I

System of Linear Equations: Direct Methods- Gauss elimination – Pivoting, Partial and Total Pivoting, Triangular factorization method using Crout LU decomposition, Cholesky method, Iterative Method- Gauss-Seidel and Jacobi method, ill conditioned matrix System of Non-linear equation- Newton Raphson and Modified Newton Raphson Method. Iterative methods.

Interpolation and Approximation: Lagrange, Spline and Hermite interpolation, Approximations, Error of approximation, Norms for discrete and continuous data, Least square approximation.

Numerical Integration: Newton Cotes closed Quadrature, Gauss Legendre Quadrature, Multiple Integration.

Numerical Solution of Differential Equations: Finite Difference Schemes, Numerical solution of Ordinary differential equation using Modified Euler's method, Runge-Kutta method of 2nd, 3rd and 4th orders, Predictor- Corrector method, Solution of Laplace's and Poisson's equations by Liebman's method, Solution of one dimensional time dependent heat flow.

Probability and statistics: Review of concept of probability, Random Variables, Continuous and discrete distribution function, moments and moments generating functions, Binomial, Poisson, Negative Binomial, Geometric and Hyper-geometric Distributions, Uniform, Normal, Exponential, Gamma and Beta distributions. Point and Interval estimation, Testing of Hypothesis (t-test and chi square test), Analysis of variance and Introduction of Design of experiments.

Unit –VI

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

1. Numerical Methods for Scientific and Engineering Computation (6^{th}edition) by Jain, Iyengar & Jain, New Age International publishers.
2. Probability & Statistics for Engineers & Scientists (9^{th}edition) by R.E.Walpole, R,H,Myers&K.Ye.
1. Numerical Methods by E Balagurusamy, Tata McGraw Hill
2. Curtis F. Gerald and Patrick O Wheatley, Applied Numerical Analysis, Pearson Education Ltd.
3. Introductory Methods of Numerical Analysis by S.S. Sastry, PHI learning Pvt Ltd.
4. Numerical methods for Engineers (6^{th}edition), Steven C. Chapra and Raymond P. Caynale.
5. Numerical Methods in Engineering & Science (9^{th}edition), by B.S.Grewal
6. Statistical Methods by S.P. Gupta, Sultan Chand and Sons
7. Probability and Statistics by Schaum's series (3^{rd}edition)

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE1110	Advanced Design and Analysis of Algorithms	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure	Data Structures and Algorithms				
Co-requisites					

Course Objectives

1. To know the importance of the complexity of a given algorithm.
2. To study various algorithmic design techniques.
3. To utilize data structures and/or algorithmic design techniques in solving new problems.
4. To know and understand basic computability concepts and the complexity classes P, NP, and NP-Complete.

Course Outcomes

At the end of the course, students will be able to:

1. Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
2. Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
3. Solve the problems through graph algorithms.
4. Justify that a certain problem is NP-Complete
5. Understand and apply linear programming concepts to real time applications.

Course Content

Unit I: Introduction **8 Hours**

Overview of algorithmic design**,** asymptotic notation and its properties, Growth of Functions, Time complexity and Analysis of algorithms, Recurrence Relations.

Unit II: Sorting and Searching Algorithms **8 Hours**

Brute Force Method - Sorting in Quadratic time, insertion , selection and Bubble sort; Divide and conquer method- Sorting in Logarithmic time – Quick Sort , merge Sort , Shell Sort , Heap sort; Non-comparison sorts - Sorting in Linear Time - Counting Sort , Radix Sort , Bucket Sort; Worst Case and best case analysis of all sorting algorithms; Linear Search, Binary Search, Hashing, Randomized select , randomized quick sort.

Unit III: Algorithms for Trees **8 Hours**

Binary Tree - Binary Tree traversals, Binary Search Tree, heap, priority Queues, Red Black Trees, B-Trees.

Unit IV : Graph Algorithms **8 Hours**

Graph Searching- Breadth-First Search, Depth-First Search, DAGs and topological sorting, minimum spanning tree, shortest path, backtracking, Network flow algorithms.

Unit V: Greedy Algorithms, Amortized Analysis and Dynamic Programming **8 Hours**

Longest common subsequence, Greedy Algorithms - Knapsack problem; Huffman codes, Algorithms for String Matching, Theory of NP-completeness; Turing machines and the halting problem, Applications of Algorithms in Databases, Information Retrieval and Web Searching, Data Mining.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Cormen, Leiserson, Rivest and Stein, "Introduction to Algorithms", 2nd Edition, by, McGraw-Hill, 2000.**
2. **E. Horowitz, and S. Sahni, "Fundamentals of Computer Algorithms", Computer Science Press (1978).**

Reference Books

1. Jon Kleinberg and Eva Tardos. Algorithm Design. Pearson Education, 2007.
2. Sanjoy Das Gupta, Christos Papadimitriou, Umesh Vazirani, Algorithms 1st Edition, Mcgraw Higher Ed, 2006.
3. Alfred V. Aho, John E. Hopcroft, Jeffery D.Ulman, Data Structures and Algorithms, Pearson; 1st edition, 2001.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE1120	Advanced Computer Networks	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure	Computer Networks				
Co-requisites					

Course Objectives

The objective of this course is to:

1. **An ability to understand the basic concept of data communications and computer networks (e.g., different network types, applications, protocols, OSI layered architecture model, switching methodologies)**
2. **Provide the skills needed for algorithms in computer networks for various situations that one may encounter in a career in Computer Science.**
3. **Learn different algorithmic methodologies to design efficient algorithms and protocols in network field.**

Course Outcomes

At the end of the course, students will be able to:

1. To develop knowledge about physical structure of computer network
2. To understand the fundamental concepts in routing and addressing
3. To analysis the problem in different layer during the communication in network
4. To understand the congestion control and transport protocols
5. To became expert to use of Internet and public network
6. To able to understand the connection management in network at transport layer

Course Content

Unit I: Networking Standards and Specification **8 Hours**

Networking standards and specifications, Need for standardization, ISO and the IEEE standards, The IEEE 802 Project

Unit II: Addressing and Routing **8 Hours**

Network names and addresses, Physical layer addressing: the MAC address, Network layer addressing: The IP address, Network layer address: The IPX address.

Unit III: Overview of OSI and TCP/IP Protocol Suite **8 Hours**

Converting network names to IP addresses, Resolving IP addresses to physical addresses, Addressing and routing.

Unit IV : TCP/IP Protocol Suite **8 Hours**

TCP/IP Protocol Suite, TCP/IP Protocol Suite advantages, Internet Protocol (IP), Transport Layer Protocols -TCP and UDP, File Transfer protocols - FTP and TFTP, Mail and news protocols - SMTP, POP3, NNTP and IMAP, Other Protocols Suite – ICMP and ARP.

Unit V: Other Networking Protocols **8 Hours**

The IPX/SPX Protocol Suite, NetBEUI, AppleTalk Protocol, File sharing protocols - SMB, NCP, and NFS, Routing protocols - RIP, OSPF and BGP, Network Management Protocol – SNMP and CIMP, Convergent Protocols – H.323 and SIP

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Behrouz A. Forouzan, TCP/IP Protocol Suite, Third Edition, Tata McGraw-Hill, 2005.**
2. **W. Richard Stevens, TCP/IP Illustrated, The Protocols, Pearson Education, 2004.**
3. **D. E. Comer, Internetworking with TCP/IP Principles, Protocols and Architecture Vol - I, Pearson Education, 2001.**

Reference Books

1. **Internetworking with TCP/IP: Design, Implementation, and Internals by Douglas E. Comer, Stevens.Prentice Hall. Hardcover- 30 April, 2004.**
2. **Networks Fundamental Video 3 - the Transmission Control Protocol/internet Protocol (Tcp/ip) Stack by Delmar.Delmar. Unknown Binding- 1 December, 2002.**

3. **Advanced IP Routing in Cisco Networks (McGraw-Hill Technical Expert) by Terry Slattery, Bill Burton. Osborne McGraw-Hill. Paperback- 1 October, 2000.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE1130	Advanced Operating Systems	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure	Operating System				
Co-requisites					

Course Objectives

1. **To learn the fundamentals of Operating Systems.**
2. **To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.**
3. **To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.**
4. **To know the components and management aspects of Real time, Mobile operating systems.**

Course Outcomes

At the end of the course, students will be able to:

1. **Discuss the various synchronization, scheduling and memory management issues.**
2. **Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.**
3. **Discuss the various resource management techniques for distributed systems.**
4. **Identify the different features of real time and mobile operating systems.**
5. **Install and use available open source kernel.**
6. **Modify existing open source kernels in terms of functionality or features used.**

Course Content

Unit I: Introduction **8 Hours**

Operating system concept - processes and threads, process model, process creation, process termination, process hierarchies, and process states, Implementation of processes, Threads- Thread model, thread usage, Implementation of threads in user space and kernel, Hybrid implementations.

Unit II: Inter Process Communication **8 Hours**

Race conditions, critical regions, Mutual Exclusion with busy waiting, sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing; Scheduling- scheduling in batch systems, Interactive systems, Real time systems, Thread scheduling.

Unit III: Deadlocks **8 Hours**

Deadlocks-Introduction, Deadlock Detection and Recovery – Deadlock Detection with one resource of each type, with multiple resource of each type, recovery from deadlock; Deadlock Avoidance, Deadlock Prevention

Unit IV: Memory and Device Management **8 Hours**

Introduction, Swapping, Paging, Virtual memory – Demand paging, page replacement Algorithms; File System Management- Organization of File System, File Permissions, MS DOS and UNIX file system case studies, NTFS; Device Management- I/O Channels, Interrupts and Interrupt Handling, Types of device allocation.

Unit V: Distributed Operating Systems **8 Hours**

Distributed operating system concept – Architectures of Distributed Systems, Distributed Mutual Exclusion, Distributed Deadlock detection, Agreement protocols, Threads, processor Allocation, Allocation algorithms, Distributed File system design; Real Time Operating Systems: Introduction to Real Time Operating Systems, Concepts of scheduling , Real time Memory Management.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Mukesh Singhal and Niranjan, "Advanced Concepts in Operating Systems", TMH, 1st Edition, 2001**
2. **Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education, 2nd Edition, 2006**
3. **Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education, 2nd Edition, 2001.**
4. **Pradeep K. Sinha, "Distributed Operating Systems and concepts", PHI, First Edition, 2002**

Reference Books

1. **Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.**
2. **Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.**
3. **Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code:MCSE1150	Advanced Software Engineering	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure	Software Engineering				
Co-requisites					

Course Objectives

1. **To understand Software Engineering Lifecycle Models**
2. **To do project management and cost estimation**
3. **To gain knowledge of the System Analysis and Design concepts.**
4. **To understand software testing approaches**
5. **To be familiar with DevOps practices**

Course Outcomes

At the end of the course, students will be able to:

1. **Understand the advantages of various Software Development Lifecycle Models**
2. **Gain knowledge on project management approaches as well as cost and schedule estimation strategies**
3. **Use UML diagrams for analysis and design**
4. **Architect and design using architectural styles and design patterns**
5. **Understand software testing approaches**
6. **Understand the advantages of DevOps practices**

Course Content

Unit I: INTRODUCTION **8 Hours**

Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management.

Unit II: SOFTWARE REQUIREMENT SPECIFICATION **8 Hours**

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram.

Unit III: ARCHITECTURE AND DESIGN **8 Hours**

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client-server - Tiered - Pipe and filter.- User interface design

Unit IV : TESTING **8 Hours**

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking.

Unit V: DevOps **8 Hours**

DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline: Overall Architecture Building and Testing-Deployment- Case study: Migrating to Micro services.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearson Education, 2004.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
3. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.

Reference Books

1. Len Bass, Ingo Weber and Liming Zhu, ―DevOps: A Software Architect‘s Perspective‖, Pearson Education, 2016
2. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009. 6. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE1111	Advanced Design and Analysis of Algorithms Lab	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	0	0	2	1
Prerequisite/Exposure	Data Structures and Algorithms				
Co-requisites					

List of Experiments:

1. Write C++ programs to implement the following: a) Prim's algorithm. b) Kruskal's algorithm.
2. Write a C++ program to find optimal ordering of matrix multiplication. (Note: Use Dynamic programming method).
3. Consider the problem of eight queens on an (8x8) chessboard. Two queens are said to attack each other if they are on the same row, column, or diagonal. Write a C++ program that implements backtracking algorithm to solve the problem i.e. place eight non-attacking queens on the board.
4. Write a C++ program to find the strongly connected components in a digraph.
5. Write a C++ program to implement file compression (and un-compression) using Huffman's algorithm. .
6. Write a C++ program to implement dynamic programming algorithm to solve all pairs shortest path problem.
7. Write a C++ program to solve 0/1 knapsack problem using the following: a) Greedy algorithm. b) Dynamic programming algorithm. c) Backtracking algorithm. d) Branch and bound algorithm.
8. Write a C++ program that uses dynamic programming algorithm to solve the optimal binary search tree problem.
9. Write a C++ program for solving traveling sales persons problem using the following: a) Dynamic programming algorithm. b) The back tracking algorithm.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: MCSE1121	Advanced Computer Networks Lab	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	0	0	2	1
Prerequisite/Exposure	Computer Networks				
Co-requisites					

List of Experiments:

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat)
5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterize traffic when the DNS server is up and when it is down.
6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterize file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails
8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: MCSE1151	Technical Seminar	L	T	P	C
Version No.1.0	Date of Approval: 19/06/2018	0	0	2	1
Prerequisite/Exposure					
Co-requisites					

Progressive Assessment:

The progressive assessment would be carried out based on following criteria**.**

i. Innovativeness of the topic
ii. Initiative and efforts taken in searching the topic
iii. Amount and quality of material collected related to topic by searching library/internet/automobile companies etc.
iv. Creativity and innovativeness in preparing models/charts etc.
v. Planning the activities and then pursuing that plan.
vi. Persistence in the efforts and resourcefulness.
vii. Communication skills.
viii. Timely achievement of the targets.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: MCSE1240	Artificial Intelligence & Machine Learning	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

OBJECTIVES:

1. Understand the Concept of artificial intelligence &machine learning.
2. Understand the Concept of Neural Network.
3. Evaluate the essentials of AI/ML using R language.
4. Decision making through Inference Technique.
5. Make students understand the knowledge discoveries in AI & ML.
6. Learn AI & ML tools.

OUTCOMES:

Students who complete this course will be able to

1. **Students should know about artificial intelligence and machine learning**
2. **Students should learn machine learning tools.**
3. **Students should know about neural networks.**
4. **Students use prediction of AI techniques.**

5. **Students can use classification of machine learning algorithm.**
6. **Further take the R&D interest and try to contribute some new methods to the area.**

Course Content

UNIT-I INTRODUCTION TO DATA SCIENCE AND AI & ML

Data Science, AI & ML, Use cases in business and scope, Scientific method, Modeling concept, CRISP-DM method, ML techniques overview, Validation techniques(Cross-validation), Feature reduction/ Dimensionality reduction, Principle component analysis(Eigen value, Eigen vector, Orthogonality), AI application areas, AI basics(divide & conquer, greedy, branch and bound,Gradient descent), NN basics(perceptron and MLP, FFN, Back propagation).

UNIT-II R ESSENTIAL

Programming

Command and syntax, Packages and libraries, Introduction to data types, Data structure in R-vectors, Matrices, Array, List, Factors, Data frames, Importing and exporting data, Control structure and functions

Descriptive Statistics

Data exploration(histograms, bar chart, box plot, line graph, scatter plot), Qualitative and quantitative data, Measure of central tendencies(mean, median, mode), Measure of positions(quartiles, deciles, percentiles and quantiles), Measure of dispersion(range, median, absolute deviation about median, variance and standard deviation), Anscombe's quartet, Other measures - quartile and percentile, interquartile range

UNIT-III PRINCIPLES OF BIG DATA AND FRAMEWORKS (HADOOP,SPARK,NOSQL)

Introduction to big data, Challenges of processing big data(volume, velocity, variety perspective), Use cases, Processing, storage and programming framework, Hadoop ecosystem components and functions, Essential algorithms (word count, page rank, IT-IDF), Spark: RDDs, streaming and spark ml, NoSQl concepts(CAP, ACID, NoSQL types).

UNIT-IV NEURAL NETWORKS

Convolution NN

Image classification, Text classification, Image classification and hyper parameter tuning, Emerging NN architecture

Recurrent NN

Building recurrent NN, Long short-term memory, Time series forecasting

UNIT-V CLASSIFIERS AND SVM

Naive Bayes Classifiers

Model Assumptions, Probability estimation, Required data processing, M-estimates. Feature selection Mutual information, Classifiers

K-Nearest Neighbors

Computational geometry; Wilson editing and triangulation, Aspects to consider while designing K-Nearest Neighbour

Support Vector Machines

Linear learning machines and Kernel space, making Kernels and working in feature space, SVM for classification and regression problems

Decision Trees

ID4, C4.5, CART

Ensembles Trees

Bagging & boosting and its impact on bias and variance, C5.0 boosting, Random forest, Gradient Boosting Machines and XGBoost

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

REFERENCES:

1. Super Intelligence - Paths,Danger,Strategies ; Nick Bostrom
2. How to Create a Mind ; Ray Kirzweil.
3. Artificial Intelligence-A Modern Approach ; Stuart J. Russell,PeterNarvig
4. Deep Learning with R ; Francois Chollet, J.J. Allaire.
5. Deep Learning (Adaptive Computation and Machine Learning series); Ian Goodfellow.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9100	Data Mining & Analytics using R	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	3	0	0	3
Prerequisite/Exposure	Database Management System				
Co-requisites					

OBJECTIVES:

1. To learn data analysis techniques.
2. To understand Data mining techniques and algorithms.
3. Comprehend the data mining environments and application.

OUTCOMES:

Students who complete this course will be able to

1. To compare various conceptions of data mining as evidenced in both research and application.
2. To characterize the various kinds of patterns that can be discovered by association rule mining.
3. To evaluate mathematical methods underlying the effective application of data mining.

UNIT- I INTRODUCTION TO DATA MINING

Data mining-KDD versus data mining - Stages of the Data Mining Process- Data Mining Techniques –KDD Process - knowledge representation – Data mining query languages- Integration of a Data Mining System with a Data Warehouse –Data pre-processing – Data cleaning- Data transformation- Feature selection-Dimensionality reduction.

UNIT-II ASSOCIATION AND CLASSIFICATION

Association Rules- Association rule Mining -Mining frequent patterns association- Apriori Algorithm - correlation – Classification - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Associative -Classification – Lazy Learners – Other Classification Methods

UNIT-III CLUSTERING

Clustering techniques – Partitioning methods- k-means Clustering - Hierarchical Methods – Distance based agglomerative and divisible clustering - Density-Based Methods – Expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

UNIT-IV DATA MINING SOFTWARE AND APPLICATIONS

Mining complex data objects - Spatial databases - temporal databases - Multimedia databases- Time series and Sequence data - Text Mining - Graph mining-Web mining-Application and trends in data mining.

UNIT-V METHODS OF INTERNAL ANALYSIS & DATA ANALYTICS USING R

Methods of Internal analysis – Cluster analysis – Association among variables – Web mining analysis -Data Analytics – Simulated data – Mathematical statistic analysis – Applications of probability theory – Linear models – Case study.

Unit VI: APPLICATION AND RESEARCH

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

REFERENCES:

1. AdelchiAzzalini, Bruno Scapa, “Data Analysis and Data mining”, 2nd Edition, Oxford University Press Inc., 2012.
2. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, 3rd Edition, Morgan Kaufmann Publishers, 2011.
3. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, 10th Edition, TataMc Graw Hill Edition, 2007.
4. G. K. Gupta, “Introduction to Data Mining with Case Studies”, 1st Edition, Easter Economy Edition, PHI, 2006.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE1260	Research Methodology	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES:

The course should enable the students to:

1. Identify an appropriate research problem in their interesting domain.
2. Understand ethical issues Understand the Preparation of a research project thesis report.
3. Understand the Preparation of a research project thesis report
4. Understand the law of patent and copyrights.
5. Understand the Adequate knowledge on IPR

COURSE OUTCOMES (COs):

CO 1: Understand the research problem and research process.
CO 2: Understand research ethics.
CO 3: Prepare a well-structured research paper and scientific presentations
CO 4: Explore on various IPR components and process of filing.
CO 5 : Understand the adequate knowledge on patent and rights

UNIT-I	**MEANING OF RESEARCH PROBLEM**	**Classes: 08**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II	**LITERATURE STUDIES**	**Classes: 08**

Effective literature studies approaches, analysis Plagiarism, and Research ethics.

UNIT-III	**TECHNICAL WRITING**	**Classes: 08**

Effective technical writing, how to write report, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee.

UNIT-IV	**RESEARCH PROPOSAL**	**Classes: 08**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-V	**PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR**	**Classes: 08**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

UNIT VI

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books:

1. Stuart Melville and Wayne Goddard, " Research methodology: an introduction for science & engineering students"

2. Ranjit Kumar, 2nd Edition, " Research Methodology: A Step by Step Guide for beginners

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE1241	AI & ML using Python Lab	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	0	0	4	2
Prerequisite/Exposure					
Co-requisites					

Continuous Assessment Pattern

Module I	**Introduction to Artificial Intelligence and Machine Learning tools.**
1. PyTorch - Download and Install Anaconda (https://www.anaconda.com/distribution/) then install pyTorch repository. **2. Weka - Install Weks (https://sourceforge.net/projects/weka/) then install JDK.** **3. Tableau - Download and Install Tableau Public (https://public.tableau.com/en-us/s/download).** **4. Knime - Download and Install Knime (https://www.knime.com/downloads/download-knime) .** **5. Google ML - Download and Install (https://developers.google.com/ml-kit)** **6. Apache Mahout - Download and Install (https://mahout.apache.org/)** **7. Scikit Learn - Download and Install Anaconda (https://www.anaconda.com/distribution/) or pyCharm (https://www.jetbrains.com/pycharm/) and then use Scikit learn.** **8. Tensor Flow - Download and Install (https://www.tensorflow.org/install)** **9. Shogun - Download and Install** **10. Colab - Download and Install**	
Module II	**Programs based on the respective tools .**
1. PyTorch - MNIST classification, Image Super-Resolution, Image Colorization, Text-Classification, CUB dataset, COCO dataset, **2. Weka -** **3. Tableau - Data Connection, Organizing and Simplifying Data, Mapping, Analytics, Data Visualization.** **4. Knime - Data Analyze, Data Pre-processing, Data Visualization, Data Manipulation, Data Wrangling.** **5. Google ML -** **6. Apache Mahout -** **7. Scikit Learn -** **8. Tensor Flow -** **9. Shogun -** **10. Colab -**	
Module III	**Artificial Intelligence and Machine Learning programs using Python**
1. Use Tensor Flow library to perform AI & ML program. **2. Use Scikit-Learn library to perform AI & ML program.** **3. Use NumPy library to perform AI & ML program.** **4. Use Theano library to perform AI & ML program.** **5. Use Keras library to perform AI & ML program.** **6. Use NLTK library to perform AI & ML program.** **7. Use Mahout library to perform AI & ML program.** **8. Use PyTorch library to perform AI & ML program.** **9. Implementing KNN - classification clustering algorithm using python.**	

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: MCSE9100	Data Mining & Analytics using R Lab	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	0	0	4	2
Prerequisite/Exposure	Database Management System				
Co-requisites					

List of Projects

1. Box office prediction using twitter reaction.
2. Tweet emotion analysis.
3. Prediction of the weather forecast.
4. Detecting fraud apps using sentimental analysis.
5. Movie success prediction.
6. Crime rate using k means.
7. Cancer prediction using data mining.
8. Topic detection using keyword clustering.
9. Smart Health Disease Prediction using Naive Bayes
10. Diabetes Prediction using data mining
11. TV show popularity analysis using data Mining
12. Secure E-learning using data mining techniques
13. E-banking Log system
14. Data Mining for Sales Prediction in the tourism industry
15. Cancer Prediction Using Data Mining
16. Financial status analysis using credit score rating
17. Opinion Mining for restaurant reviews
18. Personality Prediction System using CV Analysis.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

List of Experiments

Course Code: MCSE1250	Python Programming	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	0	0	4	2
Prerequisite/Exposure					
Co-requisites					

1. Write a python program to print all prime numbers among the interval given by user.
2. Write a python program to double the values in a list using map()
3. Write a python program to show the importance of operator precedence and associativity of different operators
4. Write a python program to do the following operations

   a. Reversing a given integer number.
   b. Find the sum of digits of given integer number.
5. Write a python program to implement Dice game for 2 players using random()
6. Write a python program to utilize all in-built mathematical functions.
7. Write a python program to check the given string is palindrome or not, without using In-built functions.
8. Write a python program to find a character and number of occurrence of a given character in a string.
9. Write a python program to manage student's details using dictionary.
10. Write a python program to design groceries billing system using dictionary.
11. Write a python program to get a date from user and give the day as output
12. Write a python program to find the number of days between two dates given by user.(Age Calculator)
13. Write a python program tofind Factorial of a given number without using Recursion Concept.
14. Write a python program tofind sum of N given numbers using Recursion by using Function.
15. Write a python program using the module, maintain students data and retrieve it accordingly.
16. Write a python program to implement a user defined math function using module.
17. Write a python program to copy the content of one file to another file.
18. Write a python program to search the give character or string is present in a file.
19. Write a python program which defines a function f. f takes two arguments a and b and do (a+b) / (a-b) computation. Implement exception handling with try, catch and else.
20. Write a python program to take input from the user again and again until correct value is given by user. Three user defined exceptions can be created i.e:
    a. NegativeValueError(if value entered is negative),
    b. ValueTooLarge(if value entered is more than stored value), and
    c. ValueTooSmall(if the value stored is less than stored value).

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: MCSE1251	Advanced Java Programming Lab(PBL)	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	0	0	4	2
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES:

- **To learn advanced Java programming concepts like interface, threads, Swings etc.**
- **To develop network programs in Java**
- **To understand Concepts needed for distributed and multi-tier application**
- **To understand issues in enterprise applications development.**

COURSE OUTCOMES:

- Upon the successful completion of the course, students will be able to:

CO	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	**Develop Swing-based GUI**	K3

CO2	**Develop client/server applications using socket programming**	K3
CO3	Design, Update and retrieve the data from the databases using SQL	K3
CO4	**Develop distributed applications using RMI and component-based Java software using JavaBeans**	K3
CO5	**Develop server-side programs in the form of Servlets and enterprise applications.**	K3

ROLES OF CO-ORDINATOR:

- **Give PBL orientation and motivation to students**
- **Clarify the doubts in the PBL process**
- **Monitor and record the progress of each individuals**
- **Evaluating and measuring the course outcome attainment**
- **Collect the feedback from the students and keep track of records**

ROLES OF STUDENTS:

- **Identify the suitable projects for Advanced Java Programming**
- **Individual student should develop the projects**
- **Must follow the deadline given for the review**
- **Equally contribute to the development of projects**
- **Project should be unique for MTE, ETE (2 different project problem)**

BASIC LAB EXERCISES:

LIST OF EXPERIMENTS:CYCLE – I

S.No.	Experiment Name
1.	Create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings
2.	Apply Event Handling on AWT and Swing components
3.	Develop java swing program to accept two numbers from user and output the sum, difference in the respective text boxes.
4.	Develop a website using HTML and validating the form fields by using Java script
5.	Servlet program to implement and demonstrate get () and post() methods (using HTTP Servlet class).
6.	Session tracking for a hit count using Java Servlet.

LIST OF EXPERIMENTS: CYCLE – II

S.No.	Experiment Name

1.	Create three tier application using Servlet by incorporating Java Database Connectivity inside Servlet to save data in a table.
2.	Creating JSP program to implement attributes of directive tags
3.	Cookies and session management using JSP
4.	Create MVC application with Struts framework: using Servlet /JSP
5.	Creating Stateless and Stateful Session Beans
6.	**EJB Application that demonstrates Entity Bean, Session Bean**

LIST OF PBL PROJECTS:

1. Students Assessment system in Java
2. Flight Reservation System in Java
3. Hotel Management System in Java
4. Gas Booking system in Java
5. Weather Forecasting system in Java
6. Candidate Management system in Java
7. University Management System in Java
8. Simple Car Sales System in JAVA
9. Bus Management System in Java
10. Hospital Management in JAVA
11. Library Management System in Java
12. Online Medical Diagnostic System in JAVA
13. Student Information System in JAVA
14. Vehicle Management System in JAVA
15. College Library Management in JAVA
16. Group of Hotels Management in J2EE
17. Human Resource Database Management System in Java
18. Design of Shopping Mall Management System
19. Online Course Registration System in JAVA
20. Simple Search Engine in JAVA Servlets
21. Simple Railway Reservation in JAVA
22. Simple Chat Program in JAVA
23. Weather Report Application in JAVA
24. Online Address Book in JAVA
25. Mini Orkut Using JAVA
26. Web Auction in EJB
27. Telephone Billing System
28. Vehicle Investigation System in JSP

29. JAVA Based Online Shopping
30. Stock Market Trading

REQUIRED SOFTWARE:

1. **Microsoft Windows (Version 7 or later)**
2. **Web server (WebLogic/ Glassfish Server/ Xampp Server)**
3. **Java Development Kit (JDK 1.8 or later)**
4. **Eclipse IDE**

RUBRICS FOR EVALUATION:

1) IA Rubric:

IA Components	Marks Awarded
Quiz- Moodle/LMS	**10**
Activity based mini model	**10**
Co-curricular activities	**10**
Extra curricularActitvities	**10**
Design of Mini Application –GUI & Implementation	**10**
Total	**50(scale to 20)**

2) MTE - Rubric:

IA Components	Complete App Development (Marks)
Project Specification & Detailed Design	**10**
GUI / Website design	**10**
Data base Connectivity	**5**
Project Implementation	**20**
Viva-Voce	**5**
TOTAL	**50(Scale to 30)**

3) ETE - Rubric:

IA Components	Complete App Development (Marks)
Quiz	**20**
Detailed Design	**20**
GUI / Website design	**10**
Data base Connectivity	**10**
Project Implementation	**30**
Viva-Voce	**10**
TOTAL	**100**

SCHEDULE OF PBL IMPLEMENTATION

Modules	Title
Module 1	Swings, Html, Javascript, CSS
Module 2	Servlets
Module 3	JSP
Module 4	EJB
Module 5	Implementation of real Time Project

Text Books:

1. Elliotte Rusty Harold, "Java Network Programming", O'Reilly publishers, 2004
2. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 2004.

ii. Reference Books:

1. Hortsmann& Cornell, "CORE JAVA 2 ADVANCED FEATURES, VOL II", Pearson Education, 2002.
2. Patrick Naughton, "COMPLETE REFERENCE: JAVA2", Tata McGraw-Hill, 2003.

iii. Online resources

1. www.cs.rit.edu/~jmk/java707/lecnotes/lecnotes.html
2. http://www.inf.ed.ac.uk/teaching/courses/cs2/LectureNotes/CS2Bh/APJ/apj5.pdf
3. http://ebookmaterials.blogspot.in/2011/07/advanced-programming-in-java-lecturer.html
4. http://java.sun.com.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: MCSE2320	Software Project Management	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand overall software development life cycle and adopt suitable processes.
2. Analyze, prioritize, and manage both functional and quality requirements.
3. Estimate efforts required, plan, and track the plans.
4. Understand and apply configuration and quality management techniques.

COURSE OUTCOMES (COs):

CO1: Understand overall software development life cycle and adopt suitable processes.
CO2: Analyze, prioritize, and manage both functional and quality requirements.
CO3: Estimate efforts required, plan, and track the plans
CO4: Understand and apply configuration and quality management techniques.

Co5: Create Software product using Various Process.

UNIT -I DEVELOPMENT LIFE CYCLE PROCESSES:
Overview of Software Development Life Cycle, introduction to processes, Personal Software Process (PSP), Team Software Process (TSP), unified processes, agile processes, choosing the right process.

UNIT -II REQUIREMENTS MANAGEMENT:
Functional requirements and quality attributes, elicitation techniques, Quality Attribute Workshop (QAW), analysis, prioritization, and trade off, Architecture Centric Development Method (ACDM), requirements, documentation, and specification, change management, traceability of requirements.

UNIT -III ESTIMATION, PLANNING, AND TRACKING:
Identifying and prioritizing risks, risk mitigation plans, estimation techniques, use case points, function points, COCOMO II, top down estimation, bottom up estimation. Work break down structure, macro and micro plans, planning poker, wideband Delphi, documenting the plan, tracking the plan, Earned Value Method (EVM).

UNIT -IV CONFIGURATION AND QUALITY MANAGEMENT:
Identifying articrafts to be configured, naming conventions and version control, configuration control, quality assurance techniques, peer reviews, Fagan inspection, unit, registration, system, and acceptance testing, test data and test cases, bug tracking, casual analysis

UNIT -V SOFTWARE PROCESS DEFINITION AND MANAGEMENT:
Process elements, process architecture, relationship between elements, process modeling, process definition techniques, ETVX (Entry-Task-Validation-exit), process base lining, process assessment and improvement, CMMI, six sigma.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books:

1. Pankaj Jalote, “Software Process Management in Practice”‖, Pearson, Illustrated, 2002.
2. Walker Royce, “Software Project Management – A Unified Framework”,Pearson Education, 1st Edition, 2002

Reference Books:

1. Watts S.Humphrey, “PSP: A Self Improvement Process for Software Engineers”, Addison Wesley, 1st Edition, 2005.
2. Chris F. Kemerer, “Software Project Management- Readings and Cases”, McGraw-Hill, Illustrated Edition, 1997.
3. Watts S. Humphrey, “Introduction to the Team Software Process”, Addison-Wesley, Illustrated Reprint, 2000.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: SLMT 5001	Software Development Lab	L	T	P	C
Version No.1.0	Date of Approval: 03/01/2020	0	0	4	2
Prerequisite/Exposure					
Co-requisites					

List of Mini Projects

1. Library Management System
2. Student Mark Analyzing System
3. Creation of Text Editor
4. Dictionary
5. Telephone dictionary
6. Banking System
7. Payroll System
8. Inventory System

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

List of Electives

Course Code:MCSE9110	IoT Technology and Applications	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To understand the fundamentals of Internet of Things.**
2. **To learn about the basics of IOT protocols.**
3. **To build a small low cost embedded system using Raspberry Pi.**
4. **To apply the concept of Internet of Things in the real world scenario.**

Course Outcomes

At the end of the course, students will be able to:

1. **Analyze various protocols for IoT Develop web services to access/control IoT devices.**
2. **Design a portable IoT using Rasperry Pi.**
3. **Deploy an IoT application and connect to the cloud.**
4. **Analyze applications of IoT in real time scenario.**

Course Content

Unit I: INTRODUCTION TO IoT **8 Hours**

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

Unit II: IoT ARCHITECTURE **8 Hours**

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

Unit III: IoT PROTOCOLS **8 Hours**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

Unit IV: BUILDING IoT WITH RASPBERRY PI & ARDUINO **8 Hours**

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

Unit V: CASE STUDIES AND REAL-WORLD APPLICATIONS **8 Hours**

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **ArshdeepBahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press, 2015.**
2. **Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things‖, Springer, 2011.**
3. **Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.**

Reference Books

1. **Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.**
2. **Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2012**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9120	IoT on Cloud	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. To understand the basics of Internet of Things.
2. To get an idea of some of the application areas where Internet of Things can be applied.
3. To understand the middleware for Internet of Things.
4. To understand the concepts of Web of Things.
5. To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing.
6. To understand the IOT protocols.

Course Outcomes

At the end of the course, students will be able to:

1. Identify and design the new models for market strategic interaction.
2. Design business intelligence and information security for WoB.
3. Analyze various protocols for IoT.
4. Design a middleware for IoT.
5. Analyze and design different models for network dynamics.

Course Content

Unit I:INTRODUCTION **8 hours**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

Unit II: IOT PROTOCOLS **8 Hours**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

Unit III: WEB OF THINGS **8 hours**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

Unit IV : INTEGRATED **8 hours**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behaviour in Networks - The Small-World Phenomenon.

Unit V: APPLICATIONS **8 Hours**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.**
2. **Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles(Eds.) – Springer – 2011**
3. **Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010**
4. **The Internet of Things: Applications to the Smart Grid and Building Automation by -Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012**
5. **Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012**

Reference Books

1. **Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.**
2. **Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2012**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code:MCSE9130	Big Data Mining and Analytics	L	T	P	C
Version No.1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure	Data Mining				
Co-requisites					

Course Objectives

1. **To understand the computational approaches to Modeling, Feature Extraction.**
2. **To understand the need and application of Map Reduce.**
3. **To understand the various search algorithms applicable to Big Data.**
4. **To analyse and interpret streaming data.**
5. **To learn how to handle large data sets in main memory.**
6. **To learn the various clustering techniques applicable to Big Data.**

Course Outcomes

At the end of the course, students will be able to:

1. **Design algorithms by employing Map Reduce technique for solving Big Data problems.**
2. **Design algorithms for Big Data by deciding on the apt Features set.**
3. **Design algorithms for handling petabytes of datasets.**
4. **Design algorithms and propose solutions for Big Data by optimizing main memory consumption.**
5. **Design solutions for problems in Big Data by suggesting appropriate clustering techniques.**

Course Content

Unit I:DATA MINING AND LARGE SCALE FILES 8 Hours

Introduction to Statistical modeling – Machine Learning – Computational approaches to modeling – Summarization – Feature Extraction – Statistical Limits on Data Mining - Distributed File Systems – Map-reduce – Algorithms using Map Reduce – Efficiency of Cluster Computing Techniques

Unit II: SIMILAR ITEMS 8 Hours

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

Unit III: MINING DATA STREAMS 8 Hours

Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.

Unit IV : LINK ANALYSIS AND FREQUENT ITEMSETS 8 hours

Page Rank –Efficient Computation - Topic Sensitive Page Rank – Link Spam – Market Basket Model – A-priori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets.

Unit V: CLUSTERING 8 Hours

Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE – Clustering in Non – Euclidean Spaces – Streams and Parallelism – Case Study: Advertising on the Web – Recommendation Systems.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers

published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.**
2. **Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011.**
3. **Ian H.Witten, Eibe Frank "Data Mining – Practical Machine Learning Tools and Techniques", Morgan Kaufman Publications, Third Edition, 2011.**
4. **David Hand, HeikkiMannila and Padhraic Smyth, "Principles of Data Mining", MIT PRESS, 2001**

Reference Books

1. **Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.**
2. **Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things – Key applications and Protocols‖, Wiley, 2012**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9260	Foundations of Information Security	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security.**
2. **Master the key concepts of information security and how they "work."**
3. **Develop a "security mindset:" learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, viewpoints, and trade-offs.**
4. **To provide the ability to examine and analyze real-life security cases.**

Course Outcomes

At the end of the course, students will be able to:

1. **Evaluate vulnerability of an information system and establish a plan for risk management.**
2. **Demonstrate basic principles of Web application security.**
3. **Evaluate the authentication and encryption needs of an information system.**
4. **Demonstrate how to secure a network.**
5. **Evaluate a company's security policies and procedures.**

Course Content

Unit I: INTRODUCTION **8 Hours**

Need for security, Computer Security Concepts (CIA) - Confidentiality, Integrity, Availability, Accountability and Assurance, Interdependencies. Information security history- Physical security and administrative security, Security current trends-Emergence of internet, digital information, financial losses and national defense, Terminology-Threats, Attacks and Assets. Software Security - Vulnerabilities and protections, malware, program analysis

Unit II: Practical Cryptography **8 Hours**

Ciphers, Caser Cipher, Cryptanalysis, Encryption- Types of encryption, authentication-authentication factors, types of authentication methods, hashing-feature of hash function, properties of hash functions, message Digest, Secure hash function, RIPEMD, symmetric and asymmetric cryptography, Digital Signatures and Certificates.

Unit III: **Network Security:** **8 Hours**

Network security issues, Sniffing-types of sniffing, IP spoofing-DDoS attacks, application layer attacks, security research, Common threats, E-Mail security, IPSec- uses of IP security, components of IP security, SSL Protocol, PGP- Definition of PGP and uses of PGP, Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems.

Unit IV: Cyber Security: **8 hours**

Cyber Crime and security- types of cyber crime, prevention of cyber crime, Security tools- metasploit, Nmap, wireshark, aircrack-ng, john the ripper and nessues, Introduction to Digital Forensic-characteristics of digital forensic, principle of digital forensic, challenges of digital forensic, OS fingerprinting, TCP/IPstack masking, Social Engineering-attack techniques, prevention.

Unit V: Applications and special topics **8 hours**

Web application Security-vulnerabilities- cross site scripting, sql injection, denial of services, memory corruption, buffer overflow, cross-site request forgery, data breach, Privacy and Anonymity- privacy, trust, anonymity, VPN services, and public policy.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Computer Security: Principles and Practice, William Stallings; Lawrie Brown.**
2. **Introduction to Computer Security, 2004 Matt Bishop, Addison-Wesley, ISBN 0-321-24744.**

Reference Books

1. **Buchmann J. A., Introduction to Cryptography, Springer Verlag (2001)..**
2. **Stallings William, Cryptography and Network Security, Pearson Education (2006)..**
3. **Schneier Bruce, Applied Cryptography, John Wiley and Sons (1996).**
4. **Britz M., Computer Forensic and cyber crime, Upper Saddle River, Prentice Hall (2003).**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9310	Formal Models of Software Systems	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To understand the goals, complexity of software systems, the role of Specification activities and qualities to control complexity.**
2. **To understand the fundamentals of abstraction and formal systems.**
3. **To learn fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems.**
4. **To understand formal specification models based on set theory, calculus and algebra and apply to a case study.**
5. **To learn Z, Object Z and B Specification languages with case studies.**

Course Outcomes

At the end of the course, students will be able to:

1. **Understand the complexity of software systems, the need for formal specifications activities and qualities to control complexity.**
2. **Gain knowledge on fundamentals of abstraction and formal systems.**
3. **Learn the fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems.**
4. **Develop formal specification models based on set theory, calculus and algebra and apply to a typical case study.**
5. **Have working knowledge on Z, Object Z and B Specification languages with case studies.**

Course Content

Unit I:SPECIFICATION FUNDAMENTALS **8 Hours**

Role of Specification- Software Complexity - Size, Structural, Environmental, Application, domain, Communication Complexity, How to Control Complexity. Software specification, Specification Activities- Integrating Formal Methods into the Software Life-Cycle. Specification Qualities- Process Quality Attributes of Formal Specification Languages, Model of Process Quality, Product Quality and Utility, Conformance to Stated Goals Quality Dimensions and Quality Model.

Unit II: FORMAL METHODS **8 Hours**

Abstraction- Fundamental Abstractions in Computing. Abstractions for Software Construction. Formalism Fundamentals - Formal Systems, Formalization Process in Software Engineering Components of a Formal System- Syntax, Semantics, and Inference Mechanism. Properties of Formal Systems - Consistency. Automata- Deterministic Finite Accepters, State Machine Modeling Nondeterministic Finite Accepters, Finite State Transducers Extended Finite State Machine. Case Study—Elevator Control. Classification of C Methods- Property-Oriented Specification Methods, Model-Based Specification Techniques.

Unit III: **LOGIC** **8 Hours**

Propositional Logic - Reasoning Based on Adopting a Premise, Inference Based on Natural Deduction. Predicate Logic - Syntax and Semantics, Policy Language Specification, knowledge Representation Axiomatic Specification. Temporal Logic -.Temporal Logic for Specification and Verification, Temporal Abstraction Propositional Temporal Logic (PTL), First Order Temporal Logic (FOTL).Formal Verification, Verification of Simple FOTL, Model Checking, Program Graphs, Transition Systems.

Unit IV: SPECIFICATION MODELS **8 Hours**

Mathematical Abstractions for Model-Based Specifications-Formal Specification Based on Set Theory, Relations and Functions. Property-Oriented Specifications- Algebraic Specification, Properties of Algebraic Specifications, Reasoning, Structured Specifications. Case Study—A Multiple Window Environment: requirements, Modeling Formal Specifications. Calculus of Communicating Systems: Specific Calculus for Concurrency. Operational Semantics of Agents, Simulation and Equivalence, Derivation Trees, Labeled Transition Systems.

Unit V: FORMAL LANGUAGES **8 Hours**

The Z Notation, abstractions in Z, Representational Abstraction, Types, Relations and Functions, Sequences, Bags. Free Types-Schemas, Operational Abstraction -Operations Schema Decorators, Generic Functions, Proving Properties from Z specifications, Consistency of Operations. Additional Features in Z. Case Study: An Automated Billing System. The Object-Z Specification Language- Basic Structure of an Object-Z, Specification. Parameterized Class, Object-Orientation, composition of Operations-Parallel Communication Operator, Nondeterministic Choice Operator, and Environment Enrichment. The B-Method -Abstract Machine Notation (AMN), Structure of a B Specification, arrays, statements. Structured Specifications, Case Study- A Ticketing System in a Parking.

UNIT VI

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Mathematical Logic for computer science, second edition, M.Ben-Ari, Springer,2003.**
2. **Logic in Computer Science- modelling and reasoning about systems, 2nd Edition, Cambridge University Press, 2004.**
3. **Specification of Software Systems, V.S. Alagar, K. Periyasamy, David Grises and Fred B Schneider, Springer –Verlag London, 2011.**

Reference Books

1. **The ways Z: Practical programming with formal methods, Jonathan Jacky, Cambridge University Press,1996.**
2. **Using Z-Specification Refinement and Proof,Jim Woodcock and Jim Devies Prentice Hall, 1996**
3. **Z: An introduction to formal methods, Second Edition, Antoi Diller, Wiley, 1994**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks

20	30	50	100

Course Code: MCSE9320	Embedded Software Development	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To understand the architecture of embedded processor, microcontroller and peripheral devices.**
2. **To interface memory and peripherals with embedded systems.**
3. **To study the embedded network environment.**
4. **To understand challenges in Real time operating systems.**
5. **To study, analyze and design applications on embedded systems.**

Course Outcomes

At the end of the course, students will be able to:

1. **Understand different architectures of embedded processor, microcontroller and peripheral devices.**
2. **Interface memory and peripherals with embedded systems.**
3. **Work with embedded network environment.**
4. **Understand challenges in Real time operating systems.**
5. **Design and analyze applications on embedded systems.**

Course Content

Unit I: EMBEDDED PROCESSORS **8 Hours**

Embedded Computers - Characteristics of Embedded Computing Applications - Challenges in Embedded Computing System Design - Embedded System Design Process- Formalism for System Design - Structural Description - Behavioural Description - ARM Processor - Intel ATOM Processor.

Unit II: EMBEDDED COMPUTING PLATFORM **8 Hours**

CPU Bus Configuration - Memory Devices and Interfacing - Input/Output Devices and Interfacing - System Design - Development and Debugging – Emulator – Simulator - JTAG Design Example – Alarm Clock - Analysis and Optimization of Performance - Power and Program Size.

Unit III: **EMBEDDED NETWORK ENIVIRONMENT** **8 Hours**

Distributed Embedded Architecture - Hardware And Software Architectures - Networks for Embedded Systems - I2C - CAN Bus - SHARC Link Supports – Ethernet – Myrinet – Internet - Network-based Design - Communication Analysis - System Performance Analysis - Hardware Platform Design - Allocation and Scheduling - Design Example - Elevator Controller.

Unit IV: REAL-TIME CHARACTERISTICS **8 Hours**

Clock Driven Approach - Weighted Round Robin Approach - Priority Driven Approach - Dynamic versus Static Systems - Effective Release Times and Deadlines - Optimality of the Earliest Deadline First (EDF) Algorithm - Challenges in Validating Timing Constraints in Priority Driven Systems - Off-Line versus On-Line Scheduling.

Unit V: SYSTEM DESIGN TECHNIQUES **8 Hours**

Design Methodologies - Requirement Analysis – Specification - System Analysis and Architecture Design - Quality Assurance - Design Examples - Telephone PBX - Ink jet printer - Personal Digital Assistants - Set-Top Boxes.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers

published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things" Wiley Publication, First edition, 2013.**
2. **Andrew N Sloss, D. Symes, C. Wright, Arm system developers guide‖, Morgan Kauffman/Elsevier, 2006.**
3. **ArshdeepBahga, Vijay Madisetti, " Internet of Things: A Hands-on-Approach" VPT First Edition, 2014.**
4. **C. M. Krishna and K. G. Shin, —Real-Time Systems, McGraw-Hill, 1997.**

Reference Books

1. **Frank Vahid and Tony Givargis, —Embedded System Design: A Unified Hardware/Software Introduction‖, John Wiley & Sons.**
2. **Jane.W.S. Liu, —Real-Time systems‖, Pearson Education Asia.**
3. **Michael J. Pont, —Embedded C‖, Pearson Education, 2007.**
4. **Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi, "The AVR Microcontroller and Embedded Systems: Using Assembly and C" Pearson Education, First edition, 2014.**
5. **Steve Heath, —Embedded SystemDesign, Elsevier, 2005.**
6. **Wayne Wolf, —Computers as Components:Principles of Embedded Computer System Design‖, Elsevier, 2006.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9330	Social Network Analysis	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/2018	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To understand the components of the social network.**
2. **To model and visualize the social network.**
3. **To mine the users in the social network.**
4. **To understand the evolution of the social network.**
5. **To know the applications in real time systems.**

Course Outcomes

At the end of the course, students will be able to:

1. **Work on the internals components of the social network.**

2. **Model and visualize the social network.**
3. **Mine the behaviour of the users in the social network.**
4. **Predict the possible next outcome of the social network.**
5. **Apply social network in real time applications.**

Course Content

Unit I: INTRODUCTION **8 Hours**

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

Unit II: MODELING AND VISUALIZATION **8 Hours**

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality-Clustering - Node-Edge Diagrams - Visualizing Social Networks with MatrixBased Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

Unit III: **MINING COMMUNITIES** **8 Hours**

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

Unit IV : EVOLUTION **8 Hours**

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models..

Unit V: APPLICATIONS **8 Hours**

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, —Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2012**

2. **BorkoFurht, —Handbook of Social Network Technologies and Applications, Springer, 1st edition, 2011.**
3. **Charu C. Aggarwal, —Social Network Data Analytics, Springer; 2014.**

Reference Books

1. **Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis, Springer, 2010.**
2. **Guandong Xu, Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, Springer, 1st edition, 2012.**
3. **Peter Mika, —Social Networks and the Semantic Web, Springer, 1st edition, 2007.**
4. **PrzemyslawKazienko, Nitesh Chawla,Applications of Social Media and Social Network Analysis, Springer,2015.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9340	Bio Inspired Computing	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To learn bio-inspired theorem and algorithms.**
2. **To Understand random walk and simulated annealing.**
3. **To learn genetic algorithm and differential evolution.**
4. **To learn swarm optimization and ant colony for feature selection.**
5. **To understand bio-inspired application in image processing.**

Course Outcomes

At the end of the course, students will be able to:

1. **Implement and apply bio-inspired algorithms.**
2. **Explain random walk and simulated annealing.**
3. **Implement and apply genetic algorithms.**
4. **Explain swarm intelligence and ant colony for feature selection.**
5. **Apply bio-inspired techniques in image processing.**

Course Content

Unit I: INTRODUCTION **8 Hours**

Introduction to algorithm - Newton' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Mataheuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control.

Unit II: RANDOM WALK AND ANEALING **8 Hours**

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling..

Unit III: **GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION 8 Hours**

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA varients - schema theorem - convergence analysis - introduction to differential evolution - varients - choice of parameters - convergence analysis - implementation..

Unit IV: SWARM OPTIMIZATION AND FIREFLY ALGORITHM 8 hours

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation –varients - Ant colony optimization toward feature selection.

Unit V: APPLICATION IN IMAGE PROCESSING 8 Hours

Bio-Inspired Computation and its Applications in Image Processing: An Overview – Fine Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.**
2. **Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013.**
3. **Xin-She Yang, Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016.**

Reference Books

1. **Xin-She Yang, "Nature Inspired Optimization Algorithm, Elsevier First Edition 2014.**
2. **Yang,Cui,XIao,Gandomi, Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9410	Data Visualization Techniques	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To develop skills to both design and critique visualizations.**
2. **To introduce visual perception and core skills for visual analysis.**
3. **To understand visualization for time-series analysis.**
4. **To understand visualization for ranking analysis.**
5. **To understand visualization for deviation analysis.**
6. **To understand visualization for distribution analysis.**
7. **To understand visualization for correlation analysis.**
8. **To understand visualization for multivariate analysis.**
9. **To understand issues and best practices in information dashboard design.**

Course Outcomes

At the end of the course, students will be able to:

1. **Explain principles of visual perception.**
2. **Apply core skills for visual analysis.**
3. **Apply visualization techniques for various data analysis tasks.**
4. **Design information dashboard.**

Course Content

Unit I: CORE SKILLS FOR VISUAL ANALYSIS 8 Hours

Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

Unit II: TIME-SERIES, RANKING, AND DEVIATION ANALYSIS 8 Hours

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

Unit III: **DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS 8 Hours**

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

Unit IV: INFORMATION DASHBOARD DESIGN 8 hours

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

Unit V: INFORMATION DASHBOARD DESIGN 8 Hours

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together Unveiling the dashboard.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.**
2. **Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.**
3. **Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.**
4. **Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.**

Reference Books

1. **Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.**
2. **Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.**
3. **Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.**
4. **Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9420	Reconfigurable Computing	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To understand the need for reconfigurable computing.**
2. **To expose the students to various device architectures.**
3. **To examine the various reconfigurable computing systems.**
4. **To understand the different types of compute models for programming reconfigurable architectures.**
5. **To expose the students to HDL programming and familiarize with the development environment.**
6. **To expose the students to the various placement and routing protocols.**
7. **To develop applications with FPGAs.**

Course Outcomes

At the end of the course, students will be able to:

1. **Identify the need for reconfigurable architectures.**
2. **Discuss the architecture of FPGAs.**
3. **Point out the salient features of different reconfigurable architectures.**
4. **Build basic modules using any HDL.**
5. **Develop applications using any HDL and appropriate tools.**
6. **Design and build an SoPC for a particular application.**

Course Content

Unit I: DEVICE ARCHITECTURE **8 Hours**

General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies.

Unit II: RECONFIGURABLE COMPUTING

8 Hours

Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management.

UNIT III: ARCHITECTURES AND SYSTEMS **8 hours**

System-level architectures-External stand-alone processing unit RC2000 -Attached processing unit co-processor Pilchard -Processor embedded in a reconfigurable fabric Xilinx Virtex II Pro

Unit IV: **PROGRAMMING RECONFIGURABLE SYSTEMS** **8 Hours**

Compute Models - Programming FPGA Applications in HDL – Compiling C for Spatial Computing – Operating System Support for Reconfigurable Computing.

Unit V: MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS **8 Hours**

The Design Flow - Technology Mapping – FPGA Placement and Routing – Configuration Bitstream Generation – Case Studies with Appropriate Tools.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Christophe Bobda, —Introduction to Reconfigurable Computing – Architectures, Algorithms and Applications‖, Springer, 2010.**
2. **Maya B. Gokhale and Paul S. Graham, —Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays‖, Springer, 2005.**
3. **FPGA Frontiers: New Applications in Reconfigurable Computing, 2017, Nicole Hemsoth, Timothy Prickett Morgan, Next Platform.**

Reference Books

1. **Reconfigurable Computing: From FPGAs to Hardware/Software Codesign 2011 Edition by Joao Cardoso (Editor), Michael Hübne, Springer.**
2. **Scott Hauck and Andre Dehon (Eds.), ―Reconfigurable Computing – The Theory and Practice of FPGA-Based Computation‖, Elsevier / Morgan Kaufmann, 2008.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCSE9430	Mobile Application Development	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **Understand system requirements for mobile applications.**
2. **Generate suitable design using specific mobile development frameworks.**
3. **Generate mobile application design.**
4. **Implement the design using specific mobile development frameworks.**
5. **Deploy the mobile applications in marketplace for distribution.**

Course Outcomes

At the end of the course, students will be able to:

1. **Describe the requirements for mobile applications.**
2. **Explain the challenges in mobile application design and development.**
3. **Develop design for mobile applications for specific requirements.**
4. **Implement the design using Android SDK.**
5. **Implement the design using Objective C and iOS.**
6. **Deploy mobile applications in Android and iPhone marketplace for distribution.**

Course Content

Unit I: INTRODUCTION **8 Hours**

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

Unit II: BASIC DESIGN **8 Hours**

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

Unit III: **ADVANCED DESIGN** **8 Hours**

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

Unit IV: ANDROID **8 Hours**

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

Unit V: IOS **8 Hours**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as

well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **Charlie Collins, Michael Galpin and Matthias Kappler, —Android in Practice‖, DreamTech, 2012.**
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, —Beginning iOS 6 Development: Exploring the iOS SDK‖, Apress, 2013.
3. http://developer.android.com/develop/index.html.

Reference Books

1. **James Dovey and Ash Furrow, —Beginning Objective C‖, Apress, 2012.**
2. **Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.**
3. **Reto Meier, —Professional android Development‖, Wiley-India Edition, 2012**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code:MCSE9440	Information Storage Management	L	T	P	C
Version No. 1.0	Date of Approval: 19/06/18	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

Course Objectives

1. **To understand the storage architecture and available technologies.**
2. **To learn to establish & manage datacenter.**
3. **To learn security aspects of storage & data center.**

Course Outcomes

At the end of the course, students will be able to:

1. **Select from various storage technologies to suit for required application.**
2. **Apply security measures to safeguard storage & farm.**
3. **Analyse QoS on Storage.**

Course Content

Unit I:STORAGE TECHNOLOGY 8 Hours

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities.

Unit II: STORAGE SYSTEMS ARCHITECTURE 8 Hours

Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems, High-level architecture and working of an intelligent storage system.

Unit III: **INTRODUCTION TO NETWORKED STORAGE 8 Hours**

Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application environments.

Unit IV: INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTERS 8 Hours

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime -Business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center.

Unit V: SECURING STORAGE AND STORAGE VIRTUALIZATION 8 Hours

Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes.

Unit VI:

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Text Books

1. **EMC Corporation, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley, India, 2010.**
2. **Marc Farley, —Building Storage Networks‖, Tata McGraw Hill,Osborne, 2001.**

Reference Books

1. **Robert Spalding, —Storage Networks: The Complete Reference—, Tata McGraw Hill, Osborne, 2003.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

School of Computing Science and Engineering

Program: B. Tech (Hons) Computer Science and Engineering with Specialization

Scheme: 2020 – 2021

Curriculum

B.Tech (Hons) Specialization Buckets - Internet of Things									
Sl. No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	CSIO2020	Internet of Things	2	0	2	3	20	30	50
2	BCVV2410	Fundamentals of Cloud Computing	2	0	2	3	20	30	50
3	CSCN4024	Wireless Sensor Networks	2	0	2	3	20	30	50
4	CSIO3050	IOT Platform & Design (IOT)	2	0	2	3	20	30	50
5	BCIT4740	IoT for Multimedia Communication	2	0	2	3	20	30	50
6	CSIO4072	Privacy and Security in IoT	2	0	2	3	20	30	50
7	CSIO4070	Industrial Application of IOT	2	0	2	3	20	30	50
8	BCDA4750	Mobile and IoT Analytics	2	0	2	3	20	30	50
B.Tech (Hons) Specialization Buckets – Artificial Intelligence and Machine Learning									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	CSDA2020	Predictive Analytics	2	0	2	3	20	30	50
2	CSAI4073	Computer Vision	2	0	2	3	20	30	50
3	CSBA4090	Big & NoSql Data Bases	2	0	2	3	20	30	50
4	CSAI3050	Natural Language Processing	2	0	2	3	20	30	50
5	CSAI4090	Human Computer Interaction	2	0	2	3	20	30	50
6	CSAR4070	Augmented Reality	2	0	2	3	20	30	50
7	BCSE9090	Genetic algorithm	2	0	2	3	20	30	50
8	BCAI3520	Neural networks	2	0	2	3	20	30	50
B.Tech (Hons) Specialization Buckets – Business Analytics, Data Analytics & Blockchain Technology									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	CBBD2020	Introduction to Big Data and Data Science	2	0	2	3	20	30	50
2	CSBA4091	Mathematics for Big Data & Optimization	2	0	2	3	20	30	50
3	CSBA3050	Business Intelligence	2	0	2	3	20	30	50
4	CSDA2021	Predictive Analytics	2	0	2	3	20	30	50
5	CSBA4090	Big & No Sql Data Bases	2	0	2	3	20	30	50
6	BCSE9005	Big Data Analytics Using Hadoop	2	0	2	3	20	30	50
7	CSDA4070	Data Visualization using R	2	0	2	3	20	30	50
8	CSIT4090	Cluster Computing	2	0	2	3	20	30	50

B.Tech (Hons) Specialization Buckets – Computer Network and Computer Security									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	CSCN2020	Ethical Hacking	2	0	2	3	20	30	50
2	CSIO4072	Privacy and Security in IoT	2	0	2	3	20	30	50
3	CSCV4022	Cloud Security	2	0	2	3	20	30	50
4	CSCN3050	Network Security	2	0	2	3	20	30	50
5	BCSE9008	Routing and Switching Essentials (CN&CS)	2	0	2	3	20	30	50
6	CSCN4024	Wireless Sensor Networks	2	0	2	3	20	30	50
7	CNCS4090	Security Threats and Trends	2	0	2	3	20	30	50
8	CSCN4022	Cyber Laws & Security Policies	2	0	2	3	20	30	50
B.Tech (Hons) Specialization Buckets – Cloud Computing									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	CSCC2020	Fundamentals of Virtualization & Cloud Computing	2	0	2	3	20	30	50
2	CSCC3050	Cloud Organization & Architecture	2	0	2	3	20	30	50
3	BCVV3630	Cloud Deployment Model	2	0	2	3	20	30	50
4	BCSE9020	Cloud Storage & Disaster Recovery	2	0	2	3	20	30	50
5	BCSE9030	Cloud Security & Management	2	0	2	3	20	30	50
6	CSCC4090	Container Orchestration & Infrastructure Automation	2	0	2	3	20	30	50
7	CSCC4002	Cloud Management and Tuning	2	0	2	3	20	30	50
8	BCVV4750	Backup Disaster & Recovery	2	0	2	3	20	30	50

Detailed Syllabus

Name of The Course	Internet of Things
Course Code	CSIO2020

Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

- To understand Smart Objects and loT Architectures
- To learn about various lOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

Course Outcomes

At the end of this course, students will be able to:

CO1	Explain the concept of IoT.
CO2	Analyze various protocols for IoT.
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4	Apply data analytics and use cloud offerings related to IoT.
CO5	Analyze applications of IoT in real time scenario
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

Reference Books

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David
4. Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.

Course Content

Unit I: INTRODUCTION TO IoT	**8 Hours**
Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology	

Unit II: IoT ARCHITECTURE	**8 Hours**
M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture	
Unit III: IoT PROTOCOLS	**8 Hours**
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security	
Unit IV: BUILDING IoT WITH RASPBERRY PI & ARDUINO	**8 Hours**
Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.	
Unit V: CASE STUDIES AND REAL-WORLD APPLICATIONS	**8 Hours**
Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.	
Unit VI: Advances and the Latest Trends	**8 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Fundamentals of Cloud Computing**				
Course Code	**BCVV2410**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

cloud computing is that to host web services, store and backup data, high-performance computing, host and stream media, build search engines, server-side of mobile applications & many more. No matter what cloud service you choose, they focus on synchronisation & concurrency.

Course Outcomes

At the end of this course, students will be able to:

CO1	**To understand the Virtualization concept.**
CO2	**To understand the Cloud Computing.**
CO3	**To understand the cloud models.**
CO4	**To understand the cloud security.**
CO5	**To understand the cloud applications.**
CO6	**Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)**

Text Books

1.Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg,Andrzej M. Goscinski, Wile, 2011

2. Cloud Computing First Steps: Cloud Computing for Beginners, Ravi Shankar, Navin Sabharwal, PBC Distributors.

Reference Books

1. Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam,Springer, 2012

2. Virtualization For Dummies, 3rd HP Special Edition (Bernard Golden)

3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010 T10: D.Ulman, " Principles of Database and Knowledge base System", Computer Science Press.

Course Content

Unit I: Introduction to Virtualization	**8 Hours**
Traditional IT Infrastructure, Benefits of Virtualization, Compare. Study of Hypervisors, VM.	
Unit II: Introduction to Cloud Computing	**8 Hours**
History Cloud Computing, Cloud Benefits, Limitations, challenges; Importance of Virtualization in Cloud, Anatomy of Cloud, Cloud deployment models; Cloud delivery models; Stepping stones for the development of cloud, Grid Computing.	
Unit III: Cloud Models	**8 Hours**
Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Infrastructure as a Service (IaaS) Cloud Delivery Model, Platform as a Service (PaaS) , Software as a Service (SaaS)	

Unit IV: Cloud Workloads and Security	**8 Hours**
Cloud workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud. Intro to cloud security, Trust, and Privacy.	
Unit V: Design & Development of Cloud Applications	**8 Hours**
Economics of choosing a Cloud platform for an organization based on application requirements, economic constraints and business needs , Applications deployment on Amazon, Microsoft , IBM, Google, Salesforce.com.	
Unit VI: Advances and the Latest Trends	**8 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Wireless Sensor Networks
Course Code	CSCN4024
Prerequisite	
Co requisite	
Antirequisite	

		L	T	P	C
		2	0	2	3

Course Objectives

Aim of the course is develop in-depth knowledge and understanding of wireless sensor networks.

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the basic knowledge of WSN
CO2	Analysis the various wireless sensor protocols and its uses
CO3	Ability to perform and design the routing protocols in WSN
CO4	Implement embedded operating system to for wireless sensor network.
CO5	Learn the various applications of WSN
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.

2.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books

1.K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349

2.Philip Levis, " TinyOS Programming"

3.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd,

Course Content

Unit I: OVERVIEW OF WIRELESS SENSOR
Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations

Unit II: Medium Access Control Protocols
Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.
Unit III: Routing And Data Gathering Protocols
Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB
Unit IV: Embedded Operating Systems
Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM
Unit V: Applications Of WSN
WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**IOT Platform & Design (IOT)**
Course Code	CSIO3050

Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

Understand the basic concepts of IoT, Design procedure, machine to machine communication and various functional modulus.

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand basic concepts of Machine to Machine Communication.
CO2	Understand and needs of reference and architecture model.
CO3	Understand the different functional model.
CO4	Understand the various security, trust and privacy models
CO5	Understand the real-world deployment constraints and Understand concepts of applying the various models based on deployment constraints.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, By Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle., Elsevier, First Edition, 2014.

Reference Books

1. Enabling Things to Talk, Designing IoT solutions with the IoT Architectural Reference Model, Springer.

Course Content

Unit 1: IOT ARCHITECTURE- STATE OF ART [9 lecture hrs]
Introduction, state of the art European telecommunication standards, ETSI M2M high level architecture, M2M service capabilities, M2M interfaces, M2M resource management, Internet engineering task force architecture fragments
Unit 2: REFERENCE AND ARCHITECTURE MODEL [9 lecture hrs]

Introduction, IoT reference model, IoT reference model and reference architecture dependencies' domain model, Model notation and semantics
Unit 3 : FUNCTIONAL MODEL [9 lecture hrs]
Device functional group, communication functional group, IoT service functional group, virtual entity functional group, IoT service organization functional group
Unit 4: SAFETY AND MODEL [9 lecture hrs]
Safety model, privacy model, trust model, security model
Unit 5: REAL WORLD DESIGN CONSTRAINTS [9 lecture hrs]
Introduction, technical design constraints- hardware, device and networks, data representation and visualization.
Unit VI: Advances and the Latest Trends 9 Lecture hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.The latest research conducted in the areas covered in the course.Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	IoT for Multimedia Communication				
Course Code	BCIT4740				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

In this course, you will learn the principles of video and audio codecs used for media content in iTunes, Google Play, YouTube, Netflix, etc. You will learn the file formats and codec settings for optimizing quality and media bandwidth and apply them in developing a basic media player application.

Course Outcomes

At the end of this course, students will be able to:

CO1	Explain the tradeoffs between media quality and bandwidth for content delivery.
CO2	Extract and display metadata from media files.
CO3	Implement and demonstrate a simple media player application using Dragon Board™ 410c.
CO4	Understand the communication technologies to multimedia using IoT
CO5	Implement the storage of multimedia using IoT
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Giusto, D., Iera, A., Morabito, G., & Atzori, L. (Eds.). (2010). The internet of things: 20th Tyrrhenian workshop on digital communications. Springer Science & Business Media.
2. Yan, L., Zhang, Y., Yang, L. T., & Ning, H. (Eds.). (2008). The Internet of things: from RFID to the next-generation pervasive networked systems. CRC Press.

Reference Book

1. Yang, J., He, S., Lin, Y., & Lv, Z. (2017). Multimedia cloud transmission and storage system based on internet of things. Multimedia Tools and Applications, 76(17), 17735-17750.
2. Christin, D., Reinhardt, A., Mogre, P. S., & Steinmetz, R. (2009). Wireless sensor networks and the internet of things: selected challenges. Proceedings of the 8th GI/ITG KuVS Fachgespräch Drahtlose sensornetze, 31-34.

Course Content

Unit I: INTRODUCTION	**8 Hours**
What is multimedia, Multimedia information representation, multimedia networks: telephone networks, data networks, broadcast television networks, broadband multiservice networks, multimedia applications: interpersonal communications, interactive applications over the internet, entertainment applications.	
Unit II: MULTIMEDIA INFORMATION REPRESENTATION	**8 Hours**
Introduction, digitization principles, text, images, audio, video, text and image compression, audio and video compression	
Unit III: INTERNET OF MULTIMEDIA THINGS	**8 Hours**

Introduction, IoMT vision, Multimedia sensing in IoMT: conventional video coding, distributed video coding, compressive sensing, open issues, Reporting and addressability: IoT communication stack (link layer, network layer, transport layer, application layer), Infeasibility of IoT's communication stack for IoMT
Unit IV: COMMUNICATION TECHNOLOGIES 8 Hours
Introduction, multimedia communication in the internet of things, utilising information and communication technologies for development: the social dimensions, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems
Unit V: MULTIMEDIA COMMUNICATIONS IN THE IoT 8 Hours
Multimedia security and forensics in IoT, Multimedia processing and storage in IoT, Applications of multimedia comm. in IoT, Social multimedia interactions in IoT
Unit VI: Advances and the Latest Trends 8 Hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Privacy and Security in IoT				
Course Code	CSIO4072				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

Familiarize the students to understand the needs of Privacy and Security in IoT And their importance and effect in the system

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the various types of threats and attacks exists for IoTs.

CO2	Understand the importance of privacy preservation, its need and effect.
CO3	Understand various trust models used in IoTs.
CO4	Understand how to protect data from unauthorized access.
CO5	Understand the importance developing and needs of data security
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations. By Fei Hu, 2016, by CRC Press.

Reference Books

1. The Internet of Things: Privacy and Security in a Connected World, Federal Trade Commission staff reports, United States. Federal Trade Commission, Publisher, DIANE Publishing Company, 2015, 1457867680.

Course Content

Unit I: Threats and attacks	**8 Hours**
IoT as interconnection of threats, attack, defence and network robustness of IoT's, Malware propagation and control.	
Unit II: Privacy preservation	**8 Hours**
Privacy preservation of data dissemination, Privacy of IoT used in smart buildings.	
Unit III: Trust and Authentication	**8 Hours**
Trust models for IoT, Preventing unauthorized access to sensor data, Authentication in IoT.	
Unit IV: Data Security	**8 Hours**
Computational security for IoT, privacy preserving in data aggregation, Security protocols for IoT access network.	
Unit V: Social Awareness	**8 Hours**
Policy based approach for informed consent in IoT's. Case study.	
Unit VI: Advances and the Latest Trends	**8 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products	

available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Industrial Application of IOT				
Course Code	CSIO4070				
Prerequisite					
Co requisite					
Antirequisite					
		L	T	P	C
		2	0	2	3

Course Objectives

The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation ,transportation, healthcare, industry, etc.) with a focus towards industry.

Course Outcomes:

CO1	Understanding of IoT value chain structure ,application areas and technologies involved
CO2	Building state of the art architecture in IoT.
CO3	Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
CO4	Explore and learn about Raspberry Pi &Arduino
CO5	Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. "Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014"

Reference Books

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013

2. CunoPfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

Course Content:

UNIT I: Introduction	**9 lecture hours**
Concepts and Technologies behind Internet of Things (IOT),The Past, Present, and Future of IOT, Scope of IOT in India, How large is the IOT Market in Different Domain, IOT Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization	
UNIT II: IoT-An Architectural Overview	**9 lecture hours**
"IOT Network Architecture, I OT Device Architecture, IOT Application Architecture, IOT cloud Architecture IOT Device Design: Sensors – Classification & selection criteria based on nature, frequency, and amplitude of signal ,Embedded Development Boards – Arduino, Raspberry Pi Interfacing peripherals & Programming GPIOs – Input/output peripherals, Sensor modules Design Considerations – Cost, Performance & Power Consumption tradeoffs"	
UNIT III: IoT Applications for Value Creations	**9 lecture hours**
Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications like IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	
UNIT IV: Getting Started with Raspberry Pi	**9lecture hours**
"Introduction to Raspberry pi, Raspberry pi different model comparison, Raspberry Pi operating system choices, Set up your Raspberry pi, Raspbian OS. Introduction To Arduino Platform Advantages of Raspberry pi over Arduino. Rasberry pi Linux OS COMMANDS	
UNIT V: Preparing IOT Projects for Industries	**9 lecture hours**
Creating the sensor project - Preparing Raspberry Pi - Clayster libraries -Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data - Creating the actuator project-Hardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states - Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings -Initializing the camera.	
Unit VI: Advances and the Latest Trends	**9 Lecture hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Mobile and IoT Analytics				
Course Code	BCDA4750				
Prerequisite					
Co requisite					
Antirequisite					
		L	T	P	C
		2	0	2	3

Course Objectives

The objective of this course is to make students to understand about IoT and its analytics in various applications.

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand IoT architecture.
CO2	Understand fog computing.
CO3	Understand Mobile analytics.
CO4	Apply data visualization techniques.
CO5	Analyse using various statistical tools.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
3. R for Data Science – Hadley Wickham, Garrett Grolemund – O'Reilly – First Edition, December 2016.
4. Fog Computing in the Internet of Things, Rahmani, A., Liljeberg, P., Preden, J.-S., Jantsch, Springer International Publishing, 2016.

Course Content

Unit I: Introduction to IoT, Architecture and Technologies	**8 Hours**
Introduction to IoT: context setting, what is IoT – In depth explanation, IoT applications in different domains and verticals, IoT market in different domains, Introduction to IoT Architecture and Technologies: Architecture, tech stack, Hardware and Software Platform, Communication protocols, Cloud and IoT, Analytics & Visualization and IoT, IoT security	
Unit II: Fog Computing	**8 Hours**
Fog Computing: A platform for Internet of Things and Analytics: a massively distributed number of sources – Big Data Metadata Management in smart grids, semantic inconsistencies: role of metadata.	
Unit III: Introduction to Mobile Analytics	**8 Hours**
Introduction, the mobile market, mobile technology: growth and reach, mobile platform and applications, mobile apps market, impact of mobile-mobility, enterprise mobility-bring your own device, business context; mobile commerce, mobile payment, mobile wallets, threats to mobile data, machine to machine in healthcare and automobiles.	
Unit IV: Data Exploration and Visualization	**8 Hours**
File operation: read and write to a CSV/Excel file, Connect to a big data source and extract data using R, data exploration clean up and transformation with R, describe and summarize data using functions in R, introduction to geomaps for plotting on a geographical map, use raster for plotting fraudlent claims by categories, introduction to Azure ML platform.	
Unit V: Analytics	**8 Hours**
Statistical Analysis: techniques for visualizing relationship in data and understanding the relationships, exploring data-visualization correlation and regression, probability distribution; machine learning-concept of machine learning, Regression-linear and non-linear, Algorithms-MLR, Logistics regression, classification algorithms- SVM, decision trees and boosted decision trees, Naïve bayes; Quality of classification- concepts of ROC, hit rate, kappa statistics and K-S statistics, marketing analytics-conjoint analysis, hidden markov models.	
Unit VI: Advances and the Latest Trends	**8 Hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	PREDICTIVE ANALYTICS			
Course Code	CSDA2020			
Prerequisite	Statistics and applied mathematics, DBMS			
Corequisite				
Antirequisite				
	L	T	P	C
	2	0	2	3

Course Objectives

1. Student learn the various algorithms of Data Mining, Classification and Data Visualization
2. Student understand the concepts of Supervised and Unsupervised algorithms
3. Student learn various prediction measures and techniques of classification problems
4. Student understand the various model assessment techniques and selections
5. Student learn the different types of prediction methods and applications
6. Student learn the R programming to implement the various algorithms

Course Outcomes

At the end of the course, students will be able to:

CO1	Understand the basics of Data Mining, Classification techniques and Data Visualization.
CO2	Design and apply the various algorithms of Supervised and Unsupervised Learning.

CO3	Design and apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.
CO4	Design and apply various prediction methods to determine the future prediction of results.
CO5	Understand the common idioms of neural networks and classification methods.
CO6	Implementing various machine learning algorithms using R programming.

Text Books

1.T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008

2.Christopher Bishop. Pattern Recognition and Machine Learning. 2e

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.

4. G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,

5. E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010

Reference Books

1) Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier

2) Mallach,"Data Warehousing System",McGraw –Hill.

Course Content

Unit 1:Overview of the Data Mining Process **[8 lecture hrs]**
Overview of the Data Mining Process : Core Ideas in Data Mining -Classification - Prediction - Association Rules - Data Reduction - Data Exploration and Data Refinement: Data Summaries – Data Visualization – treatment of Missing Observation – Detection of Outliers – the Box Plot – Correlation analysis
Unit 2 : Supervised/Unsupervised Learning **[8 lecture hrs]**
Supervised Learning: Learning with Rules, Learning with Trees, Ensemble Learning, Nearest Neighbor, Unsupervised learning: clustering, dimensionality reduction, recommender systems, deep learning
Unit 3 : Evaluation Methods for Prediction and Classification Problems **[10 lecture hrs]**
Evaluation Methods for Prediction and Classification Problems : Prediction Measures: MAE, MSE, RMSE, MAPE, MSPE, and RMSPE - Classification Measures: Classification Matrix, ROC Curves, Lift Charts, and Lift Charts that Incorporate Costs and Benefits - The Role of Over-sampling in Classification Problems
Unit 4 : Prediction Methods Model Assessment and Selection: **[8 lecture hrs]**
Bias,Variance,and model complexity,Bias-variance trade off, Optimisim of the training error rate ,Esimate of In-sample prediction error,Effective number of parameters, Bayesian approach and BIC, Cross- validation ,Boot strap methods, conditional or expected test error.

Unit 5 : Neural networks and Classification Methods **[6 lecture hrs]**
Prediction Methods : Linear Regression: Best Subset Selection - Forward Selection - Backward Selection - Step-wise Regression (Efroymson's method) - All Subsets Regression - Information Criteria (AIC, SBC, etc.) - Penalized Regression Methods (Ridge, LASSO, Adaptive LASSO
Unit VI: Advances and the Latest Trends **[8 lecture hrs]**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Computer Vision				
Course Code	CSAI4073				
Prerequisite	Programming and Mathematic course				
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

In this course students will learn basic principles of image formation, image processing algorithms and different algorithms for 3D reconstruction and recognition from single or multiple images (video). This course emphasizes the core vision tasks of scene understanding and recognition. Apllications to 3D modelling, video analysis, video surveillance, object recognition and vision based control will be discussed.

Course Outcomes

At the end of this course, students will be able to:

CO1	To implement fundamental image processing techniques required for computer vision.

CO2	Understand Image formation process
CO3	To perform shape analysis
CO4	Extract features form Images and do analysis of Images
CO5	Generate 3D model from images applications
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.

2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

Reference Books

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.

2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.

3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010

4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

5. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012

6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012

Course Content

Unit I:	**9 Lecture hours**
Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality	
Unit II:	**9 Lecture hours**
Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images	
Unit III:	**9 Lecture hours**

Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multi resolution analysis
Unit IV: 9 Lecture hours
Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching Principal component analysis , Shape priors for recognition. Image Understanding : Pattern recognition methods, HMM, GMM and EM
Unit V: 9 Lecture hours
Applications: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians
Unit VI: Advances and the Latest Trends 9 Lecture hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Big Data and Nosql Database**			
Course Code	**CSBA4090**			
Prerequisite	Basics of Bigdata, Database Management			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**

	2	0	2	3

Course Objectives

The course is supplemented to help the students to reinforce their theoretical knowledge of the Bigdata and Nosql.

Course Outcomes

At the end of the course, students will be able to:

CO1	**Identify Big Data and its Business Implications.**
CO2	**List the components of Hadoop and Hadoop Eco-System**
CO3	**Differentiate between a relational database and a non-relational (NoSQL) database**
CO4	**Perform CRUD operations (create, read, update and delete) on data in NoSQL environment**
CO5	**Understand the basic storage architecture and distributed file systems**
CO6	**students would have a broad understanding of the social, economic, and historical context in which Big Data and Nosql occurs.**

Text Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. ,Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

2.Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

3.Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

4.Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

5.Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.

Course Content

7.	**Unit I: Introduction To Big Data And Hadoop 7 hours**
8.	**Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop,**
9.	**Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System,**
10.	**IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.**
Unit II: HDFS(Hadoop Distributed File System) and MapReduce 7 hours	
The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	

Unit III: Introduction and Basic Concepts **7 hours**
11. Define what a NoSQL database is, Why we need NoSQL and how is it different from traditional 12. databases. Learn about the various tools available such as MongoDB, Cassandra, HBase etc. Explore the principles of NoSQL using elementary examples in MongoDB.
13. Unit IV: Basics of NoSQL 7 hours
Develop an understanding of the available data models: value stores, document databases, column-family stores, graph databases. Understand the basic storage architecture in a distributed environment – column oriented databases, nested maps of key/value pairs, hbase distributed storage architecture.
14. Unit V: Distributed Framework & NoSQL Operations 7 hours
15. Hadoop distributed storage architecture and discussion about MapReduce processing framework. **16. The set of essential operations – CRUD refers to Create, Read, Update and Delete operations in the context of a NoSQL database environment. Practical experience of CRUD operations for document databases using MongoDB. Learn to query using MongoDB.**
Unit VI: Advances and the Latest Trends 7 hours **The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Natural Language Processing				
Course Code	CSAI3050				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

- To understand language modelling
- To provide the student with knowledge of various levels of analysis involved in NLP

- To gain knowledge in automated natural language generation and machine Translation

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the challenges of NLP
CO2	Understand regular expressions and syntactic analysis.
CO3	Apply semantic analysis.
CO4	Understand the architecture of NLG systems.
CO5	Understand the design features of information retrieval systems.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. TanveerSiddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Reference Books

1. Daniel Jurafsky and James H Martin," Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008.
2. James Allen, Bejamin/cummings, "Natural Language Understanding", 2ndedition, 1995.

Course Content

Unit I:	**9 Lecture hours**
OVERVIEW: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. LANGUAGE MODELING: Introduction-Various Grammar-based Language Models-Statistical Language Model.	
Unit II:	**9 Lecture hours**
OVERVIEW: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. LANGUAGE MODELING: Introduction-Various Grammar-based Language Models-Statistical Language Model.	
Unit III:	**9 Lecture hours**
Introduction- Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation DISCOURSE PROCESSING: Introduction- cohesion-Reference Resolution- Discourse Coherence and Structure.	

Unit IV:	**9 Lecture hours**
Introduction-Architecture of NLG Systems- Generation Tasks and Representations-Application of NLG MACHINE TRANSLATION: Introduction-Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.	
Unit V:	**9 Lecture hours**
Introduction-Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – Evaluation LEXICAL RESOURCES: Introduction- WordNet-FrameNet-Stemmers-POS Tagger- Research Corpora.	
Unit VI: Advances and the Latest Trends	**9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Human Computer Interaction				
Course Code	**CSAI4090**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**

		2	0	2	3

Course Objectives

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

Course Outcomes

At the end of this course, students will be able to:

CO1	Design effective dialog for HCI
CO2	Design effective HCI for individuals and persons with disabilities.
CO3	Assess the importance of user feedback.
CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5	Develop meaningful user interface.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, ―Mobile Design and Development, First Edition, O‘Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O‘Reilly, 2009. (UNIT-V)

Course Content

Unit I:	**9 Lecture hours**
The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. – Case Studies	
Unit II:	**9 Lecture hours**
Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	
Unit III:	**9 Lecture hours**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.
Unit IV: 9 Lecture hours
Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. – Case Studies
Unit V: 9 Lecture hours
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studie.
Unit VI: Advances and the Latest Trends 9 Lecture hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Augmented Reality				
Course Code	CSAR4070				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

- Understanding of the basic concept and framework of augmented reality.
- Learning of the methodologies and classification of the Augmented Reality.
- Possible modes of Augmented Reality on applying it in real time environment.
- Application of 3D in Augmented Reality and the challenges faced.

- Types of Augmented Reality Technologies and the case Study on it.

Course Outcomes

At the end of this course, students will be able to:

CO1	Summarize the Augmented Reality basic Concepts
CO2	Classify the Augmented Reality Methods and the components of it.
CO3	Differentiate the techniques of Augmented reality and the applications.
CO4	Explain the challenges faced by implementation of Augmented Reality.
CO5	Aware of the real time applications and the technologies of Augmented Reality
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Hael Haller Upper Austr a Un vers ty of Appl ed Sc ences, Austr a. Mark B ll nghurst, “Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013”.

2. ANA REGINA MIZRAHY CUPERSCHMID, REGINA COELI RUSCHEL AND MÁRCIA REGINA DE FREITAS, ”Technologies that support Augmented Reality applied to Architecture and Construction”

Course Content

Unit I:	**9 Lecture hours**
Augmented Reality- Difference between Augmented Reality and Virtual Reality and Mixed Reality - History of Augmented Reality-characteristics of Augmented Reality systems-Issues & Challenges in Augmented Reality–The SDK’s and Tool’s used to build Augmented Reality applications -Advantages and Disadvantages of AR.-Future scope of Augmented Reality	
Unit II:	**9 Lecture hours**
Concepts of Augmented Reality-Scene Capture, Scene Identification-Scene visualization-visualization techniques for augmented reality- Components of Augmented Reality architecture - Augmented Reality systems and functionality.	
Unit III:	**9 Lecture hours**
Techniques of Augmented Reality -Augmented reality working planes- infinite carving planes-laser carving- laser colouring- texture map capture -surface of revolution.	
Unit IV:	**9 Lecture hours**
3D Vision –The challenge of 3D -Challenges in computer vision-Texturize Lighting ,weather conditions-Large and volatile databases-Developments in 3D vision theory-Sub-problems & approaches-Camera Parameters-enhancing interactivity in Augmented Reality environments.	

Unit V:	**9 Lecture hours**
Projection based Augmented Reality -Non-interactive Augmented Reality - interactive Augmented Reality - Location Based Augmented Reality - Recognition Based Augmented Reality - Augmented Reality Working on Different Devices-Applications of Augmented Reality in real Time environment-Famous companies building augmented reality applications-.Case study on popular augmented Reality applications-Wikitude , Augment and Pokemon go Game	
Unit VI: Advances and the Latest Trends	**9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Genetic algorithm				
Course Code	BCSE9090				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

- Mathematical foundations for Genetic algorithm, operators
- Applications of Genetic Algorithms
- Genetic based machine learning and its applications

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand genetic algorithms.

CO2	Use fundamental theorems.
CO3	Discuss GA Operators.
CO4	Explain the applications of GA.
CO5	Investigate the applications of genetics.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, July 2017.
2. David E. Gold Berg, "Genetic Algorithms in Search, Optimization & MachineLearning", Pearson Education, 2001

Reference Books

1. Kalyanmoy Deb, "Optimization for Engineering Design, algorithms and examples", PHI 1995.
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, " Neural Networks, Fuzzy Logic and Genetic Algorithms ", PHI , 2003 (Chapters 8 and 9).

Course Content

Unit I:	**9 Lecture hours**
Introduction to Genetic Algorithm – Robustness of Traditional Optimization and Searchmethods – Goals of optimization-GA versus Traditional methods – Simple GA – GA at work – Similarity templates (Schemata) – Learning the lingo.	
Unit II:	**9 Lecture hours**
The fundamental theorem - Schema processing at work. – The 2-armed & k-armed Banditproblem. –The building Block Hypothesis. – Minimal deceptive problem.	
Unit III:	**9 Lecture hours**
Data structures – Reproduction- Roulette-wheel Selection – Boltzman Selection – Tournament Selection-Rank Selection – Steady –state selection –Crossover mutation – Mapping objective functions to fitness forum. – Fitness scaling. Coding – A Multi parameter, Mapped, Fixed – point coding – Discretization – constraints.	
Unit IV:	**9 Lecture hours**
The rise of GA – GA application of Historical Interaction. – Dejung & Function optimization-Current applications of GA - Advanced operators & techniques in genetic search. Dominance, Diploidy & abeyance.	

Unit V:	**9 Lecture hours**
The Rise of GBMC – Development of CS-1, the first classifier system. Smitch's Poker player–Other Early GBMC efforts. –Current Applications.	
Unit VI: Advances and the Latest Trends	**9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Neural networks				
Course Code	BCAI3520				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

- To understand the basics of ANN and comparison with Human brain
- To study about various methods of representing information in ANN
- To learn various architectures of building an ANN and its applications

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the basics of ANN and its applications.
CO2	Explain pattern classification algorithms.
CO3	Apply pattern association rules.
CO4	Understand neural nets.
CO5	To understand the Pattern classification and Pattern Association techniques
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Fausett, "Fundamentals of Neural Networks-Architectures, Algorithms and Applications", Pearson Education, 2011.

Course Content

Unit I:	**9 Lecture hours**
Definition of ANN-Biological Neural Networks-Applications of ANN-Typical Architectures-Setting the weights-Common Activation functions-Development of Neural Networks-McCulloch-Pitts Neuron.	
Unit II:	**9 Lecture hours**
General discussion - Hebb net – Perceptron- Adaline – Back propagation neural net- Architecture-Delta Learning Rule Algorithm-Applications.	
Unit III:	**9 Lecture hours**
Training Algorithm for Pattern Association-Hetero associative memory neural network applications-Auto associative net-Iterative Auto associative net-Bidirectional Associative Memory-Applications.	
Unit IV:	**9 Lecture hours**
Fixed Weights Competitve Nets- Kohonen's Self-Organizing Map –Applications- Learning Vector Quantization-Applications-Counter Propagation Network- Applications.	
Unit V:	**9 Lecture hours**
Motivation – Basic Architecture- Basic Operation-ART1-ART2-Architecture- Algorithm-applications-Analysis Probabilistic Neural Net-Cascade Correlation- Neocognitron: Architecture—Algorithm-Applications.	

Unit VI: Advances and the Latest Trends	**9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Introduction to Big Data and Data Science**				
Course Code	**CBBD2020**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

Today's world is data-driven world. Increasingly, the efficient operation of organizations across sectors relies on the effective use of vast amounts of data. This course provides grounding in basic and advanced analytic methods and an introduction to big data analytics technology and tools, including MapReduce and Hadoop

Course Outcomes

At the end of this course, students will be able to:

CO1	**Learn about the basics of data Science and to understand the various supervised and unsupervised learning techniques.**
CO2	**To unders Bringing together several key technologies used in manipulating, storing, and analyzing big data from different perspectives. tand the Cluster Computing.**

CO3	**Understanding the Hadoop architecture and implementation of MapReduce Application.**
CO4	**To understand the Hadoop System.**
CO5	**To understand the Map reduce.**
CO6	**Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)**

Reference Books

1. David Dietrich, Barry Heller and Beibei Yang, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley, ISBN 13:9788126556533, 2015.

2. Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data", The McGraw-Hill Companies, ISBN : 978-0-07-179054-3, 2012.

3. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly, ISBN: 9789352130672, 2015.

4. Biris Lublinsky, Kevin T. Smith and Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN 13:9788126551071, 2015.

Course Content

Unit I: INTRODUCTION TO DATA SCIENCE
Introduction of Data Science – Basic Data Analytics using R – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.
Unit II: ADVANCED ANALYTICAL THEORY AND METHODS
Overview of Clustering – K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R – Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes' Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R
Unit III: BIG DATA FROM DIFFERENT PERSPECTIVES
Big data from business Perspective: Introduction of big data-Characteristics of big data-Data in the warehouse and data in Hadoop- Importance of Big data- Big data Use cases: Patterns for Big data deployment. Big data from Technology Perspective: History of Hadoop-Components of HadoopApplication Development in Hadoop-Getting your data in Hadoop-other Hadoop Component.
Unit IV: HADOOP DISTRIBUTED FILE SYSTEM ARCHITECTURE
HDFS Architecture – HDFS Concepts – Blocks – NameNode – Secondary NameNode – DataNode – HDFS Federation – Basic File System Operations – Data Flow – Anatomy of File Read – Anatomy of File Write.

Name of The Course	**Business Intelligence**				
Course Code	**CSBA3050**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Unit V: PROCESSING YOUR DATA WITH MAPREDUCE
Getting to know MapReduce – MapReduce Execution Pipeline – Runtime Coordination and Task Management – MapReduce Application – Hadoop Word Count Implementation.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Objectives

This course provides a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments. The course discusses the concepts and features related to Virtualized datacenter and cloud, Information storage security and design, storage network design and cloud optimized storage.

Course Outcomes

At the end of this course, students will be able to:

CO1	**Understand the Business Intelligence.**
CO2	**Understand the elements of Business Intelligence solutions.**
CO3	**Understand the building of BI Projects.**
CO4	**Understand the report authoring.**
CO5	**Understand the BI deployment, administration and security**
CO6	**Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)**

Text Books

1. Business Intelligence Guidebook: From Data Integration to Analytics By Rick Sherman

Reference Books

1. Business Intelligence: A Managerial Approach By David King, Efraim Turban, and Ramesh Sharda
2. Fundamentals of Business Intelligence By Mr. Wilfried Grossmann and Stefanie Rinderle-Ma

Course Content

Unit I: Introduction to BI	**6 Lecture hours**
Understanding the scope of today's BI solutions and how they fit into existing infrastructure. Assessing new options such as SaaS and cloud- based technologies. Describe BI, its components & architecture. Previewing the future of BI. Crafting a better experience for all your business users. End User Assumptions. Setting Up Data for BI . The Functional Area of BI Tools. Query Tools and Reporting. OLAP and Advanced Analytics. Supporting the requirements of senior executives, including performance management	
Unit II: Elements of Business Intelligence Solutions	**8 Lecture hours**
Reports & ad hoc queries; Analyze OLAP data; Dashboards & Scorecards developmentMetadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications.	
Unit III: Building the BI Project	**9 Lecture hours**
Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.	
Unit IV: Reporting authoring	**9 Lecture hours**

Building reports with relational vs Multidimensional data models ; Types of Reports - List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill- up, drill-down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, CSV, xml etc.
Unit V: BI Deployment, administration and security. 8 Lecture hours
Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements, and DependenciesSystem Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication, Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.
Unit VI: Advances and the Latest Trends 9 Lecture hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	PREDICTIVE ANALYTICS			
Course Code	CSDA2020			
Prerequisite	Statistics and applied mathematics, DBMS			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives

- Student learn the various algorithms of Data Mining, Classification and Data Visualization

- Student understand the concepts of Supervised and Unsupervised algorithms
- Student learn various prediction measures and techniques of classification problems
- Student understand the various model assessment techniques and selections
- Student learn the different types of prediction methods and applications
- Student learn the R programming to implement the various algorithms

Course Outcomes

At the end of the course, students will be able to:

CO1	Understand the basics of Data Mining, Classification techniques and Data Visualization.
CO2	Design and apply the various algorithms of Supervised and Unsupervised Learning.
CO3	Design and apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.
CO4	Design and apply various prediction methods to determine the future prediction of results.
CO5	Understand the common idioms of neural networks and classification methods.
CO6	Implementing various machine learning algorithms using R programming.

Text Books

1.T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008

2.Christopher Bishop. Pattern Recognition and Machine Learning. 2e

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.

4. G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,

5. E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010

Reference Books

1) Jiawei Han, Micheline Kamber, ”Data Mining Concepts & Techniques” Elsevier

2) Mallach,”Data Warehousing System”,McGraw –Hill.

Course Content

Unit 1:Overview of the Data Mining Process	**[8 lecture hrs]**
Overview of the Data Mining Process : Core Ideas in Data Mining -Classification - Prediction - Association Rules - Data Reduction - Data Exploration and Data Refinement: Data Summaries – Data Visualization – treatment of Missing Observation – Detection of Outliers – the Box Plot – Correlation analysis	

Unit 2 : Supervised/Unsupervised Learning **[8 lecture hrs]**
Supervised Learning: Learning with Rules, Learning with Trees, Ensemble Learning, Nearest Neighbor, Unsupervised learning: clustering, dimensionality reduction, recommender systems, deep learning
Unit 3 : Evaluation Methods for Prediction and Classification Problems [10 lecture hrs]
Evaluation Methods for Prediction and Classification Problems : Prediction Measures: MAE, MSE, RMSE, MAPE, MSPE, and RMSPE - Classification Measures: Classification Matrix, ROC Curves, Lift Charts, and Lift Charts that Incorporate Costs and Benefits - The Role of Over-sampling in Classification Problems
Unit 4 : Prediction Methods Model Assessment and Selection: [8 lecture hrs]
Bias,Variance,and model complexity,Bias-variance trade off, Optimisim of the training error rate ,Esimate of In-sample prediction error,Effective number of parameters, Bayesian approach and BIC, Cross-validation ,Boot strap methods, conditional or expected test error.
Unit 5 : Neural networks and Classification Methods [6 lecture hrs]
Prediction Methods : Linear Regression: Best Subset Selection - Forward Selection - Backward Selection - Step-wise Regression (Efroymson's method) - All Subsets Regression - Information Criteria (AIC, SBC, etc.) - Penalized Regression Methods (Ridge, LASSO, Adaptive LASSO
Unit VI: Advances and the Latest Trends
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Big Data and Nosql Database**			
Course Code	**CSBA4090**			
Prerequisite	Basics of Bigdata, Database Management			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**

	2	0	2	3

Course Objectives

The course is supplemented to help the students to reinforce their theoretical knowledge of the Bigdata and Nosql.

Course Outcomes

At the end of the course, students will be able to:

CO1	**Identify Big Data and its Business Implications.**
CO2	**List the components of Hadoop and Hadoop Eco-System**
CO3	**Differentiate between a relational database and a non-relational (NoSQL) database**
CO4	**Perform CRUD operations (create, read, update and delete) on data in NoSQL environment**
CO5	**Understand the basic storage architecture and distributed file systems**
CO6	**students would have a broad understanding of the social, economic, and historical context in which Big Data and Nosql occurs.**

Text Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. ,Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

2.Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

3.Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

4.Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

5.Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.

Course Content

Unit I: Introduction To Big Data And Hadoop	**7 hours**
Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	
Unit II: HDFS(Hadoop Distributed File System) and MapReduce	**7 hours**
The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	
Unit III: Introduction and Basic Concepts	**7 hours**

Define what a NoSQL database is, Why we need NoSQL and how is it different from traditional databases. Learn about the various tools available such as MongoDB, Cassandra, HBase etc. Explore the principles of NoSQL using elementary examples in MongoDB.
Unit IV: Basics of NoSQL 7 hour
Develop an understanding of the available data models: value stores, document databases, column-family stores, graph databases. Understand the basic storage architecture in a distributed environment – column oriented databases, nested maps of key/value pairs, hbase distributed storage architecture.
Unit V: Distributed Framework & NoSQL Operations 7 hour
Hadoop distributed storage architecture and discussion about MapReduce processing framework. The set of essential operations – CRUD refers to Create, Read, Update and Delete operations in the context of a NoSQL database environment. Practical experience of CRUD operations for document databases using MongoDB. Learn to query using MongoDB.
Unit VI: Advances and the Latest Trends 7 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Big Data Analytics Using Hadoop				
Course Code	BCSE9005				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

This technical course is designed to help student to learn about HTML language. Further PHP programming will be taught to make active web pages and website. Concepts of server side and client side software and middleware

like web server and database server will be explained. An introduction to JavaScript will also be provided for form validation.

Course Outcomes

At the end of this course, students will be able to:

CO1	Introduce the Big Data.
CO2	Introduce the Hadoop.
CO3	Introduce the HDFS.
CO4	Introduce the MapReduce
CO5	Introduce the HIVE and PIG.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Big Data and Hadoop Kindle Edition, V.K.Jain, Khanna Publishing; 1 edition, 2016.

Reference Books

1.Hadoop: The Definitive Guide By Tom White, O′Reilly; 3 edition, 2012.

Course Content

Unit I:
Definition with Real Time Examples, How BigData is generated with Real Time Generation, Use of BigData-How Industry is utilizing BigData, Future of BigData.
Unit II:
Why Hadoop? What is Hadoop? Hadoop vs RDBMS, Hadoop vs BigData, Brief history of Hadoop, Problems with traditional large-scale systems, Requirements for a new approach, Anatomy of a Hadoop cluster.
Unit III:
.Concepts & Architecture, Data Flow (File Read , File Write), Fault Tolerance, Shell Commands, Java Base API, Data Flow Archives, Coherency, Data Integrity, Role of Secondary NameNode.
Unit IV:
Theory, Data Flow (Map – Shuffle - Reduce), MapRed vs MapReduce APIs, Programming Mapper, Reducer, Combiner, Partitioner
Unit V:

Architecture, Installation, Configuration, Hive vs RDBMS, Tables, DDL & DML, Partitioning & Bucketing, Hive Web Interface, Why Pig, Use case of Pig, Pig Components, Data Model, Pig Latin.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Data Visualization Using R**				
Course Code	CSDA4070				
Prerequisite	Basic Knowledge on R				
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

The goal of this course is to introduce students to data visualization including both the principles and techniques. Students will learn the value of visualization, specific techniques in information visualization and scientific visualization, and how understand how to best leverage visualization methods.

Course Outcomes

At the end of the course, students will be able to:

CO1	**Understand the fundamental syntax of R through readings, practice exercises, demonstrations, and writing R code.**
CO2	**Apply critical programming language concepts such as data types, iteration, control structures, functions, and boolean operators by writing R programs and through examples**
CO3	**Prepare or tidy datas for in preparation for analysis**

CO4	**Analyze a data set in R and present findings using the appropriate R packages**
CO5	**Visualize data attributes using ggplot2 and other R packages.**
CO6	**students would have a broad understanding of the social, economic, and historical context in which Data visualization is needed.**

Text Books

1.Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz

Course Content

Unit I: Introduction to R programming **7 hours**
What is R?, Installing R and RStudio ,RStudio Overview ,Working in the Console ,Arithmetic, Operators **Logical Operations ,Using Functions ,Getting Help in R and Quitting RStudio, Creating Variables,** **Numeric, Character and Logical Data , Vectors , Data Frames , Factors , Sorting Numeric, Character, and** **Factor Vectors , Special Values**
Unit II: R packages and scripts **7 hours**
Installing and loading packages, Setting up your working directory, Downloading and importing data , Working with missing data , Extracting a subset of a data frame , Writing R scripts , Adding comments and documentation , Creating reports.
Unit III: Descriptive statistics in R **7 hours**
Measures of central tendency , Measures of variability , Skewness and kurtosis , Summary functions, describe functions, and descriptive statistics by group , Correlations, Scatter Plots , Box Plots , Scatter Plots and Boxand-Whisker Plots Together , Histograms.
Unit IV: Working with messy data **7 hours**
Messy Data , Renaming Columns (Variable Names) , Attaching / Detaching , Tabulating Data: Constructing Simple Frequency Tables , Ordering Factor Variables, while loops , for loops, If / else , Boolean logical operators.
Unit V: Data exploration and visualization **7 hours**
Using the ggplot2 package to visualize data , Applying themes from ggthemes to refine and customize charts and graphs, Building data graphics for dynamic reporting, Writing SQL statements in R , Using the Select, From, Where, Is, Like, Order By, Limit, Max, Min SQL functions.
Unit VI: Advances and the Latest Trends **7 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**CLUSTER COMPUTING**				
Course Code	**CSIT4090**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

- Cluster is a type of parallel system that consists of a collection of interconnected computers used as a single unified computing resource.

Course Outcomes

At the end of this course, students will be able to:

CO1	**To understand the Distributed system.**
CO2	**To understand the Cluster Computing.**
CO3	**To understand the Technology and simulation.**
CO4	**To understand the Grid Architecture.**
CO5	**To understand the Web services and Clusters.**
CO6	**Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)**

Reference Books

1. Grid and Cluster Computing, Prabhu C.S.R, PHI Learning Private Limited

2. A networking Approach To Grid Computing by Daniel Minoli (Chapter 1) (John Wiley and Sons, INC Publication)

3. Distributed and Cloud Computing, First Edition, Geoffrey C. Fox, KaiHwang, Jack J. Dongarra, Elsevier India Pvt. Ltd.-New Delhi

4. Fran Berman, Geoffrey C. Fox, Anthony J.G Hey Grid Computing making the global infrastructure a Reality

5. High Performance Cluster Computing: Architectures and Systems, Vol. 1, Prentice Hall

6. In search of clusters (2nd ed.), Gregory F. Pfister, IBM, Austin, TX, Prentice-Hall

Course Content

Unit I: Basic concepts in Distributed Systems
Notion of time Distributed Mutual exclusion, Consensus, Failure models Paradigms for process interaction in distributed programs, Programming Paradigms, Shared memory, Message passing, Workflows.
Unit II: Cluster Computing
Introduction to Cluster Computing, Cluster Middleware: An Introduction, Early Cluster Architecture and High Throughput Computing Clusters, Networking, Protocols and I/O for Clusters, Setting Up and Administering a Cluster.
Unit III: Technology and simulation
Cluster Technology for High Availability, Performance Models and Simulation, Process Scheduling, Load Sharing and Load Balancing, Distributed Shared Memory.
Unit IV: Grid Architecture
Introduction to Grid Architecture, Characterization of Grid, and Grid related standard bodies, Grid types, Topologies, Components and Layers, Comparison with other approaches.
Unit V: Web services and Clusters
System Infrastructure, Traditional paradigms for distributed computing, Web Services, Grid standards: OGSA and WSRF, Case Studies of Cluster Systems: Beowulf, COMPaS, NanOS and PARAM.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**

20	30	50	100

Name of The Course	Ethical Hacking				
Course Code	CSCN2020				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

- Introduce Student to learn technical foundation of cracking and ethical hacking
- Aspects of security, importance of data gathering, foot printing and system hacking
- evaluation of computer security
- Practical tasks will be used to re-enforce and apply theory to encourage an analytical and problem-based approach to ethical hacking

Course Outcomes

At the end of this course, students will be able to:

CO1	Learn various hacking methods.
CO2	Perform system security vulnerability testing.
CO3	Perform system vulnerability exploit attacks.
CO4	Produce a security assessment report
CO5	Learn various issues related to hacking
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Patrick Engbreston: “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”,1st Edition, Syngress publication,2011.

2.Ankit Fadia : “Unofficial Guide to Ethical Hacking”, 3rd Edition , McMillan India Ltd,2006.

Reference Books

1.Simpson/backman/corley, “HandsOn Ethical Hacking & Network Defense International”, 2nd Edition,Cengageint,2011.

Course Content

Unit I: Hacking Windows
BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies, URL History, The Registry, Baby Sitter Programs
Unit II: Advanced Windows Hacking
Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.
Unit III: Getting Past the Password
Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords
Unit IV: The Perl Manual
Perl: The Basics, Scalars, Interacting with User by getting Input, Chomp() and Chop(), Operators, Binary Arithmetic Operators, The Exponentiation Operator(**), The Unary Arithmetic Operators, Other General Operators, Conditional Statements, Assignment Operators. The?: Operator, Loops, The While Loop, The For Loop, Arrays, THE FOR EACH LOOP: Moving through an Array, Functions Associated with Arrays, Push() and Pop(), Unshift() and Shift(), Splice(), Default Variables, $_, @ARGV, Input Output, Opening Files for Reading, Another Special VariableS.
Unit V: How does a Virus Work
What is a Virus, Boot Sector Viruses (MBR or Master Boot Record), File or Program Viruses, Multipartite Viruses, Stealth Viruses, Polymorphic Viruses, Macro Viruses, Blocking Direct Disk Access, Recognizing Master Boot Record (MBR) Modifications, Identifying Unknown Device Drivers, How do I make my own Virus?, Macro Viruses, Using Assembly to Create your own Virus, How to Modify a Virus so Scan won‟t Catch it, How to Create New Virus Strains, Simple Encryption Methods.
Unit VI: Advances and the Latest Trends **9 Lecture hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Privacy and Security in IoT				
Course Code	CSIO4072				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

Familiarize the students to understand the needs of Privacy and Security in IoT And their importance and effect in the system

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the various types of threats and attacks exists for IoTs.
CO2	Understand the importance of privacy preservation, its need and effect.

CO3	Understand various trust models used in IoTs.
CO4	Understand how to protect data from unauthorized access.
CO5	Understand the importance developing and needs of data security
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations. By Fei Hu, 2016, by CRC Press.

Reference Books

1. The Internet of Things: Privacy and Security in a Connected World, Federal Trade Commission staff reports, United States. Federal Trade Commission, Publisher, DIANE Publishing Company, 2015, 1457867680.

Course Content

Unit I: Threats and attacks
IoT as interconnection of threats, attack, defence and network robustness of IoT's, Malware propagation and control.
Unit II: Privacy preservation
Privacy preservation of data dissemination, Privacy of IoT used in smart buildings.
Unit III: Trust and Authentication
Trust models for IoT, Preventing unauthorized access to sensor data, Authentication in IoT.
Unit IV: Data Security
Computational security for IoT, privacy preserving in data aggregation, Security protocols for IoT access network.
Unit V: Social Awareness
Policy based approach for informed consent in IoT's. Case study.
Unit VI: Advances and the Latest Trends **9 Lecture hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Cloud Security			
Course Code	CSCV4022			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives:

This course on cloud security introduces the basic concepts of security systems and cryptographic protocols, which are widely used in the design of cloud security. The issues related multi tenancy operation, virtualized infrastructure security and methods to improve virtualization security are also dealt with in this course.

Course Outcomes

CO1	Understand the security concepts in cloud.
CO2	Describe the Multi-Tenancy issues.
CO3	Differentiate various attacks.
CO4	Use enhanced security techniques.
CO5	Solve compliance issues in cloud security.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Book (s)

1 Ronald L. Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing 1st Edition, Kindle Edition”, Wiley, 2010.

2 Tim Mather, SubraKumaraswamy, ShahedLatif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.

Reference Book (s)

1 John Rittinghouse, James Ransome, “Cloud Computing” CRC Press; 1 edition [ISBN: 1439806802], 2009.

2 J.R. ("Vic") Winkler, “Securing the Cloud” Syngress [ISBN: 1597495921] 2011.

3 Cloud Security Alliance, “Security Guidance for Critical Areas of Focus in Cloud Computing” 2009

4 Vmware “VMware Security Hardening Guide” White Paper, June 2011 .

Course Contents:

Unit I:Introduction	**8 lecture hours**
Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.	
Unit II: Multi-Tenancy Issues	**8 lecture hours**
Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues- e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).	
Unit III:Virtualization System-Specific Attacks	**8 lecture hours**
Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.	
Unit IV:Technologies for Virtualization-Based Security	**8 lecture hours**
IBM security virtual server protection, virtualization-based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention. Location of the Perimeter.	
Unit V : Legal and Compliance Issues	**8 lecture hours**
Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.	
Unit VI: Advances and the Latest Trends	**9 Lecture hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Network Security**				
Course Code	CSCN3050				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

- To understand the fundamentals of network security.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.

- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To design security applications in the field of Information technology.

Course Outcomes

At the end of this course, students will be able to:

CO1	Compare various Security Techniques Design Secure applications Inject secure coding in the developed applications.
CO2	Implement basic security algorithms required by any computing system.
CO3	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
CO4	Analyze the possible security attacks in complex real time systems and their effective countermeasures.
CO5	Identify the security issues in the network and resolve it.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Behrouz A. Ferouzan, ―Cryptography & Network Security‖, Tata Mc Graw Hill, 2007.

2.Bruce Schneier and Neils Ferguson, ―Practical Cryptography‖, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.

3.Charles Pfleeger, ―Security in Computing‖, 4th Edition, Prentice Hall of India, 2006.

4.Charlie Kaufman and Radia Perlman, Mike Speciner, ―Network Security, Second Edition, Private Communication in Public World‖, PHI 2002.

Reference Books

1.Douglas R Simson ―Cryptography – Theory and practice‖, First Edition, CRC Press, 1995.

2.Man Young Rhee, ―Internet Security: Cryptographic Principles‖, ―Algorithms and Protocols‖, Wiley Publications, 2003.

Course Content

Unit I:
Services, Mechanisms and attacks-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.
Unit II:
Data Encryption Standard-Block cipher design principles-block cipher modes of operation Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key encryption: Principles of

public key cryptosystems-The RSA algorithm – Key Management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.
Unit III:
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.
Unit IV:
E-mail Security: Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP security policy-Encapsulation Security Payload (ESP)-Combining Security Associations-Internet Key Exchange. Web Security: Web Security Considerations-Secure Socket Layer(SSL)- Transport Layer Security(TLS)- -Secure Electronic Transaction (SET).
Unit V:
Authentication applications – Kerberos – X.509 Authentication services - Firewalls – Types of Firewalls-Firewall design principles- Trusted System. Intruders – Intrusion detection – Viruses and related threats – Virus Countermeasures.
Unit VI: Advances and the Latest Trends 9 Lecture hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Routing and Switching Essentials (CN&CS)				
Course Code	BCSE9008				
Prerequisite					
Co requisite					
Antirequisite					
		L	T	P	C

		2	0	2	3

Course Objectives

Introduces the concept of interconnection of switches in Local Area Network and its configuration and explains the procedure to provide network access to LAN users.

Course **Outcomes**

At the end of this course, students will be able to:

CO1	Plan and effectively manage any LAN network using Switching.
CO2	Deploy and effectively manage the LAN.
CO3	Analyze how a router learns about remote networks and determines the best path to those networks.
CO4	Describe the relationship between router interfaces, directly connected networks and the routing table.
CO5	Categorize various dynamic routing protocols.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Rick Graziani , Allan Johnson, Routing Protocols & Concepts: CCNA Exploration Companion Guide, Pearson Education, Edition 1,2012.
2. Cisco Networking Academy Program :Routing & Switching Essentials Companion Guide, Pearson Education, Edition 1, 2014

Reference Books

1. Behrouz Forouzan , Data Communications and Networking , Tata McGraw-Hill , Edition 5, 2012.
2. Andrews S. Tanenbaum, David J Wetherall , Computer Networks , Pearson Education , Edition 5, 2012.

Course Content

Unit I: Introduction to Switched Networks, Basic Switching Concepts and Configuration
LAN Design, Converged Network, Switched Network, Frames Forwarding, Switching Domains, Basic switch configuration, Switch security, Secure remote access, Security concerns in LAN, Switch port security.
Unit II: VLANs

Overview of VLAN, VLAN Assignment, VLAN Trunks, DTP, VLAN Security and Design.
Unit III: Routing Concepts
Initial configuration of a router, Functions of a router, Routing Decision, Path determination, Router operation.
Unit IV: Inter-VLAN Routing
Inter-VLAN Routing configuration, Troubleshoot Inter-VLAN Routing, Layer 3 Switching.
Unit V: Static Routing
Static Routing, Types of Static Route, Configure Static Route and Default Route, Review of CIDR and VLSM, Configure Summary and Floating Static Route.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Wireless Sensor Networks				
Course Code	CSCN4024				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

Aim of the course is develop in-depth knowledge and understanding of wireless sensor networks.

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the basic knowledge of WSN
CO2	Analysis the various wireless sensor protocols and its uses
CO3	Ability to perform and design the routing protocols in WSN
CO4	Implement embedded operating system to for wireless sensor network.
CO5	Learn the various applications of WSN
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.

2.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books

1.K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349

2.Philip Levis, " TinyOS Programming"

3.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd,

Course Content

Unit I: OVERVIEW OF WIRELESS SENSOR
Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations
Unit II: Medium Access Control Protocols
Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.
Unit III: Routing And Data Gathering Protocols

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB
Unit IV: Embedded Operating Systems
Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM
Unit V: Applications Of WSN
WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Security Threats and Trends**				
Course Code	**CNCS4090**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

This course provides a basic understanding of full-spectrum cyberspace operations, the complexities of the cyberspace environment, as well as planning, organizing, and integrating cyberspace operations.

Course Outcomes

At the end of the course, students will be able to:

CO1	**Understand the fundamental of security threats.**
CO2	**Understand the security risk management**
CO3	**Understand about various security elements**
CO4	**Analyzes various security elements**
CO5	**Understands about real world problems**
CO6	**students would have a broad understanding of the social, economic, and historical context in which Security issues occurs**

Reference Books

1. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.

2. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.

3. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005

4. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.

Course Content

Unit I: Introduction 7 hours
Introduction: Security threats - Sources of security threats- Motives - Target Assets and vulnerabilities – Consequences of threats- E-mail threats - Web-threats - Intruders and Hackers, **Insider threats, Cyber crimes. Network Threats: Active/ Passive – Interference – Interception– Impersonation – Worms –Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels –** **Backdoors – Bots – IP, Spoofing - ARP spoofing - Session Hijacking - Sabotage-Internal treats Environmental threats - Threats to Server security.**
Unit II: Security Threat Management 7 hours
Security Threat Management: Risk Assessment - Forensic Analysis - Security threat correlation – Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools –Threat identification - Threat Analysis - Threat Modeling - Model for Information Security Planning.
Unit III: Security Elements 7 hours
Security Elements: Authorization and Authentication - types, policies and techniques – Security certification - Security monitoring and Auditing - Security Requirements Specifications – Security Policies and Procedures, Firewalls, IDS, Log Files, Honey Pots.
17. Unit IV: Security Models 7 hours
18. Access control, Trusted Computing and multilevel security - Security models, Trusted Systems,Software security issues, Physical and infrastructure security, Human factors – Security awareness,training , Email and Internet use policies.

19. Unit V: Casestudy 7 hours
20. Real Time Security bleaches – Real World Cybers attacks
Unit VI: Advances and the Latest Trends 7 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Cyber Law &Security Policies**				
Course Code	CSCN4022				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

1. To maintain an appropriate level of awareness, knowledge and skill required to minimize the occurrence and severity of incidents related to cyber law Security Policies.
2. To Enable Learner To Understand, Explore, And Acquire A Critical Understanding Cyber Law.
3. Develop Competencies for Dealing with Frauds and Deceptions (Confidence Tricks, Scams) and Other Cyber Crimes
4. Study about various IT Acts

Course Outcomes

At the end of this course, students will be able to:

CO1	To understand the cyberlaw evaluation and trademark
CO2	To understand information technology act and their limitations
CO3	Student will able to understand different cyber law related legislation
CO4	Students have knowledge about different legal issues in electronic business.

CO5	Able to understand effect of cyber crime.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. K.Kumar," Cyber Laws: Intellectual property & E Commerce, Security",1st Edition, Dominant Publisher,2011.

2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.

3. Information Security policy &implementation Issues, NIIT, PHI.

Reference Books

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2nd Edition,PHI,2003.
2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1st Edition,New Delhi, 2003.
3. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004.
4. Augastine, Paul T.," Cyber Crimes And Legal Issues", Crecent Publishing Corporation, 2007.

Course Content

Unit I: Introduction to Cyber Law Evolution of Computer Technology
Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.
Unit II: Information technology Act
Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.
Unit III: Cyber law and related Legislation
Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).
Unit IV: Electronic Business and legal issues
21. Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models-B2B, B2C,E security. Application area:Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.
Unit V: Case Study On Cyber Crimes

Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Fundamentals of Virtualization & Cloud Computing				
Course Code	CSCC2020				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

- To understand the concepts of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

Course Outcomes

At the end of this course, students will be able to:

CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
CO2	Identify the architecture, infrastructure and delivery models of cloud computing.

CO3	Explain the core issues of cloud computing such as security, privacy and interoperability.
CO4	Choose the appropriate technologies, algorithms and approaches for the related issues.
CO5	To be able to set up a private cloud
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

2.John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

3.Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach”, McGraw-Hill Osborne Media, 2009.

Reference Books

1.Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

2.Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner‟s Guide”, McGraw-Hill Osborne Media, 2009.

3. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012. 7. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.

Course Content

Unit I:	**9 Lecture hours**
Evolution of Cloud Computing -System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture -IaaS - On-demand Provisioning - Elasticity in Cloud - Examples of IaaS Providers - PaaS - Examples of PaaS Providers - SaaS - Examples of SaaS Providers - Public , Private and Hybrid Clouds – Google App Engine, Amazon AWS - Cloud Software Environments - Eucalyptus, Open Nebula, Open Stack, Nimbus.	
Unit II:	**9 Lecture hours**
Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization	
Unit III:	**9 Lecture hours**

G Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines –Desktop Virtualization – Application Virtualization – Work with AppV – Mobile OS for smart phones – Mobile Platform Virtualization – Collaborative Applications for Mobile platforms
Unit IV: 9 Lecture hours
Map Reduce Hadoop Distributed File Systems – Hadoop I/O – Developing Map Reduce Applications – Working of Map Reduce – Types and Formats – Setting up Hadoop Cluster
Unit V: 9Lecture hours
Architectural Design of Compute and Storage Clouds - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources - Security Overview – Cloud Security Challenges – Software as a Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security
Unit VI: Advances and the Latest Trends 9 Lecture hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Cloud Organization & Architecture**				
Course Code	**CSCC2020**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

This module gives students the skills and knowledge to understand how Cloud Computing Architecture can enable transformation, business development and agility in an organization.

Course Outcomes

At the end of this course, students will be able to:

CO1	**Analyze the components of cloud computing showing how business agility in an organization can be created**
CO2	**Evaluate the deployment of web services from cloud architecture**
CO3	**Critique the consistency of services deployed from a cloud architecture**
CO4	**Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.**
CO5	**Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications**
CO6	**Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)**

Reference Books

1. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.

3. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 edition [ISBN: 1439834539],2010.

Course Content

Unit I: - CLOUD COMPUTING FUNDAMENTALS
Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.
Unit II: CLOUD APPLICATIONS
Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages

Unit III: MANAGEMENT OF CLOUD SERVICES
Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics : Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)
Unit IV: APPLICATION DEVELOPMENT
Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.
Unit V: CLOUD IT MODEL
Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO)
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Cloud Deployment Model				
Course Code	BCVV3630				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

To learn Public, Private, Hybrid cloud deployment model and different deployment model.

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the Public cloud deployment model,.
CO2	Understand the Private cloud deployment model,
CO3	Understand the hybrid cloud deployment model,
CO4	Understand the process of Maintenance of different cloud deployment model.
CO5	Understand the Data Backup and Recovery Methods
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Cloud Deployment Model by IBM ICE Publication Verison 1.1 2013.

Reference Books

1.Cloud Computing For Dummies (November, 2009), Judith Hurwitz, Robin Bloor, Marcia Kaufman, Dr. Fern Halper

2. Developing and Hosting Applications on the Cloud (July, 2012), Alex Amies, Harm Sluiman, QiangGuo Tong, GuoNing Liu. Cloud Computing http://www.ibm.com/cloud-computing/us/en/

Course Content

Unit I: Introduction
Why Cloud Computing; Evolution of Cloud Computing ; What is Cloud Computing ; Types of Cloud ; Cloud Computing Advantages; Illustration of the benefits of Cloud Computing; Cloud Computing Challenges; Cloud Computing Service Models; Cloud Computing deployment models; Cloud adoption considerations; Cloudadoption–Summary.
Unit II: Private cloud deployment model
Overview of Private cloud deployment model, Illustration of Private Cloud; Advantages and Limitations of private cloud deployment model, Service Management; Journey into private cloud Planning and Strategy, standardization, Virtualization, Automation. Case Study–Vmware vcloud, IBM Smart cloud entry.
Unit III: Public Cloud

Introduction; What is Public Cloud; Illustration of Public Cloud; Why Public Cloud; Advantages of Public Cloud; Limitations of Public Cloud – Low degree of security and control, Lack of control on infrastructure configuration, Network latency and accessibility concerns, highest long term cost; Public Vs Private; Journey into Public Cloud – revisit the idea of adopting public cloud, cloud vendor selection, Migration to cloud; Cloud Vendor Selection - SLA, Credits/Compensation terms, Credit process, disaster recovery plan, exclusions, Security and Privacy, Periodic upgrade and Maintenance, data location and jurisdiction, Pricing and Measurability, Interoperability and lock-in, Exit process
Unit IV: Hybrid Cloud
Introduction; What is a hybrid Cloud; Why hybrid cloud; Illustration of Hybrid cloud; Advantages of Hybrid cloud; Challenges of Hybrid cloud; Develop and manage hybrid work loads–developing applications for hybrid work loads; Develop applications using PaaS–managing hybrid workloads; Journey into hybrid cloud–Assess current IT Infrastructure and business, Explore cloud computing, Create Cloud deployment strategy plan, Hybrid Cloud implementation.
Unit V: Cloud deployment Model
Other cloud deloyment model available-virtual private cloud deloyment model, vertical and special purpose clouds, migration path for cloud adoption, selection criteria for cloud deployment types.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Cloud Storage and Disaster Recovery**				
Course Code	**BCSE9020**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**

		2	**0**	**2**	**3**

Course Objectives

This course provides a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments. The course discusses the concepts and features related to Virtualized datacenter and cloud, Information storage security and design, storage network design and cloud optimized storage.

Course Outcomes

At the end of this course, students will be able to:

CO1	**Critically appraise the opportunities and challenges of information management in complex business environments.**
CO2	**Evaluate information storage management design in a cloud environment and how it relates to the business objectives of an organization.**
CO3	**Analyze the role technology plays in the design of a storage solution in a cloud architecture.**
CO4	**Investigate how a global storage solution can be optimized so that it can be delivered successfully from the cloud.**
CO5	**Analyze how best to provide reliable access to information both locally and remotely using storage technologies.**
CO6	**Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)**

Reference Books

1. Greg Schulz, “Cloud and Virtual Data Storage Networking”, Auerbach Publications [ISBN: 978-1439851739], 2011.

2. Marty Poniatowski, “Foundations of Green IT” Prentice Hall; 1 edition [ISBN: 978-0137043750], 2009.

3. EMC, “Information Storage and Management” Wiley; 2 edition [ISBN: 978- 0470294215],2012.

4. Volker Herminghaus, Albrecht Scriba, “Storage Management in Data Centers” Springer; editioN [ISBN: 978-3540850229]. 2009.

Course Content

Unit I: - VIRTUALIZED DATA CENTER ARCHITECTURE
Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas, Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures.
Unit II: INFORMATION STORAGE SECURITY & DESIGN
Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments. Monitoring and management; security auditing and SIEM.
Unit III: STORAGE NETWORK DESIGN

Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, host system design considerations.
Unit IV: OPTIMIZATION OF CLOUD STORAGE
Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.
Unit V: INFORMATION AVAILABILITY DESIGN
Designing backup/recovery solutions to guarantee data availability in a virtualized environment. Design a replication solution, local remote and advanced. Investigate Replication in NAS and SAN environments. Data archiving solutions; analyzing compliance and archiving design considerations.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Cloud Security & Management				
Course Code	BCSE9030				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	2	0	2	3	

Course Objectives:

This course on cloud security introduces the basic concepts of security systems and cryptographic protocols, which are widely used in the design of cloud security. The issues related multi tenancy operation, virtualized infrastructure security and methods to improve virtualization security are also dealt with in this course.

Course Outcomes

CO1	Understand the security concepts in cloud.

CO2	Describe the Multi-Tenancy issues.
CO3	Differentiate various attacks.
CO4	Use enhanced security techniques.
CO5	Solve compliance issues in cloud security.
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Book (s)

1 Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing 1st Edition, Kindle Edition", Wiley, 2010.

2 Tim Mather, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.

Reference Book (s)

1 John Rittinghouse, James Ransome, "Cloud Computing" CRC Press; 1 edition [ISBN: 1439806802], 2009.

2 J.R. ("Vic") Winkler, "Securing the Cloud" Syngress [ISBN: 1597495921] 2011.

3 Cloud Security Alliance, "Security Guidance for Critical Areas of Focus in Cloud Computing" 2009

4 Vmware "VMware Security Hardening Guide" White Paper, June 2011 .

Course Contents:

Unit I:Introduction	**8 lecture hours**
Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.	
Unit II: Multi-Tenancy Issues	**8 lecture hours**
Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues- e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).	
Unit III:Virtualization System-Specific Attacks	**8 lecture hours**
Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.	
Unit IV:Technologies for Virtualization-Based Security	**8 lecture hours**

IBM security virtual server protection, virtualization-based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention. Location of the Perimeter.
Unit V : Legal and Compliance Issues **8 lecture hours**
Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Container Orchestration & Infrastructure Automation			
Course Code	**CSCC4090**			
Prerequisite	Basic Docker familiarity Basic Linux command line familiarity			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	2	3

Course Objectives

This course will teach you how to use the container management platform used by companies like Google to manage their application infrastructure.

Course Outcomes

At the end of the course, students will be able to:

CO1	**Understands how to work with Kubernetes**
CO2	**Understands the basics of kubernetes architecture**
CO3	**Learns about the basic building blocks of Kubernetes**
CO4	**Understands the application life cycle of kubernetes**

CO5	**Understands about the scheduling mechanism**
CO6	**students would have a broad understanding of the social, economic, and historical context in which Kubernetes works**

Reference Books

1. Kubernetes: A Step by Step Guide to Learn and Master Kubernetes, By Brayden Smith

2. Kubernetes in Action: 1st EditionScreen, By Marko Luksa

3. Kubernetes Patterns: Reusable Elements for Designing Cloud-Native Applications, By Bilgin Ibryam and Rolan Huß

4. Kubernetes: The Complete Guide to Master Kubernetes, By Joesph D. Moore

5. Managing Kubernetes Performance at Scale, By Eva Tuczai and Asena Hertz

Course Content

Unit I: Introduction 7 hours
Setting the grounds, Containerization and Docker, Containers Orchestration, Introduction to Kubernetes, Kubernetes Project, Kubernetes as a Platform, Workload types - Stateless Apps, Stateful Apps
Unit II: Kubernetes Architecture 7 hours
Kubernetes Architecture - Master & Nodes, Components, CLI Tool – Kubectl- Kubeconfig file, Create, Get, Describe, logs, exec, etc.. Kubernetes Dashboard -Installing the Dashboard, Common Operations.
Unit III: Kubernetes Building Blocks 7 hours
Kubernetes Building Blocks – Pod, ReplicaSet, Replication Controller, Deployments, Jobs & CronJobs DaemonSets, Services and Ingress- Different types of Services, Ingress Resource and Controller, Managing configuration – ConfigMaps, Secrets.
Unit IV: Application Life-cycle 7 hours
Application Life-cycle – Liveliness, Readiness, Requests and Limits, Auto-Scaling, Horizontal Pod – Autoscaler, Cluster Auto-scaler, Storage- Persistent Volumes and Claims, Cloud, On-PreStorageClasses Dynamic Provisioning.
Unit V: Stateful applications 7 hours
Stateful applications – StatefulSets, Scheduling - Labels and Annotations, Taints and Tolerations, Affinity, Helm Package Manager, CI/CD with Kubernetes - Optional - if time permits - Common Cloud Offerings and integrations, Jenkins X, Drone.io, Spinnaker, Micro-services & Istio - Optional - if time permits- Micro-services Pains and Challenges, Service Mesh & Istio

Unit VI: Advances and the Latest Trends	**7 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Cloud Management and Tuning				
Course Code	CSCC4002				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	0	2	3

Course Objectives

Cloud provides benefits throughout an organization, offering reduced time to market, which enables a first mover advantage and standardization that provides reduced complexity in the data center. This leads to improved operational efficiencies and offers the client reduced, predictable annual costs. Other benefits were realized in areas, such as self service, service catalog, automatic provisioning and deprovisioning, and capacity flexibility. A cloud provides clients with features, such as disaster recovery, security, and metering, which enable clients to reduce costs, increase standardization, and improve business continuity

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the Performance Tuning.
CO2	Understand the Hardware Performance Tuning.
CO3	Understand the Operating System
CO4	Understand the Hypervisor

CO5	Understand the Database
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Data Storage Backup and Replication: Effective Data Management to Ensure Optimum Performance and Business Continuity by Nitin Kotwal, 2015

Course Content

Unit I: Introduction
Introduction, Elements of Cloud Infrastructure (Hardware, Operating Systems, Hypervisors, Networks, Power Management), Elements of Performance Tuning(Resource Allocation, Resource Monitoring
Unit II: Cloud Hardware
Introduction, Basic Cloud Hardware Setup(CPU Implications, Memory Consideration, Storage Issues,Network Power Setup and Management, Heat Dissipation linked Performance), Zones & LPAR Concepts, Load Balancing, Key Performance Indicators and Metrics, CPU Analysis & Tuning, Clock Frequency, Actual vs Calculated Operations performed per instruction, Branching Penalties, Native vs Adapted Execution.
Unit III: Operating Systems
Overview of Operating Systems, Process Management Techniques, Threads, Multicore Programming,Multithreaded Models, Threading Issues, Implicit Threading, CPU Scheduling (Scheduling Criteria, Multiple Processor Scheduling, Real-Time Scheduling), Memory Management, Main Memory Management, Virtual Memory Management, Storage Management(File Systems, Bulk Storage Systems), I/O Sub-Systems (I/O Application Interface, Kernel I/O Sub-System, Converting I/O Request .
Unit IV: Hypervisor
Hypervisor Basics, Understanding Virtualization, Understanding Virtual Machines, Hypervisor,Architecture, Managing a Hypervisor Setup, Managing CPUs for a Virtual Machine, Managing Memory for a Virtual Machine, Managing Storage for a Virtual Machine, Managing Network for a Virtual Machine, Creating a Virtual Machine, Loading Windows in a Virtual Environment, Loading Linux in a Virtual Environment, Copying a Virtual Machine, Managing Additional Devices in a Virtual Machine, Applications in a Virtual Machine.
Unit V: RDBMS concepts
Introduction, RDBMS concepts, types of workload, DB2 Universal Database, Oracle databases,Fundamental Parameters, Sizing a Database system, Designing RDBMS servers, Monitoring an RDBMS system for performance, Tuning an RDBMS system, Code Optimization. Introduction, Code Analysis, Code Optimization, Caching Strategies, Bottleneck Analysis
Unit VI: Advances and the Latest Trends **9 Lecture hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	Backup Disaster & Recovery				
Course Code	BCVV4750				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives

- The drivers behind a DR Plan.
- Disaster Recovery Fundamentals.
- Risk analysis for Small Business & NFP
- Steps to build a robust DR Plan .

Course Outcomes

At the end of this course, students will be able to:

CO1	Understand the introduction to Backup disaster
CO2	Understand the High Availability
CO3	Understand the Disaster Recovery
CO4	Understand the Disaster Recovery Planning
CO5	Understand the Data Backup and Recovery Methods
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1.Data Storage Backup and Replication: Effective Data Management to Ensure Optimum Performance and Business Continuity by Nitin Kotwal, 2015

2.High Availability and Disaster Recovery: Concepts, Design, Implementation by Klaus Schmidt, 2010

Course Content

Unit I: Data storage and backup
Fundamental of Data storage and backup – understanding availability requirements, Recovery point objective(RPO), Recovery Time Objective(RTO), Backup Mechanism in Virtualized and Non Virtualized Environment.
Unit II: High Availability
Overview of High Availability, Definition, Level of High Availability (Hardware, RAID level) Clustering, Mirroring, Hypervisor, OS, Application, Cost Versus value analysis while deciding the availability requirement.
Unit III: Disaster Recovery
Overview of Disaster Recovery, Definition, Technologies and constrains, various types of Disaster Recoveries – Local & Remote.
Unit IV: Disaster Recovery Planning
Introduction, Disaster Recovery Planning Tools, Disaster Recovery planning web sites, Data Backup solution tools, server backup solution tools, Online Backup tools, Case Study.
Unit V: Data Backup and Recovery Methods
Introduction, Binary Versus Textual Backups, Making Binary Backups, Making Text Backups, Backing Up Log and Status Files, Replication as an Aid to Backup, MySQL Cluster as Disaster Prevention, Data Recovery.
Unit VI: Advances and the Latest Trends **9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

GALGOTIAS UNIVERSITY
(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

School of Computing Science and Engineering

Program: BCA

Scheme: 2020 – 2024

Vision

To be known globally as a premier department of Computer Science and Engineering for value-based education, multidisciplinary research and innovation.

Mission

MD1: Create a strong foundation in fundamentals of Computing Science and Engineering through Outcome based Teaching.

MD2: Establish state-of-the art facilities for Analysis, Design and Implementation to solve real world problems.

MD3: Conduct trans-disciplinary research for developing innovative solutions.

MD4: Involve the aspirants in group activities including professional bodies to develop leadership and communication skills.

Program Educational Objectives

PEO1: Graduates of Computer Science and Engineering will be globally competent and provide sustainable solutions for interdisciplinary problems as team players.

PEO2: Graduates of Computer Science and Engineering will engage in professional activities with ethical practices in the field of Computer Science and Engineering to enhance their own stature to contribute towards society.

PEO3: Graduates of Computer Science and Engineering will acquire specialized knowledge in emerging technologies for research, innovation and product development.

Program Specific Objectives

PSO1: Students are trained to perform tasks related to conversion of mechanical system to automatic system, integrating mechanical system to IoT and cloud based technologies.

PSO2: Students are practiced to use augmented reality / virtual reality along with different CAE tools for rapid prototyping and additive manufacturing.

Program Outcomes

1. **Engineering Knowledge** : Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems.
2. **Problem analysis** : Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

3. **Design/development of solutions** : Design of solutions for complex engineering problems and design of system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems** : Use research based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions.
5. **Modern tool usage** : Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling complex engineering activities with an understanding of limitations.
6. **The engineer and society: Apply** reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability** : Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.
8. **Ethics :**Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and team work :**Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication :**Communicate effectively on complex engineering activities with the engineering community and with society at large such give and receive clear instructions.
11. **Project management and finance :**Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments.
12. **Life-long Learning :**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Curriculum

Semester 1									
Sl. No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCAC1101	Discrete Mathematics	3	0	0	3	20	50	100
2	BCAC1102	Fundamentals of Digital Computers	3	0	0	3	20	50	100
3	BCAC1103	Introduction to Information Technology	3	0	0	3	20	50	100
4	BCAC1104	Programming Essentials in C	3	0	0	3	20	50	100
5	SLBC1001	Basic English	0	0	4	2	70		30
6	BCAC1114	Programming Essentials in C Lab	0	0	2	1	70		30
7	BCAC1113	Information Technology Lab	0	0	2	1	70		30
		Total	**12**	**0**	**8**	**16**			

Semester II									
Sl. No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	ENVS1001	Environmental Science	3	0	0	3	20	50	100
2	SLBC1002	Professional Communication	0	0	4	2	70		30
3	BCAC1211	Data Structures using C	3	0	0	3	20	50	100
4	BCAC1203	Web Technology	3	0	0	3	20	30	50
5	BCAC1204	Enterprise Resource Planning	3	0	0	3	20	50	100
6	BCAC1205	Numerical Methods	3	0	0	3	20	50	100
7	BCAC1202	Python Programming	3	0	0	3	20	50	100
8	BCA9004	Disruptive Technologies	2	0	0	2	20	50	100
9	BCAC1201	Data Structures using C Lab	0	0	2	1	70		30
10	BCAC1213	Web Technology Lab	0	0	2	1	70		30
11	BCAC1212	Python Programming Lab	0	0	2	1	70		30
		Total	**20**	**0**	**10**	**25**			

Semester III									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCAS2001	Computer Architecture	3	0	0	3	20	50	100
2	BCAS2002	Database Management System	3	0	0	3	20	50	100
3	BCAS2003	JAVA Programming	3	0	0	3	20	50	100
4	BCAS2004	Introduction to Algorithm Analysis and Design	3	0	0	3	20	50	100
5	LLL223	Logical Skill Building	0	0	4	2	70		30
6	BCAS2036	Cryptographic Fundamentals	3	0	0	3	20	50	100
7	BCAS2007	Computer Networking	3	0	0	3	20	50	100
8	BCAS2008	Computer Networking Lab	0	0	2	1	70		50
9	BCAS2009	Java Programming Lab	0	0	2	1	70		30
10	BCAS2010	Database Management System Lab	0	0	2	1	70		30
		Total	**18**	**0**	**10**	**23**			

Semester IV									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	LLL245	Campus-to-Corporate	0	0	4	2	70		30
2	BCAS2015	Operating System	3	0	0	3	20	50	100
3	BCAS2016	Software Engineering	3	0	0	3	20	50	100
4	BCAS2025	.Net Technology	3	0	0	3	20	30	50
5	BCAS2021	Linux Administration	3	0	0	3	20	50	100
6	BCAS2013	Graph Theory	3	0	0	3	20	50	100
7		Elective-I	3	0	0	3	20	50	100
8	BCAS2026	.Net Technology Lab	0	0	2	1	70		30
9	BCAS2022	Linux Administration Lab	0	0	2	1	70		30
10	BCA9003	iOS, Android App Development Lab	0	0	2	1	70		30
11		Elective-I Lab	0	0	2	1	70		30
		Total	**18**	**0**	**8**	**24**			

Semester V									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCAS3066	Big Data Computing	3	0	0	3	20	50	100
2	BCAS3003	Computer Graphics	3	0	0	3	20	50	100
3	BCAS3004	E-Commerce	3	0	0	3	20	50	100
4	BCAS3006	Software Project Management	3	0	0	3	20	50	100
5		Elective-II	3	0	0	3	20	50	100
6	BCAS3005	Computer Graphics Lab	0	0	2	1	70		30
7		Elective II lab	0	0	2	1	70		30
8	BCAS9998	Project-I	0	0	8	4	70		30
		Total	**15**	**0**	**12**	**21**			

Semester VI									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCAS9999	Project Work-2	0	3	30	15	70		30
		Total	**23**	**0**	**4**	**25**			

List of Electives

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
		Elective-I(Any one)							
1	BCAS2028	Advance DBMS	3	0	0	2	20	50	100
2	BCAS2029	Advance DBMS Lab	3	0	0	2	70		30
3	BCA9001	PE-1 - AI & ML	3	0	0	2	20	50	100
4	BCA9002	PE-1- AI & ML using Python Lab	0	0	2	1	70		30
		Elective -II (Any one)	L	T	P	C			
1	BCAS3008	Multimedia System	3	0	0	3	20	50	100
2	BCAS3009	Multimedia System Lab	0	0	2	1	70		30
3	BCAS3010	Network Security	3	0	0	3	20	50	100
4	BCAS3011	Network Security Lab	0	0	2	1	70		30
5	BCAS3012	Search Engine Optimisation	3	0	0	3			
6	BCAS3013	Search Engine Optimisation Lab	0	0	2	1	70		30

Name of The Course	Discrete Mathematics	L	T	P	C
Course Code	BCAC1101	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

This course provides elementary mathematical knowledge and problem solving techniques.This course studies the mathematical elements of computer science including propositional logic, predicate logic, combinatorics, mathematical induction, recurrence relation, graphs, and Boolean algebra. At the end of this course student should be able to understand the concepts and skills of basic operations in discrete mathematics.

Course Outcomes

CO1	Explain at high levels concepts and implement basic operations in discrete mathematics.
CO2	Perform combinatorial analysis to solve counting problems.
CO3	Develop mathematical models from computation theory to programming languages through combinatorics.
CO4	Use mathematical reasoning to comprehend and construct mathematical arguments, graphs.
CO5	Develop techniques for counting, permutations and combinations.

Text Book (s)

1. Seymour lipschutz, Marc Lars Lipson, Theory and Problems of Discrete Mathematics Third Edition, Schaum's Outline Series McGRAW-HILL.
2. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, PHI
3. Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill

Reference Book (s)

1. Swapan Kumar Sarkar, A Textbook of Discrete Mathematics, S.Chand Publication
2. Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Application to Computer Science, McGraw-Hill
3. J.L. Mott, A. Kandelad T.P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, PHI, 2nd Edition, 1999.
4. Liu and Mohapatra, "Elements of Distcrete Mathematics", McGraw Hill

Unit-1	MATHEMATICAL LOGIC	6 hours
Introduction, Propositions, Connectives, Truth tables, Tautologies and Contradictions, Equivalences implications, Normal forms, Methods of proof rules of inference for quantified propositions, Mathematical induction.		
Unit-2	COMBINATORICS	8 hours
Basics of counting, Combinations of permutations, Enumeration of combination and permutation, Pigeonhole principle, Inclusion, Exclusion principle, Ordered and unordered portions.		
Unit-3	RECURRENCE RELATIONS	8 hours
Generating function of sequences, Calculating coefficients of generating functions, Recurrence relations, solving recurrence relations by substitutious and generating functions, Method of characteristic roots, Solution of homogenous recurrence relations		
Unit-4	GRAPH THEORY	8 hours
Basic concepts of graph theory, Diagraph, Paths, Reachability connectedness, Matrix representation of graphs, Subgraphs, Isomorphisms trees, Properties, Directed tress, Binary trees.		
Unit-5	BOOLEAN ALGEBRA	6 hours
Post, Hasse diagrams, Lattices, Types of Lattices, Boolean Algebra, Basic theorems, Applications.		
Unit-6	**Advancement & Research**	4 hours
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	Fundamentals of Digital Computers	L	T	P	C
Course Code	BCAC1102	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

The purpose of this course is to provide digital computer fundamentals. The main goal of the course is to introduce students to the number system conversion from one base to another, to solve equations using Karnaugh map and Tabulation method, design circuits for binary adder, code converter, multiplexer, arithmetic circuits and accumulator.

Course Outcomes

CO1	Develop an understanding of the number system
CO2	**Design the logic gates And solve K-maps Problems.**
CO3	**Understand the logics of Adder, Multiplexer and encoder-decoder.**
CO4	**Understand the Flip-flops and application of flip-flops**
CO5	**Understand Registers and Memory classification.**

Text Book (s)

M. Morris Mano – Digital Logic and Computer Design, 3rd Ed, PHI – 1994.

Reference Book (s)

A.P. Malvino and D.P. Leach – Digital Principles and Applications – Fourth Edition – Tata McGraw Hill Edition – 1999.

Unit-1	**Introduction**	**8 hours**
Introduction – Converting Numbers from One Base to Another – Complements – Binary Codes – Integrated Circuits – Boolean Algebra – Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms		
Unit-2	**Logic Gates**	**8 hours**
Logic Gates – Karnaugh Map Up to 3 Variables – Don't Care Condition – Sum of Products and Products of Sum Simplification		
Unit-3	**Adder – Subtractor**	**8 hours**
Adder – Subtractor – Code Converter – Multilevel NAND and NOR Circuits – Binary Parallel Adder – Decimal Adder – Binary Multiplier-Binary Divider-Decoders – Encoder – Multiplexers-Demultiplexer.		
Unit-4	**Flip Flops**	**8 hours**
Flip Flops – Triggering of Flip Flops – Design of Counters –Ripple Counters.		
Unit-5	**Registers**	**8 hours**
Registers – Shift Registers –Memory Devices – Introduction,Classificationof Memories ,Basic Memory Structure ,RAM,ROM,PLA.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Introduction to Information Technology**	**L**	**T**	**P**	**C**
Course Code	**BCAC1103**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Provide information about the various computer tools available.**
2. **Enable the students understand the role of information technology in various fields.**

Course Outcomes

CO1	**Understand the basics of Information System and GPS**
CO2	**Understand about Computer System, CPU, Microprocessor and I/O.**
CO3	**Learn about the I/O Devices and storage Media.**
CO4	**Understand about the Software, word processing, spreadsheets and database Application.**
CO5	**Understand the Network Application, Tools of multimedia.**

Text Book (s)

1. D.P. Curtin, K. Foley, K. Sen and C. Morin, Information Technology – The Breaking Wave, TMH Edition – 1999.

Reference Book (s)

1. Sawyer, Williams and Hutchinson, Using Information Technology – Brief Version, McGraw Hill International Edition – 2003.
2. Fundamentals of Information Technology, Alexis Leon & Mathews Leon–Vikas Publishing House Pvt. Ltd. – 1999.

Unit-1	**Introduction**	**6 hours**
IT an Introduction – Information Systems – Software and Data – IT in Business, Industry, Home, at Play, Education, Training, Entertainment, Arts, Science, Engineering and Maths – Computers in Hiding – Global Positioning System (GPS).		
Unit-2	**Technology**	**8 hours**
Types of Computers – Anatomy of a Computer – Foundations of Modern Information Technology – The Central Processing Unit – How		

Microprocessors and Memory Chips are Made – Memory – Buses for Input and Output – Communication With Peripherals.		
Unit-3	**Devices**	**8 hours**
I/O Devices – Inputting Text and Graphics – State of the Art – Input and Output – Pointing Devices – Foundations of Modern Output – Display Screens – Printers – Foundations of Modern Storage – Storage Media – Increasing Data Storage Capacity – Backing up your Data – The Smart Card.		
Unit-4	**Interfaces**	**8 hours**
Software – User Interfaces – Application Programs – Operating Systems – Document – Centric Computing – Major Software Issues – Network Computing – Word Processing and Desktop Publishing – Spreadsheet and Database Applications.		
Unit-5	**Networks**	**8 hours**
Network Applications – Foundation of Modem Networks – Local Area Networks – Wide Area Networks – Links Between Networks – Networks: Dial–up Access – High Bandwidth Personal Connections – Multimedia – Tools of Multimedia – Delivering Multimedia – Multimedia on Web.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Programming Essentials in C**	**L**	**T**	**P**	**C**
Course Code	**BCAC1104**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Introduce the students to the concepts of C programming with emphasis on the following topics Functions, Arrays, Pointers, Structures, Files.**
2. **Solve problems using the above concepts.**

Course Outcomes

CO1	**Understand the working and architecture of 'C'**
CO2	**Understand when and how to take decisions, to compare and iterate, to simplify the problems.**
CO3	**Students should be able to implement syntax and logics for development according to user account, implement algorithmic solutions in a programming language.**
CO4	Solve problems of limited scope by writing programs using the concepts taught.
CO5	**To allow the student to write their own programs using standard language infrastructure regardless of the hardware or software platform.**

Text Books

1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004.

Reference Books

1. **E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999**

Unit-1	**Introduction**	**8 hours**
Identifiers - Keywords- Data Types - Access Modifiers - Data Type Conversions - Operators - Conditional Controls - Loop Controls- Input / Output Operations - Character Test Functions		
Unit-2	**Arrays**	**8 hours**
Arrays - One Dimensional Arrays - Two Dimensional Arrays - Multi Dimensional Arrays - Handling of Character Strings - String - Handling Functions - Table of Strings - enum - Typedef.		
Unit-3	**Functions**	**8 hours**
User Defined Functions - Need for User Defined Functions - Category of Functions - Nesting of Functions - Recursion - Functions with Arrays - Storage Classes - Macros and Preprocessors.		
Unit-4	**Structures**	**8 hours**
Structures - Array of Structures - Arrays within Structures - Structures within Structures - Structures and Functions - Unions - Size of Structures.		
Unit-5	**Pointers**	**8 hours**
Pointers - Pointer Variables - Passing Pointers to Functions - Pointers and One Dimensional Array - Dynamic Memory Allocation - Pointers and Multi Dimensional Arrays - Arrays of Pointers - Pointers to Structures – Data files - Opening and Closing a		

Data file - Creating a Data file - Processing a Data file - Unformated Data file.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Basic English**	**L**	**T**	**P**	**C**
Course Code	**SLBC1001**	**0**	**0**	**4**	**2**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**	**0**	**30**	**100**

Course Objectives:

1. To expose students to communication challenges (verbal as well as non-verbal) in the professional environment
2. To define & interpret verbal and non-verbal messages
3. To express and present themselves effectively in business situations

To familiarize students with contemporary writing practices in the business environment

Course Outcomes

CO1	**To understand importance & various concepts of effective business communication**
CO2	**To enable students to understand significance and interpretation of Nonverbal communication**
CO3	**To understand & execute the concept, principles and various situations in Group Discussion & how to handle them.**
CO4	**To prepare the students for job interviews.**
CO5	**To familiarize students with contemporary writing practices in the business environment**

Text Book (s)

Meenakshi Raman, Prakash Singh, Business Communication, Oxford University Press

Reference Book (s)

Unit-1	**Professional Communication**	**8 hours**
Purpose, Process & Classification of Communication Barriers of Communication **7Cs of Communication**		
Unit-2	**Non-Verbal Communication**	**8 hours**
Role of Non-Verbal Communication Classification of Non-Verbal Communication Guidelines for developing Non-Verbal Communication		
Unit-3	**Written Communication**	**8 hours**
Structure & Layout of Business letters **Type of Letters: Sales, Order, Complaint, Enquiry, Memo, Circular, Notice, etc.**		
Unit-4	**Spoken**	**8 hours**
Introduction to Pronunciation **Group Discussion, Mock Interviews**		
Unit-5	**Practical**	**8 hours**
Exercises		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Programming Essentials in C Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAC1114**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiments:

1. Write a program to convert temperature from degree centigrade to Fahrenheit. °F = °C*9/5+32
2. Write a program to compute the addition, subtraction, product, quotient and remainder of two given numbers.

3. Write a program to swap the values of two variables.
4. Write a program to compute net amount from the given quantity purchased and rate per quantity. Discount of 10 .is allowed if quantity purchased exceeds 100.
5. Write a program to print the sum of digit of a given number.
6. Write program to print the Fibonacci series up to a given number.
7. Write a program to print the prime numbers within a given number.
8. Write a program to check a given number is prime or not.
9. Write a program to check whether a no is an Armstrong number.
10. Write a program to determine and print the sum of the following harmonic series for a given value of n1 +1/2+1/3+1/4+……+1/n
11. Write a program to print the Floyds triangle

    1
    3
    5 6
12. Write a program to read three integer values from the keyboard and display the output stating that they are the sides of right angled triangle.
13. Write a program to accept an year from the user and check whether the entered year is a leap year or not.
14. Write a program to print binary equivalent of an integer number.
15. Write a program to print the following pattern (take number of lines as input from the user).

    ***
    **
    *
16. Write a program to evaluate the following functions to

    Sin(x) = x - x3/3!+ x5/5!-…… & Cos(x) = x – x2/2!+ x4/4!-x6/6!+……
17. Write a program to _nd out the length of a given string without using the library function strlen().
18. Write a program to print the reverse of a given string.
19. Write a program to check if a given string is palindrome or not. A string is said to be palindrome if the reverse of the string is equal to the string.
20. Write a program to count the number of vowels in a given string.
21. Write a program for addition of two nxm matrices
22. Write a program for multiplication of two nxm matrics
23. Write a program to compute factorial of a given number using function.
24. Write a function for swapping of two numbers.
25. Write a program for finding factorial of a number using recursion.
26. Write a program to sort an array using Bubble Sort (using function).
27. Write a program to search a key number in an array using Sequential Search Method.(use function)
28. Write a program to accept student details (name,roll, address,phone no)and store them in a _le and perform the following operations on it.
    a. Search b. Add c. Delete d. Modify e. Display.

Name of The Course	**Information Technology Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAC1113**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

	Title of Lab Experiments
1.	Write a procedure to create a resume.
2.	Write a procedure to create a cover page of a project report.
3.	Write a procedure to create a greeting card.
4	Write a procedure to create company letter head.
5	Write a procedure to create simple newsletter.
6.	Write a procedure to create a mail merge letter.
7.	Write a procedure to create a macro and use it in an application.
8.	Write a procedure to create a presentation on basic DOS commands given below: a. Dir b. Md c. Cd d. Copy e. Del f. Copy

9	Write a procedure to create presentation and add audio to it.
10.	Write a procedure to create a worksheet with 4 columns, enter 10 records and find the sum of all columns
11.	Write a procedure to create a report containing the pay details of the employee.
12.	Write a procedure to create a student result sheet.
13.	Write a procedure to create a simple bar chart to represent the sales of a company for 3 different periods
14.	Write a procedure to create a worksheet importing data from database and calculate sum of all the columns
15.	Write a procedure to create a simple table for result processing.
16.	Write a procedure to create a query table for the result processing table.
17.	Write a procedure to create a form to update/modify the result processing table.
18.	Write a procedure to create a report to print the result sheet and marks card for the result.

Name of The Course	**Environmental Science**	**L**	**T**	**P**	**C**
Course Code	**ENVS1001**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Introduce the fundamentals and abstract concepts of environment studies.**
2. **Learn how concepts of social issues and the environment studies are useful in realistic problem solving.**

Course Outcomes

CO1	**Students will understand the need for eco-balance**
CO2	**Also, Knowledge on the method of pollution prevention**
CO3	**Understand the knowledge of Environmental Pollution**
CO4	**Demonstrate Social Issues and the Environment**
CO5	**Students able to understand Human Population and the Environment**

Text Books

1. **Kurian Joseph & R. Nagendran, "Essentials of Environmental Studies", 1st Edition , Pearson Education, 2004.**

Reference Books

1. Keerthinarayana & Daniel Yesudian,"Environmental Science and Engineering",1st Edition, Hi-Tech publications, 2004.
2. Erach Bharucha, "A Text Book for Environmental Studies", Text Book of University Grants Commission, 2004.
3.Metcalf & Eddy,"Wastewater Engineering: Treatment and Reuse", New Delhi, TMH

Unit-1	**Environment & Natural Resources**	**6 hours**
Definition, scope, importance, need for public, Natural Resources – forest resources – use, exploitation, deforestation, construction of multipurpose dams – effect on forests, Water resources – use of surface and subsurface water; effect of floods, drought, water conflicts, food resources – food problems, advantage and disadvantage of fertilizers & pesticides, effect on environment, Energy resources – need to develop renewable energy, land resources – Land degradation, landslides, soil erosion, desertification & case studies.		
Unit-2	**Ecology & Bio-Diversity**	**8 hours**
Concept of ecosystem, structure & function of an ecosystem, producers, consumers and decomposers, energy flow, ecological succession, food chains, food webs and ecological pyramids. Bio diversity: Definition, genetic, species and ecosystem diversity, bio-geographical classification of India, hotspots, threats related to habitat loss, poaching of wildlife, man-wildlife conflicts, Conservation of bio-diversity.		
Unit-3	**Environmental Pollution**	**8 hours**
Definition – Causes, pollution effects and control measures of Air, Water, Soil, Marine, Noise, Thermal, Nuclear hazards. Solid `waste management: causes, effects and control measures of urban and industrial wastes, pollution measures, case studies, Disaster management: floods, earthquake, cyclone and landslides.		
Unit-4	**Social Issues and the Environment**	**8 hours**
Urban problems related to energy & sustainable development, water conservation, rain water harvesting, watershed management, problems		

related to rehabilitation – case studies, Wasteland reclamation, Consumerism and waste products - Environment Protection Act, Air, Water, Wildlife, Forest Conservation Act, Environmental legislation and public awareness.		
Unit-5	**Human Population and the Environment**	**6 hours**
Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/ AIDS, Women and Child Welfare, Role of Information Technology – Visit to local polluted site / Case Studies.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Professional Communication**	**L**	**T**	**P**	**C**
Course Code	**SLBC1002**	**0**	**0**	**4**	**2**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

Course Objectives:

1. **Make students understand that both oral & written communications are equally important.**
2. **The students should be comfortable with both verbal & written communication.**

Course Outcomes

CO1	**Students understand the value of business communication, written & presentation skills in professional life.**
CO2	**Students should be well equipped with business & written communication with effective presentation skills.**
CO3	**Students understand the Forms of Technical Communication**
CO4	**Students able to understand presentation strategies**
CO5	**Understand the fundamentals of human relations**

Text Books

1 Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi .
2 Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press 2007, New Delhi.

Reference Books

1 Effective Technical Communication by Barun K. Mitra, Oxford Univ. Press, 2006, New Delhi.
2 Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
3 How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London.
4 Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors; Delhi.
5 Developing Communication Skills by Krishna Mohan, Meera Banerji- Macmillan India Ltd. Delhi.
6 Manual of Practical Communication by L.U.B. Pandey & R.P. Singh; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, Delhi.

Unit-1	**Basics of Technical Communication**	**6 hours**
Technical Communication: features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Importance of technical communication; Barriers to Communication		
Unit-2	**Constituents of Technical Written Communication**	**8 hours**
Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods -Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.		
Unit-3	**Forms of Technical Communication**	**8 hours**
Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Job application and Resumes. Official Letters: D.O. Letters; Govt. Letters, Letters to Authorities etc. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Technical Paper, Project. Dissertation and Thesis Writing: Features, Methods & Writing.		

Unit-4	Presentation Strategies	8 hours
Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time-Dimension		
Unit-5	**Fundamentals of Human Relations**	**6 hours**
Intra-personal, Interpersonal and Group Relationships, Transactional Analysis Implications for Managers in Organizational Context. Formal Written Communication: Official Letters, Report, Writing: Categories Formats, Memorandums and Circulars, Agenda and Minutes, Resume, Drafting Advertisements. Enquires and Replies, Quotations, Voluntary Offers, Placing of Order, Cancellation of Order, Complains and Adjustments. Formal Verbal Communication: Group Discussion, Interview, Extempore, Business Negotiation, Public Speaking, Meeting, Toasting, Counselling, Business Presentation. Negotional Skills. Social Skills for Managers: Update of Etiquettes a Manager should observe in Various Formal and Informal Situations; The Knowledge of Body Language.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	Data Structures using C	L	T	P	C
Course Code	BCAC1211	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

1. **Introduce the fundamentals and abstract concepts of Data Structures.**
2. **Introduce searching, sorting techniques**
3. **Learn how concepts of data structures are useful in problem solving.**

Course Outcomes

CO1	**Understand the Basic concepts of Data Structures.**
CO2	**Understanding various searching & sorting techniques.**
CO3	**Analyze step by step and develop algorithms for Linked List to solve real world problems.**
CO4	**Applying various data Structures like Stacks, Queues in real world problems.**
CO5	**Implement and developed new program for graphs and trees using C.**

Text Books

1. Data Structures : By Seymour Lipschutz, Tata Mcgraw- Hill Publication.
2. Data Structure and algorithm using C :By R.S.Salaria-Khanna Publication.
3. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication

Reference Books

3. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data StructuresUsing C and C++" , PHI
4. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill
5. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
6. Lipschutz, "Data Structures" Schaum's Outline Series, TMH
7. G A V Pai, "Data Structures and Algorithms", TMH

Unit-1	Introduction to Data Structure	6 hours
Introduction, Basic Terminology : Data and information, ADT, Data Organization and types of Data Structure.		
Unit-2	**Arrays**	**8 hours**
Representation of Linear Arrays, Types of Arrays : 1D,2D & M-D Concept, Sorting & Searching Algorithms-Bubble, Selection, Merge, Quick sort, linear and binary search. Type of Memory Allocations		
Unit-3	**Linked List**	**8 hours**
Concept of Linked List, Representation of linked List in memory, Memory Allocation, Garbage Collection ,Overflow and Underflow, Traversing a linked list, Searching a linked list, Insertion & Deletion in Linked List, More types of linked list: Header Linked List , Two way List and Circular linked list		
Unit-4	**Stacks, Queues , Recursion**	**8 hours**
Concepts of Stack, Operation on Stack, Array Representation of Stack, Arithmetic Expression		

POLISH Notation, Concepts of Queue, Operation on Queue, Representation of queues, Other types of queue: Priority Queues, Deque and Circular queue. Recursion : factorial number, Fibonacci series and Tower of Honai		
Unit-5	**Introduction of Trees and Graph**	**6 hours**
Introduction of Trees – Binary Trees –Binary Search Trees. Types of Graph		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Web Technology**	**L**	**T**	**P**	**C**
Course Code	**BCAC1203**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**30**	**50**	**100**

Course Objectives:

This course is intended to provide students with the knowledge and skills necessary for building and evaluating web sites. It covers a range of topics including: basic concepts of the Internet and internet browsers, fundamentals of Website design, Websites building tools and languages, basics of HTML (text, fonts, colors, images, lists, tables, frames, forms), Scripting and Scripting Languages (VB Script, Java Script), Website publishing, Website evaluation and assessment, case studies.

Course Outcomes

CO1	**The student will gain programming skills both in basic and advanced levels using HTML and CSS.**
CO2	Demonstrate the knowledge and able to apply the design principles, techniques and technologies to the development of creative websites using JS and HTML
CO3	Apply different syntactical elements of vbscript
CO4	The student will be able to create ASP based web applications
CO5	Understand database connectivity procedures for web applications

Text Books

Web Design: A Complete Introduction by Nigel Chapman and Jenny Chapman. John Wiley & Sons

Reference Books

HTML 4.0, No Experience required – E. Stephen Macj, J. Platt (bpb)

Completer Reference HTML - Thomas A. Powell (TMH)

Dynamic HTML in action - Michele Petrovisjy (TMH)

Unleashed HTML - (Techmedia SAMS)

Unit-1	**Introduction and HTML**	**6 hours**
Basic web designing: Introduction to web browser, architecture of web browser, web page, static & dynamic web pages, home page, web-site, Web-servers & clients, www. Introduction to HTML: History, structure of HTML document, creating & executing HTML. Tags of HTML, Creating Lists & Links, Creating Bookmarks, Image tags, Tables and Frames tags. Forms and CSS: Understanding Form, <FORM> tag, creating text boxes, buttons, checkboxes, radio buttons, hidden control, password, lists & dropdown list, textarea. Submitting a form, get & post method. Creating CSS, applying CSS to HTML documents. Use of <META> Tag.		
Unit-2	**JavaScript**	**8 hours**
JavaScript: Introduction: Scripting Language, The Use of JavaScript, Using Javascript in an HTML document, <SCRIPT> Tag. Overview of Javascript Programming: Variable, Scope of variables, number & string, Operators Statements: if-else, for, while, break, continue, for-in, new, return. Arrays, JavaScript Functions & Objects, Document Object Model (DOM), Hierarchy of objects. Properties & Methods of Objects, Event Handling & Form Validation.		
Unit-3	**VBScript**	**8 hours**
Introduction, VBScript Statements and loops, Arrays, VBScript objects, VBScript layout statements, error handling, adding objects, Forms, Controls & managing transactions, VBScript event programming, Procedures & Functions		
Unit-4	**ASP**	**8 hours**
Introduction, Variables, Data types of ASP, Statements, Request & Response Objects: Response Object - buffering page, page caching, Request Object – QueryString collection, form collection, server-variables collection, working with HTML forms, retrieving form data suing text		

boxes, textareas, buttons, checkboxes, select lists. Form validation, Session & Application Object.		
Unit-5	**Database and File system**	**6 hours**
ASP with Databases: Connection and data sources, creating connections with OLEDB and ODBC, connecting to SQL server with OLEDB and ODBC, connection to MS-Access, Executing SQL statements. Working with Record set, File System Object(FSO), Folder object		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Enterprise Resource Planning**	**L**	**T**	**P**	**C**
Course Code	**BCAC1204**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

- Know basic business functional areas and explains how they are related.
- Illustrate how un-integrated information systems fail to support business decision and how integrated information systems can help a company prosper by providing business managers with accurate, consistent, and current data.
- Understand how Enterprise Resource Planning software is used to optimize business processes acquire experience in using ERP software that can be applied in further coursework

Course Outcomes

CO1	**Understand the basic concepts of ERP.**
CO2	**Understand the enterprise modelling and related concepts**
CO3	**Identify different technologies used in ERP.**
CO4	**Understand and apply the concepts of ERP implementation and Perspective and ERP** Modules.
CO5	**Understand different tools/technologies used in ERP.**

Text Books

Enterprise Resource Planning, Alexis Leon, Tata McGraw-Hill.

Concepts in Enterprise Resource Planning, Third Edition Bret Wagner & Ellen Monk

Reference Books

Concepts in Enterprise Resource Planning, Joseph A. Brady, Ellen F. Monk, Bret J. Wagner.

Enterprise Resource Planning Systems, Daniel E. O'Leary, Cambridge University Press.

Unit-1	**ERP: An Overview**	**6 hours**
Introduction to ERP, Reasons for Growth Of ERP, Problem areas in ERP implementations, The future of ERP, Characteristics and features of ERP, Benefits of ERP.		
Unit-2	**Enterprise Modelling and Integration for ERP**	**8 hours**
Enterprise-An overview, What is enterprise , Integrated Management Information, The role of enterprise, Business modelling, Integrated Data Model, Role of Common/Shared Enterprise Database, Establishing Customer-Enterprise Link, Establishing Vendor-Enterprise Link, Client/Server Architecture and Enterprise wide Computing, Characteristics of client/Server Architecture, Different Components of ERP Client/Server Architecture		
Unit-3	**ERP And related Technologies**	**8 hours**
BPR(Business Process reengineering) :Definition, The different phases of BPR, Enterprise Redesign Principles, BPR and IT, Data Warehousing, Data Warehouse Components, Structure and Uses of Data Warehouse, Data Mining, What Is Data Mining, Data Mining Process, Advantages and Technologies Used In Data Mining, OLAP, Supply Chain Management: Definition, Benefits, ERP Vs SCM, CRM		
Unit-4	**ERP Implementation**	**8 hours**
Evolution, Evolution of ERP, Evolution of Packaged Software Solutions, The Obstacles in ERP implementation, ERP Implementation Lifecycle (Different Phases), Implementation Methodology, ERP Implementation-The Hidden Costs, In-house Implementation-Pros and Cons, Vendors and role of vendors for ERP, Consultants and role of consultants for ERP.		
Unit-5	**Technologies In ERP System**	**6 hours**
Introduction, Electronic Data Interchange(EDI), Use of EDI, Evolution of EDI, Benefits of the EDI, EDI Standards, EDI Services, EDI Components,		

EDI Administration, EDI Integration, ALE Integration, Internet Integration, OCR Integration		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Numerical Methods**	**L**	**T**	**P**	**C**
Course Code	**BCAC1205**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

In this course we will learn various numerical methods for finding solutions to the following Mathematical problems: *1.Roots of Equations,* 2.*Systems of Linear Algebraic Equations,* 3. *Interpolation,* 4. Differentiation, 5. *Integration,* 6. *Ordinary Differential Equations,* 7. *Statistical Quality Control Methods(Control Charts)*

Course Outcomes

CO1	Employ the concept of errors and apply various numerical methods to find the roots of non linear equations and solution of system of equations (K3)
CO2	Apply interpolated formulas to find approximated polynomials and missing values (K3)
CO3	Solve differentiation and integration for complex functions using numerical methods (K4)
CO4	Solve Ordinary differential equations using different numerical methods (K4)
CO5	Apply basic statistical methods to solve problems of basic data science problems of real world (K4)

Text Books:

1-Raja Raman V, Computer Oriented Numerical Methods, Prentice Hall.
2-Grewal B. S., Numerical Methods in Engineering and Science, Khanna Publishers, Delhi.
3-Gupta S. P., Statistical Methods, Sultan and Sons.

Reference Books:

1- Gerald & Wheatley, Applied Numerical Analyse, AW.
2- Jain, Iyengar and Jain, Numerical Methods for Scientific and Engineering Computations, New Age Int.
3-Veerarajan T. Ramachandran T., Theory and Problems in Numerical Method, TMH.

Unit-1	**Introduction and Solution of nonlinear equation**	**8 hours**
Advantage of Numerical techniques, Computer Arithmetic, Mathematical preliminaries, Precision and Errors, types of errors and General error formula, Error in a series approximation; Non-Linear Equations: Bisection Method, Newton-Raphson method, Iteration method, Method of false position, Methods of finding complex roots, Rate of convergence of Iterative methods, Polynomial Equations		
Unit-2	**Data interpolation and methods**	**8 hours**
Finite Differences, Difference tables, Polynomial Interpolation: Newton's forward and backward formula, Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula.		
Unit-3	**Solution of Linear Equation**	**6 hours**
Direct Methods: System of Linear Equation, Gauss Elimination, Jordon, Pivoting and non-Pivoting, Iterative Methods: Gauss seidel and Jacobi Method		
Unit-4	**Numerical Integration, Differentiation and differential equations**	**8 hours**
Numerical differentiation, Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Differential Equation : Picard's Method, Euler's Method, Taylor's Method, Predictor Corrector Methods, Runge-Kutta Methods		
Unit-5	**Regression and curve fitting**	**6hours**
Frequency chart, Regression Analysis, Linear and Nonlinear Regression, Multiple regression, , Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc Statistical Quality Control methods.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	Python Programming	L	T	P	C
Course Code	BCAC1202	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

This course introduces the student to the Python language. Upon completion of this class, the student will be able to write non trivial Python programs dealing with a wide variety of subject matter domains. Topics include language components, the IDLE environment, control flow constructs, strings, I/O, collections, classes, modules, and regular expressions. The course is supplemented with many hands on labs using Windows

Course Outcomes

CO1	Write Basic Programs using Python programming constructs.
CO2	Work with python string handling techniques and user defined functions.
CO3	Use data structures like Lists, tuples and dictionaries.
CO4	Understand File handling and Regular Expressions.
CO5	Apply Object oriented programming techniques and database.

Text Book (s)

1. **Tony Gaddis, Starting Out with Python, 3rd edition, Pearson**
2. **Y. Daniel Liang, Introduction to Programming Using Python, Pearson**
3. **Budd T A, Exploring Python , 2011, Tata McGraw Hill Education**
4. **Learning Python, Fourth Edition, Mark Lutz, O'Re illy publication**

Reference Book (s)

1. **Downey, Allen B., Think Python: How to Think Like a Computer Scientist. O'Reilly, 2012. Obtain free PDF at http://www.greenteapress.com/thinkpython/**
2. Python Programming: An Introduction to Computer Science (Second Edition) John Zelle, ISBN 978-1-59028-241-0-9, Franklin, Beedle & Associates Inc., 2004.

Unit-1	Introduction	6 hours
History , Features , Working with Python, Installing Python, basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; Arithmetic and Logical operators and Boolean expressions. Debugging, comments in the program; understanding error messages; Catching exceptions using try and except. Built-in functions – type(), id(), eval(), random, chr(), ord(); Conditional Statements : If, If-else, Nested if-else; Looping: For, While, Nested loops; Control Statements: Break, Continue, Pass;		
Unit-2	**Function and Strings**	**8 hours**
Functions in Python: Defining a function, Calling a function, Types of functions, Function Arguments – default arguments, keyword arguments, variable/arbitrary arguments. Global and local variables. Recursive functions.String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. String functions: len(), upper(), lower(), casefold(),find(),replace(),split(),join(). Formatting using % (string modulo) and format operators		
Unit-3	**Lists, Tuples and Dictionaries**	**8 hours**
Basic List operators, List methods, iterating over a list, replacing, inserting, removing an element; searching and sorting lists,calculating the sum and average of items in a list ; Tuples - sequence of values , immutability, Comparing tuples, Tuple assignment, tuple methods:		
Unit-4	**Dictionaries and Files**	**8 hours**
Dictionary- Store data as key-value pairs in dictionaries, dictionary methods, search for values, change existing values, add new, key-value pairs, and delete key-value pairs, nesting objects, sorting, dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file		
Unit-5	**Object Oriented Programming**	**6 hours**
Class, Objects, Class variables, Instance variables, Types of methods, Inheritance		
Unit-6	**Advancement & Research**	**4 hours**

Advancement in the course, Research methodologies, research discussion & publication

Name of The Course	Disruptive Technologies	L	T	P	C
Course Code	BCA9004	2	0	0	2
Prerequisite	Basic programming Languages				
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

i) Able to outline the strength of various systems and their role in an Industry 4.0 world
ii) Learners will gain deep insights into the fundamental concepts of disruptive technologies, their promises as well as their current limitations
iii) To provide an overview with the fundamental techniques and principles in the exciting growing field of big data analytics.
iv) To understand the state of the art of Arduino architecture and Sensors
v) To study about different tools like Python, Tableau and Arduino

Course Outcomes

CO1	Understand the drivers and enablers of Industry 4.0 and how organizations and individuals should handle challenges to reap the benefits.
CO2	Build the deep insight into the main methods used in machine learning (ML) and artificial intelligence (AI) Utilize the potential impact of Artificial Intelligence and machine learning
CO3	Acquire fundamental enabling techniques and scalable algorithms to Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
CO4	Analyse basic IOT protocols and its characteristics to determine the performance
CO5	Implement the basic IoT applications on embedded platform

Text Book (s)

Reference Book (s)

1. Chris Albon "Machine Learning with Python Cookbook "O'Reilly Media; March 2018
2. Marleen Meier David Baldwin "Mastering Tableau 2019.1: An expert guide to implementing advanced business intelligence and analytics with Tableau 2019.1, 2nd Edition Feb 2019
3. Charalampos Doukas "Building Internet of Things With the Arduino: Volume 1" Mar 2012

Alasdair Gilchrist "Industry 4.0: The Industrial Internet of Things" June 2016

Unit-1	Introduction to Industry 4.0	6 hours
Introduction - Business and IT Trends - Enterprise Software Trends- Key Emerging, Invention & Innovation, Industry 4.0, Industry Evolution, Key Technologies - AR/VR- Digital currencies and Blockchain Technology- Intelligent Computing AI and Autonomous Robots– Data Science and Deaplearning- Computer Vision – Industrial IoT.		
Unit-2	**Introduction AI & ML using Python**	**8 hours**
Introduction, Scope of AI & ML, Applications, Challenges, Types of learning: Supervised, Unsupervised, Reinforcement. Preparation of Data-Training and Testing. Introduction to Python, Data types, Variables, Conditions, Loops, List, Dictionary, Functions, Class and Objects, NumPy array and operations, Pandas Dataframe and operations, Matplotlib Visualization, Scikit-Learn usage, installation of Anaconda distribution, End-to-end AI & ML Project.		
Unit-3	**Introduction Data Analytics using Tableau**	**8 hours**
Introduction - Big data, challenges, applications, Big data analytics algorithms , Big data system, Big Data Life Cycle, data representation, cleansing, validation, Data analysis and visualization. Tableau Introduction- Installation, connecting to data, Aggregate functions, sorting, Calculation, grouping, Set, Action, Dashboard creation.		
Unit-4	**Introduction to Embedded system & arduino**	**8 hours**
Overview of Embedded Systems, Components of Embedded Systems, about arduino IDE , Arduino architecture and pin details, Digital & Analog I/O's, Types of Arduino boards, Installing and Setting up the Arduino development environment and simulation software, Software simulation on LED and switches, Software simulation on motor with driver, Software simulation on analog and digital sensors .		
Unit-5	**Introduction to IoT & Programming Concepts**	**6 hours**
Introduction to IoT , IoT Protocols, IoT open source platform and sensors, Basic programming		

Structure, Variables, constants and data types, Operators, Control Structure, Library Functions, Creating account in open source IoT platform, Configuring and programming Wi-Fi module with MCUs, Interfacing switches and LEDs with MCUs , Interfacing motor and driver with MCUs , Interfacing analog and digital sensors with controller. Line follower robot.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Data Structures using C Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAC1201**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiment:

1. Write a program to compute minimum/maximum of a given array.
2. Write a program to sort given set of numbers in ascending/descending order using Bubble Sort and analyze its complexity.
3. Write a menu-based program to perform array operations: deletion of an element from the specified position, inserting an element at the specified position, printing the array elements.
4. Write a program to search an element in the array using linear search.
5. Write a program to search an element in a 2-dimensional array.
6. Write a program to perform following operations in matrix:
   a. Addition
   b. Subtraction
   c. Multiplication
   d. Transpose
7. Write a menu-based program to perform following operations on single linked list:
   a. To insert a node at the beginning of the list.
   b. To insert a node at the end of the list.
   c. To insert a node after a given node in the list.
   d. To delete the first node from the list.
   e. To delete the last node from the list.
   f. To delete a node after a given node from the list.
   g. To delete a node at a given position from the list.
8. Write a menu-based program to perform following operations on double linked list:
   a. To insert a node at the beginning of the list.
   b. To insert a node at the end of the list.
   c. To insert a node after a given node in the list.
   d. To delete the first node from the list.
   e. To delete the last node from the list.
   f. To delete a node after a given node from the list.
   g. To delete a node at a given position from the list.
9. Write a menu-based program to perform following operations on circular linked list:
   a. To insert a node at the beginning of the list.
   b. To insert a node at the end of the list.
   c. To insert a node after a given node in the list.
   d. To delete the first node from the list.
   e. To delete the last node from the list.
   f. To delete a node after a given node from the list.
   g. To delete a node at a given position from the list.
10. Write a menu-based program to implement stack operations: PUSH, POP using array implementation of stack.
11. Write a menu-based program using functions to implement stack operations: PUSH, POP using linked implementation of stack.
12. Write a program to convert infix expression into postfix expression and then to evaluate resultant postfix expression.
13. Write a program to solve Towers of Hanoi Problem.
14. Write a menu-based program to implement linear queue operations: INSERTION, DELETION using array implementation of queue.

15. Write a menu-based program to implement linear queue operations: INSERTION, DELETION using linked list implementation of queue.
16. Write a menu-based program to implement circular queue operations: INSERTION, DELETION.
17. Write a program to traverse a binary tree using PRE-ORDER, IN-ORDER, POST-ORDER traversal techniques.
18. Write a menu-based program to perform operations for a binary search tree (BST).
    a. Search an element
    b. Find minimum
    c. Find maximum
    d. Insertion
    e. Deletion
19. Write a program to traverse a graph using breadth-first search (BFS), depth-first search (DFS).
20. Write a program to sort given set of numbers in ascending/descending order using insertion sort and also search a number using binary search.
21. Write a program to sort given set of numbers in ascending/descending order using Quick sort and selection sort. Also record the time taken by these two programs and compare them.
22. Write a program to sort given set of numbers in ascending/descending order using Merge sort.

Name of The Course	**Web Technology Lab (PBL)**	**L**	**T**	**P**	**C**
Course Code	**BCAC1213**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiment:

1. To create a basic web page consisting of various HTML tags.
2. To create HTML links.
3. To create HTML Table.
4. To create HTML list.
5. To create CSS file in HTML.
6. To create Student Registration Forms in HTML.
7. To create HTML Frame.
8. Introduction to java script like Add,DIV,Mul,Sub etc.
9. Using java script variables, data type and object.
10. Using java script function.
11. Using java script using validation in HTML forms.
12. Introduction to VB Script like Add,Div,Mul,Sub etc.
13. Using data type & variable.
14. Using VB Script loops and conditions.
15. Using VB script variable & procedures.
16. Introduction to ASP
17. WAP in ASP displaying the current date and time
18. WAP in ASP print the hours minutes and second

Value Added List of Experiments

1. In the XML create a program of employee detail like employee id, name, salary, designation…..

Name of The Course	**Python Programming Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAC1212**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

S. No.	**Title of Lab Experiments**
1	**Write a python program to print all prime numbers among the interval given by user.**
2	**Write a python program to double the values in a list using map()**
3	**Write a python program to show the importance of operator precedence and associativity of different operators**
4	**Write a python program to do the following operations** • Reversing a given integer number. • Find the sum of digits of given integer number.
5	**Write a python program to implement Dice game for 2 players using random()**
6	**Write a python program to utilize all in-built mathematical functions.**

7	**Write a python program to check the given string is palindrome or not, without using In-built functions.**
8	Write a python program to find a character and number of occurrence of a given character in a string.
9	Write a python program to manage student's details using dictionary.
10	Write a python program to design groceries billing system using dictionary.
11	Write a python program to get a date from user and give the day as output
12	Write a python program to find the number of days between two dates given by user. (Age Calculator)
13	Write a python program to find Factorial of a given number without using Recursion Concept.
14	Write a python program to find sum of N given numbers using Recursion by using Function.
15	Write a python program using the module, maintain students data and retrieve it accordingly.
16	Write a python program to implement a user defined math function using module.
17	Write a python program to copy the content of one file to another file.
18	Write a python program to search the give character or string is present in a file.
19	Write a python program which defines a function f. f takes two arguments a and b and do (a+b) / (a-b) computation. Implement exception handling with try, catch and else.
20	**Write a python program to take input from the user again and again until correct value is given by user. Three user defined exceptions can be created i.e:** A. NegativeValueError (if value entered is negative), B. ValueTooLarge (if value entered is more than stored value), and C. ValueTooSmall (if the value stored is less than stored value).
Experiments beyond curriculum:	
1	Write an interactive program to create a set of data to maintain the database of examination results.
2	Write a program to maintain student's database in file.

Name of The Course	**Computer Architecture**	**L**	**T**	**P**	**C**
Course Code	**BCAS2001**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

To introduce students to the different functional units of a computer system and to describe the various concepts of the same.

Course Outcomes

CO1	**understand the concepts of arithmetic operations on integer & decimal data, the input-output process and memory management.**
CO2	**Be familiar with the Von Neumann architecture**
CO3	**Be familiar with the cost-performance issues and design trade-offs in designing and constructing a computer processor including memory**
CO4	**Be familiar with the basic knowledge the design of digital logic circuits and apply to computer organization**
CO5	**understand the concepts of arithmetic operations on integer & decimal data, the input-output process and memory management.**

Text Book (s)

1 M. M. Mano – Computer System Architecture – 3rd Edition – PHI – 1994.

Reference Book (s)

1. SubrataGhoshal-Computer Architecture and Organization-First Impression-Pearson-2011
2. J. P. Hayes – Computer Architecture and Organization – McGraw–Hill – 1988 3rd Edition.

Unit-1	**Register Transfer and Micro-operations**	**8 hours**
Register Transfer Language-Register Transfer-Bus and Memory Transfers-Arithmetic Microoperations-Logic Microoperations-Shift		

Microoperations-Arithmetic Logic Shift Unit-Basic Computer organization and design-Instruction Codes-Computer Registers-Computer Instructions-Timing and Control- Instruction Cycle- Memory Reference Instructions-Input Output and Interrupt-Complete Computer Description-Design of Basic Computer-Design of Accumulator Logic		
Unit-2	**Central Processing Unit**	**6 hours**
Introduction-General Register Organization-Stack organization, Instruction Format, Addressing Modes-Data Transfer and Manipulation-Program Control.		
Unit-3	**Computer Arithmetic**	**8 hours**
Computer Arithmetic – Addition and Subtraction – Multiplication and Division Algorithms – Floating-Point and decimal Arithmetic operations		
Unit-4	**Input–Output Organization**	**8 hours**
Input–Output Organization – Peripheral devices – I/O Interface – Asynchronous Data Transfer – Modes of Transfer – Direct Memory – Access I/O Processor		
Unit-5	**Memory Organization**	**6 hours**
Memory Hierarchy – Associative Memory-Cache Memory -Virtual Memory		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Database Management System**	**L**	**T**	**P**	**C**
Course Code	**BCAS2002**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Explain data management and the use of various techniques in the manipulation of data subject to various constraints.**
2. **Describe the entity relationship diagram and to explain the basic concepts of database recovery, concurrency control, security and integrity.**

Course Outcomes

CO1	Identify data relationships and to design relational database tables adopting the normalization rules.
CO2	**Students able to understand E-R Modeling.**
CO3	**Be familiar with the concept of Normalization.**
CO4	**Understand the concept ofData Models.**
CO5	**Be familiar with the concept of Back Up & Recovery.**

Text Book (s)

1. Henry F. Korth and Abraham Silberschatz: Database system concepts, McGraw Hill International Publication, 1988 (Chapters 1 to 6 and 9 to 13), 2nd Edition,1991.

Reference Book (s)

1. Jeffrey D Ullman: Principles of data Base systems, Galgotia Publishers, 2nd Edition 1994.

2. C.J. Date, An Introduction to database Systems, Third Ed., Narosa 3rd Edition 1995.

Unit-1	**Introduction: Basic Terminology**	**6 hours**
Introduction: Purpose of Database systems - overall system structure – Data Model		
Unit-2	**E-R Modeling**	**8 hours**
Entity relationship model: entities and entity sets relationships - mappings constraints - primary keys - E.R diagram		
Unit-3	**Normalization**	**8 hours**
Relational database design: pitfalls – Normal Forms - 1 NF, 2NF 3NF and BCNF		
Unit-4	**Data Models**	**8 hours**
Basic concepts of Hierarchical data model – Tree structure diagram, Network Data Model-Data Structure diagram		
Unit-5	**Back Up & Recovery**	**6 hours**
Basic concepts of database recovery - concurrency control - Database security and integrity		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	JAVA Programming	L	T	P	C
Course Code	BCAS2003	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

Introduce students Core Java Concepts and to teach students the basic concepts of Java programming. This course covers preliminaries, I/O streaming and file handling and teach students how to program applets in Java, networking and allow the students to implement effectively

Course Outcomes

CO1	**Implement and use efficiently the java programs, can develop applets, able to access database with JDBC, work with networking protocols using java with attractive GUI**
CO2	
CO3	
CO4	
CO5	

Text Book (s)

1. R. Naughton and H. Schildt – Java2 (The Complete Reference) – Fifth Edition – TMH – 2004.

Reference Book (s)

1. K. Arnold and J. Gosling – The Java Programming Language – 3rd Edition., Pearson Edu,2005

2. David Flanagan – Java in a Nutshell: A Desktop Quick Reference for Java Programmers– O'Reilly & Associates, Inc. 1999

3. Bruce Eckel –Thinking in Java – Prentice Hall, 2nd Ed 2002

Unit-1	Introduction	6 hours
Introduction - Object oriented fundamentals, History-Java and the Internet-Java Applets and Applications, Features of Java, Java Virtual Machine (JMV), Byte-Code ,JAVA buzzwords, JAVA Environments, Command Line Arguments, Java program structure, Reserved keywords, Identifiers, Literals, Operators, Separators, Variables, Declaring a variable, Scope and lifetime of variables, Data types, Type conversion, casting		
Unit-2	**Language Basics**	**8 hours**
Control Statements, Arrays- One-Dimensional Arrays, Two-dimension Array, Vectors, Operators-Arithmetic, Boolean logical, Relational and Bitwise operators-Operator Precedence. Class :Fundamentals ,The General Form of a Class ,A Simple Declaring Objects, Assigning Object Reference Variables, Methods: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing ,Returning Objects, Recursion Introducing Access Control, Overriding Methods, Final Variables and Methods, Final class, Finalizer Methods, Abstract Methods and Class, Visibility Control, Constructors		
Unit-3	**String Handling**	**8 hours**
String : Strings, String Constructors, String length, String Literals, String Concatenation, data types-String conversion. Inheritance : basic ,Types of Inheritance, Member Access, Creating a Multilevel Hierarchy, When Constructors Are Called Method Overriding, Why Overridden Methods?, Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding . Using final to Prevent Inheritance, Packages and Interfaces		
Unit-4	**Exception Handling**	**8 hours**
Exception Handling: Exceptions Exception hierarchy, Try, Catch, Finally, Throw		
Unit-5	**Input / Output**	**6 hours**
Java.io Package-I/O Basics-Reading console Input-Writing console output Print Writer class-Reading and Writing files-Java I/O classes, Byte Stream Classes, Character Stream		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	Introduction to Algorithm Analysis and Design	L	T	P	C
Course Code	BCAS2004	3	0	0	3
Prerequisite	Fundamentals of programming & Data structures				

Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

To introduce students, the concepts of algorithm analysis for find out the space and time complexity of different algorithms. Different design techniques such as greedy method, divide and conquer, backtracking, dynamic programming, branch and bound are to be studied for finding the solution to the different problems. It also provides an insight into the basic concepts of NP and NP-hard problems and their relevance in research.

Course Outcomes

CO1	**On completion of this subject the student shall be able to find out the efficiency of algorithms for different problems.**
CO2	**Students able to understand data structure concepts**
CO3	**Understand advance design and analysis techniques**
CO4	**Understand the concept of Graph Algorithms**
CO5	**Understand the concept of NP-Hard and NP-Completeness**

Text Book (s)

T. Cormen, C.E. Leiserson, R.L. Rivest& C. Stein – Introduction to Algorithms – PHI – 2nd Edition, 2005.

Reference Book (s)

1. Knuth E. Donald, Art of Computer Programming Sorting and Searching Vol3, Second Edition, Pearson Education.

2. Brassard Bratley, "Fundamental of Algorithms", PHI

3. A V Ahoetal, "The Design and analysis of Algorithms", Pearson Education

4. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia

Unit-1	**Introduction to Algorithms & Analysis**	**6 hours**
Introduction to Algorithms & Analysis- Design of Algorithms, Growth of function, Complexity of Algorithms, Asymptotic Notations, Recurrences. Sorting: Insertion Sort, Quick Sort, Merge Sort		
Unit-2	**Advance Data Structure**	**8 hours**
Advanced Data Structure: Binary Search Trees, Red Black Trees		
Unit-3	**Advance Design and Analysis Techniques**	**8 hours**
Advanced Design and Analysis Techniques: Dynamic programming, Greedy Algorithm		
Unit-4	**Graph Algorithms**	**8 hours**
Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path		
Unit-5	**Special Topics in AAD**	**6 hours**
String Matching, Introduction of NP-Hard and NP-Completeness , Matrix Operations		

Name of The Course	**Computer Networking**	**L**	**T**	**P**	**C**
Course Code	**BCAS2007**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. Teach fundamental concepts of networks.
2. Give hands on training of network installation and configuration

Course Outcomes

CO1	**Understand basic of networking from the user's, developer's and administrator's perspective**
CO2	**Students able to Physical Layer and Data Link Layer**
CO3	**Understand the concept of Network Layer**
CO4	**Demonstration of Transport and Application Layer**
CO5	**Students able to known network administration**

Text Book (s)

1.A.S.Tanenbaum, "Computer Networks"; Pearson Education Asia, 4 thEd. 2003.

2.BehrouzA.Forouzan, "Data Communication and Networking", Tata MCGraw Hill,

3.William stallings, "Data and computer communications", Pearson education Asia, ,

Reference Book (s)

1. **MCSE: Networking Essentials Study Guide -- Tata McGrawHill Publication**
2. **MCSE: Windows 2000 N/W Infrastructure design - Tata McGraw Hill Publication**

Unit-1	**Basic Concepts, Network Reference Models**	**6 hours**
Basic Concepts: Components of data communication, distributed processing, standards and organizations. Line configuration, topology, Transmission mode, and categories of networks (LAN,WAN,PAN). Network Topologies (Bus, Star, Ring, Star Bus, Star Ring and Physical Mesh) , OSI and TCP/IP Models: Layers and their functions, comparison of models		
Unit-2	**Physical Layer and Data Link Layer**	**8 hours**
Transmission Media: Guided and Unguided. CSMA, Ethernet, FDDI, Token Ring ,Wireless LAN. DLL: Basic functions of DLL, Circuit switching, packet switching and message switching. Flow control, error control. MAC		
Unit-3	**Network Layer**	**8 hours**
Hub, Repeaters, bridges, gateways, routers, design issues of network layer, Routing algorithms,. Network Layer Protocols: IPv4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol, ARP – RARP – DHCP – ICMP		
Unit-4	**Transport and Application Layer**	**8 hours**
Transport layer: Process- to- Process delivery, Data traffic, Congestion control: Open loop, closed loop. Flow control and error Control. UDP – TCP. Application Layer: Client- Server model, DNS. DNS in internet E-mail, SMTP, FTP, HTTP, World Wide Web		
Unit-5	**Network Administration**	**6 hours**
Analyzing the technical support structure(Network manager support, End-user Support), Analyzing the current Network Management, Managing Network Connections, Installing and configuring Network adapters, Installing and Configuring TCP/IP Protocol, Managing network bindings, Sharing files and Printers, Building Internet and Intranet Infrastructure, IP address scheme, assigning IP addresses		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the Network, Research methodologies, research discussion & publication		

Name of The Course	**Computer Networking Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAS2008**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

EX.NO.	**TITLE OF LAB EXPERIMENTS**
1	**BASIC NETWORKING COMMANDS**
2	**SLIDING WINDOW**
3	**CYCLIC REDUNDANT CHECK**
4	**ROUTING-SHORTEST PATH FROM SINGLE NODE**
5	**BROADCASTING**
6	**MULTICASTING**
7	**ADDRESS RESOLUTION PROTOCOL**
8	**IMPLEMENTATION OF TCP**
9	**IMPLEMENTATION OF UDP**
10	**FILE TRANSFER PROTOCOL(FTP)**
11	**DOMAIN NAME SERVICE(DNS)**
12	**LEARNING ABOUT CONFIGURATION OF SHARING THE FILES/DESKTOP/PRINTER**

Name of The Course	**Java Programming Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAS2009**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiment:

1. Write a program that will print a "hello java" message on the screen.
2. Write a program to read a string from the command line and display the string on the screen.

3. Write a program to read an integer from the command line and calculate square root of that value.
4. Write a program to read an integer value through Scanner class and check whether it is even or odd.
5. Write a program to create constructor of a class and initialize values in it and later print them.
6. Write a java code to implement the concept of method overloading.
7. Write a java code to implement the concept of constructor overloading.
8. Write a java code to implement the concept of simple inheritance, multilevel inheritance, and hierarchical inheritance.
9. Write a program to show how method overriding is implemented in java.
10. Write a program to implement the concept of abstract classes.
11. Write a program to implement multiple inheritances using interface.
12. Write a java code to demonstrate the concept of inner classes.
13. Write a java code to show both the uses of "super" keyword.
14. Write a program to create your own package and import that package in a program.
15. Write a java program to show the use of various string functions like concat, indeOf.
16. Write programs for Exception handling using try, catch, throw and finally.
17 Write a program to read a single character from keyboard using Buffered Readerclass and print it

Name of The Course	Database Management System Lab	L	T	P	C
Course Code	BCAS2010	0	0	2	1
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		70		30	100

LIST OF EXPERIMENTS
1) Implement Data Definition language Statements.
2) Implement Data Manipulation Statements.
3)Implement SELECT command with different clauses.
4)Implement various type of Integrity Constraints on database.
5)Implement SINGLE ROW functions (Character, Numeric, Date functions) and GROUP functions (avg, count, max, min, sum).
6)Implement various type of SET OPERATORS (Union, Intersect, Minus)
7)Implement the concept of grouping of Data and Subqueries.
8)Implement the concept of Data Control Language (DCL), Transaction Control Language(TCL).
9)Implement Simple and Complex View.
Value Added Experiments
10Create a Database for Banking Sector and implement various queries on it.
11 Create a Database for Customer Sale/purchase and implement various queries on it.

Name of The Course	Campus-to-Corporate	L	T	P	C
Course Code	LLL245	0	0	4	2
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		70		30	100

Course Objectives:

1. To assess the current employability level of students.

2. To prepare students to perform effectively in Personal Interview.

3. To prepare the students for solving mathematical problems appearing in Placement Papers.

Course Outcomes

CO1	Enhance and practice employability skills required in the placement process using a simulated environment
CO2	Communicate effectively in a Personal Interview
CO3	Model interpersonal communication in a monitored environment
CO4	Enhance the ability of problem solving and decision making in short span of time
CO5	

Text Book (s)

SLLL Own Text Book

Reference Book (s)

1. Delivering Employability Skills in the Lifelong Learning Sector by Ann Gravells, ISBN-10: 1844452956
2. Sample Papers of Various companies; Real world HR interviews from companies across various sectors like IT, ITES, Manufacturing, etc. in and around NCR region

Unit-1	**Group Discussion**	**2 hours**
• Group Discussion- Concepts • Group Discussion – Practice		
Unit-2	**Real Life Simulation- Employability Skills- Job Fair**	**12 hours**
• Introduction to Job Fair • Resume Writing • Personal Interview Concepts • Mock Interviews • Job Fair – Final Event		
Unit-3	**Quantitative Aptitude**	**6 hours**
• Syllogism • Logical Reasoning • Paper Pattern Discussion		

Name of The Course	**Operating System**	**L**	**T**	**P**	**C**
Course Code	**BCAS2015**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Provide the fundamental principles of modern operating systems that explores design aspects of modern operating systems.**
2. **Solve problems using the above concepts.**

Course Outcomes

CO1	**Understand how the operating system abstractions can be used in the development of application programs, or to build higher level abstractions**
CO2	**Understand how the operating system abstractions can be implemented**
CO3	**Understand the principles of concurrency and synchronization, and apply them to write correct concurrent programs/software**
CO4	**Understand basic resource management techniques (scheduling or time management, space management) and principles and how they can be implemented. These also include issues of performance and fairness objectives, avoiding deadlocks, as well as security and protection**
CO5	**Understand the storage management concepts**

Text Book(s)

1. Operating System Concepts (7th Ed) by Silberschatz and Galvin, Wiley, 2000.

Reference Books

1. Operating Systems (5th Ed) – Internals and Design Principles By WilliamStallings, Prentice Hall,
2. Modern Operating Systems by Andrew S Tanenbaum, Prentice Hall India, 1992.
3. Operating Systems (3rd edition) by Gary Nutt, Nabendu Chaki, SarmishthaNeogy, Pearson
4. Operating Systems Design & Implementation Andrew S. Tanenbam, AlbertS. Woodhull Pearson
5. Operating Systems Achyut S. Godbole Tata Mc Graw Hill
6. Operating Systems D.M.Dhardhere Tata Mc Graw Hill

Unit-1	**Introduction**	**6 hours**
Operating System and Function, Evolution of Operating System, System Software, OS services and Components: Multitasking , Multiprogramming, Multiprocessing, Time Sharing, Buffering, Spooling, Distributed OS		
Unit-2	**Process Management**	**8 hours**
Concept of process and threads: Process states, Process management, Critical Section, Problem, Semaphores, Classical Problems in Concurrency, Inter Processes Communication, Process Generation, Process Scheduling		
Unit-3	**Sceduling**	**8 hours**
Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor		

Scheduling. Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection		
Unit-4	**Memory Management**	**8 hours**
Memory partitioning: Swapping, Paging, Segmentation Virtual memory: Overlays, Demand paging, Performance of Demand paging, Virtual memory concepts, Page replacement algorithms, Allocation algorithms, Example OS : Linux		
Unit-5	**I/O Management**	**6 hours**
I/O Devices and The Organization of I/O Function, I/O Buffering, Disk I/O, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Protection, File Sharing, Implementation Issues		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Software Engineering**	**L**	**T**	**P**	**C**
Course Code	**BCAS2016**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

Identify, formulate, analyze, and solve problems, as well as identify the computing requirements appropriate to their solutions

Course Outcomes

CO1	**Understand basic concepts and applications of Software Engineering.**
CO2	**Work with software requirement engineering process.**
CO3	**Understand the concepts of software design.**
CO4	**Develops the basic concepts of Coding and Testing concepts.**
CO5	**Understand the principles of software maintenance.**

Text Book (s)

1. Roger S Pressman," Software Engineering – A Practitioner's Approach", McGraw Hill, USA, 2007.

2. Sommerville I, "Software Engineering", Pearson Education India, New Delhi, 2006.

Reference Books

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

3. Pankaj Jalote, Software Engineering, Wiley

Unit-1	**Introduction**	**6 hours**
Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models, Selection of Software Process models		
Unit-2	**Requirement Engineering Process**	**8 hours**
Requirement Engineering Process: Elicitation, Analysis, Documentation, Analyzing a problem, creating software specification document, review for correctness, consistency, and completeness, Management of User Needs, Feasibility Study, Characteristics and components SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model		
Unit-3	**Software Design**	**8 hours**
Software Design: Refining the software Specification; Software design, fundamental design concept for data, Abstraction, Modularity, Software architecture, Cohesion and Coupling, Architectural design and procedural design, Data flow oriented design, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design, creating design document: Review of conformance for software requirements and quality.		
Unit-4	**Implementation & Testing**	**8 hours**
Coding: Relationship between design and implementation, Implementation issues and programming support environment; Coding the procedural design, Good coding style and review of correctness and readability, Structured Programming, need for structured programming,		

Coding standards, Coding style, Maintainability of programs, Code documentation – Code efficiency Testing : Software testing, Testing Objectives, Levels of testing– Unit Testing, Integration Testing, System testing, Acceptance Testing, Verification Vs Validation, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing , Incremental Vs Nonincremental testing, Structural Testing (White Box Testing), Functional Testing (Black Box Testing).		
Unit-5	**Maintenance**	**6 hours**
Maintenance: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Function Point (FP) Based Measures, Cyclomatic Complexity Measures, Software Risk Analysis and Management		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**.Net Technology (PBL)**	**L**	**T**	**P**	**C**
Course Code	**BCAS2025**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**30**	**50**	**100**

Course Objectives:

1. The student will gain knowledge in the concepts of the .NET framework as a whole and the technologies that constitute the Framework.
2. By building sample applications, the student will get experience and be ready for large-scale projects

Course Outcomes

CO1	**To understand the basis of .NET Framework.**
CO2	**Develop applications with c# using .NET Framework.**
CO3	**Develop applications with Visual Basic using .NET Framework.**
CO4	**Develop active server pages using .NET Framework.**
CO5	**Read and write data from/to files in ADO.Net .**

Text Book (s)

1. Visual studio 2010 - A beginners guide - Joseph Mayo.

Reference Books

1. Jeffrey R. Shapiro "The Complete Reference Visual Basic .NET" Tata Mcgraw Hill (2002 Edition).
2. Pro ASP.NET 4 in C# 2010, MacDonald and Freeman
3. Visual Studio 2010 and .NET 4 Six-in-One (Wrox Programmer to Programmer)

Unit-1	**Introduction**	**6 hours**
Introducing C#, Understanding .NET, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations, Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions, Defining classes and class members. Assembly, Components of Assembly, Private and Shared Assembly, Garbage Collector, JIT compiler. Namespaces Collections, Comparisons and Conversions, Delegates and Events		
Unit-2	**C#**	**8 hours**
Getting Started with .Net Framework, Exploring Visual Studio .NET, Inside a C# Program, Data Types, Statements, Arrays, Using Strings, Objects, Classes and Structs, Properties, Inheritance, Indexers, Delegates, Events, Namespaces, Generics, Collections and Data Structures, Exception Handling, Threading, Using Streams and Files, Reflection, Assemblies, versioning, Windows Forms, Controls, Data binding to Controls, Advanced Database Programming using ADO.net, Using GDI +,Networking,.net Remoting, Manipulating XML		
Unit-3	**VB.Net**	**8 hours**
Creating Applications with Visual Basic.NET, Variables, Constants, and Calculations, Making Decisions and Working with Strings, Lists, Loops, Validation, Sub Procedures and Functions, Multiple Forms, Standard Modules, and Menus, Arrays, Timers, Form Controls, File Handling, Exception		

Handling, Working with Databases, Advanced Database Programming using ADO.net, Classes, Generics, Collections, Inheritance, Custom Controls, Packaging & deployment, Using Crystal Reports		
Unit-4	**ASP.Net**	**8 hours**
Building a Web Application, Examples Using Standard Controls, Using HTML Controls, Validating Form Input Controls using Validation Controls, Understanding Applications and State, Applying Styles, Themes, and Skins, Creating a Layout Using Master Pages, Binding to Databases using Controls, Data Management with ADO.net, Creating a Site Navigation Hierarchy, Navigation Controls , Membership and Role Management, Login Controls, Securing Applications, Caching For Performance, Working with XML, Using Crystal Reports in Web Forms		
Unit-5	**DBMS**	**6 hours**
Databases: Introduction, Using SQL to work with database, retrieving and manipulating data with SQL, working with ADO.NET, ADO.NET architecture, ASP.NET data control, data source control, deploying the web site. Crystal reports. LINQ: Operators, implementations, LINQ to objects, XML, ADO.NET, Query Syntax		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the Framework, Research methodologies, research discussion & publication		

Name of The Course	**Linux Administration**	**L**	**T**	**P**	**C**
Course Code	**BCAS2021**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

- To familiarize students with the Linux environment
- To learn the fundamentals of shell scripting/programming
- Design and implement common system automation tasks using shell scripts

Course Outcomes

CO1	Understand the history of Linux and its environment. Comparing Linux and UNIX operating syste. Demonstrating the installation of Linux based operating system (Fedora and Ubuntu) on computer system.
CO2	**Explain and appraise the philosophy behind Open Source Software and GNU Public License. Differentiating between Windows based OS and Linux based OS.**
CO3	**Understanding and Practicing basic Linux commands - ls, cp, cat, mv, rm, chmod, ping, who, who –b, who-m. Analysing security and System Integrity. Managing Processes and users on Linux system. Managing networking using NFS and NIS.**
CO4	**Understanding boot process and analysing LILO and GRUB boot methods. Analysing dual boot using Linux and Windows based operating system. Explain different aspects of Linux file system and comparing different file system on a Linux distribution.**
CO5	**Understanding and practicing vi editor and shell. Understanding and practicing shell programming constructs. Creating and executing shell scripts.**

Text Book (s):

1. Richard Petersen, The Complete Reference – Linux, McGraw-Hill.
2. LINUX kernel development by Robert Love.
3. YashwantKanetkar, UNIX & Shell programming – BPB
4. Wale Soyinka, “Linux Administration: A Beginner’s Guide”, McGraw Hill Companies

Reference Book (s):

1. M.G.Venkateshmurthy, Introduction to UNIX & Shell Programming, Pearson Education
2. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, O’ Reilly

Unit-1	**History and Installation of Linux**	**6 hours**
History, Hardware and Environmental Considerations, Server Design, Methods of Installation, Installing Fedora, Installing Ubuntu		

Server. Dual-Booting Issues, Comparison between UNIX and LINUX		
Unit-2	**Introduction to Linux: Basic Terminology**	**8 hours**
Linux – The Operating System, Open Source Software, Features of Linux, GNU, GNU Public License, Advantages of Open Source Software, Difference between Windows and Linux		
Unit-3	**Linux Commands**	**8 hours**
General-Purpose commands, File oriented commands, directory oriented commands, Communication-oriented commands, process oriented commands. Commands like: ls, cp, cat, mv, rm, chmod, ping, Who, who –b, who-m etc. Security and system Integrity, Starting and Stopping the System, System Activity and Process Management, Users, Miscellaneous.		
Unit-4	**Boot Methods and Linux file system**	**8 hours**
Boot Methods: The Boot Process, LILO, GRUB, Dual-Booting Linux and Windows XP/Vista, BootTime Kernel Options.Introduction to Linux file system: Architecture, aspects/features of file system, different types of file systems.		
Unit-5	**Shell Programming**	**6 hours**
Vi Editor, features of different shells,I/Oinshell, controlstructures,loops, subprograms. Shell scripts: Creating&executingshell scriptsinLinux, shell variables, purpose of shell scripts		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Modelling & Animation using MAYA**	**L**	**T**	**P**	**C**
Course Code	**BCAP2041**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Get the Knowledge about the basics concepts of multimedia and its applications**
2. **Student will get the knowledge of its relevance with internet and its future aspects.**

Course Outcomes

CO1	**Student will gain fundamental knowledge about multimedia and its applications**
CO2	**Understand the concept of Character Setup and Rigging**
CO3	**Understand the concept of Character Animation**
CO4	**Understand the concept of Non-linear Animation**

Text Books:

1. 3d Animation with Maya 7, Patrica Beckman and Phil Young
2. How to Cheat in Maya 2013: Tools and Techniques for Character Animation, Kenny Roy and Eric Luhta

Reference Books:

1. Introducing Autodesk Maya 2013, DariushDerakhshani

Unit-1	**Basic Modeling**	**10 hours**
Polygon Basics and Poly Editing Tools – The Sculpt Polygons Tools NURBS Modeling – Subdivisions Surfaces. Advanced Modeling - Blend Shape Modeling Pipeline – Sneers, Blinks, and Smiles – The Paint, Blend Shape Weights Tool.		
Unit-2	**Character Setup and Rigging**	**10 hours**
Deformers, Skeletons Clusters and Lattices – Forward and inverse Kinematics – Creating a Proper Bipedal Skeleton – Using the Full, Body IK Skeleton – Skinning a Character		
Unit-3	**Character Animation**	**10 hours**
Preparing to Animate – The Animation Process – Pose-to-Pose blocking – Establishing Timings – Refining Animation		
Unit-4	**Non-Linear Animation**	**10 hours**
Creating Poses – Creating Clips – Modifying, blending and Sharing Clips – Animating with Maya's new Body IK Setup		
Unit-5		**4 hours**
Multimedia clippings		
Unit-6	**Advancement & Research**	**4 hours**

Advancement in Multimedia, Research methodologies, research discussion & publication

Name of The Course	Modelling & Animation using MAYA Lab	L	T	P	C
Course Code	BCAP2042	0	0	2	1
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		70		30	100

List of Experiments:

- Experiment for Animated rotation in Maya
- Experiment for Add audio to your animation
- Experiment to Create multiple animation stories with Time Editor Compositions
- Experiment for Keyframe Animation
- Working with Time Editor clips

Name of The Course	Elective-I –AI & ML	L	T	P	C
Course Code	BCA9001	3	0	0	3
Prerequisite	Discrete Maths and Probability Theory				
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

Presentation of artificial intelligence as a coherent body of ideas and methods to acquaint the student with the basic programs in the field and their underlying theory. Students will explore this through problem-solving paradigms, logic and theorem proving, language and image understanding, search and control methods and learning.

Course Outcomes

CO1	Understand different types of AI agents and implement them using different search algorithms.
CO2	Apply the knowledge and reasoning ability in logical agents and planning in real world.
CO3	Understand representation and manipulation of complex information, knowledge and uncertainty.
CO4	Analyse different Classification Techniques.
CO5	Understand the Machine Learning and its application.

Text Book (s)

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill

Reference Book (s)

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. E Charniak and D McDermott, "Introduction to Artificial Intelligence", PearsonEducation
3. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India

Unit-1	Introduction to AI	6 hours
Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents, Computer vision, Natural Language Possessing.		
Unit-2	**Searching**	**8 hours**
Searching for solutions, Uniformed search strategies, Informed search strategies, Hill Climbing, Best First Search, A* Algorithm, Constraint Satisfaction, Search for games, Min-Max and Alpha Beta Pruning.		
Unit-3	**Knowledge Representation**	**8 hours**
Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Clauses and Resolution.		
Unit-4	**Learning**	**8 hours**
Semantic Nets, Markov Model ,Hidden Markov Models (HMM), Bayesian Networks		
Unit-5	**Machine Learning**	**6 hours**
Introduction to Machine Learning, Supervised and unsupervised learning, Decision trees, Naive Bayes models, EM algorithm, Reinforcement learning.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the Machine Learning, Research methodologies, research discussion & publication		

Name of The Course	Elective-II (1) -Audio-Video Editing	L	T	P	C

	Tool & Technology				
Course Code	**BCAP2062**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

Course Objectives:

The VFX Course is a course that would help Multimedia Students understand the basic concepts of Visual Effects and how to use Video Editing software to obtain seamless shots and create internationally standard projects.Course Outcomes

CO1	Understand the basics of Audio Video Formats
CO2	Understand the editing fundamentals
CO3	Understand the usage of Tools
CO4	Understand the presentation of products
CO5	Understand the Animation and Tools for Management

Text Books:

1. Audio, Video, and Media in the Ministry, By Clarence Floyd Richmond

Reference Book:

1. Multicultural Literature for Latino Bilingual Children: Their Words, Their Worlds By Ellen Riojas Clark, Belinda Bustos Flores, Howard L. Smith, Daniel Alejandro González

Unit-1		**6 hours**
Digitization, AV data from tape to computer hard disk. Understanding the playback deck, understanding signal processing of S-video, fire wire and composite video. Editing Work Station management – disk space & speed requirement. Broadband and streaming video technology.		
Unit-2		**8 hours**
Using Editing Software – editing basics and implementation of various techniques used in non-linear editing. Mastering final edit line – audio levels, colour correction, audio mixing, mixed and un-mixed versions, importing and applying compatible graphics files. Understanding compression and its affects along with various methods		
Unit-3		**8 hours**
software/hardware tools. Overview of preproduction planning- program ideas, production models, Preproduction & Post-Production activities – Writing the program proposal, preparing a budget		
Unit-4		**8 hours**
Presenting the proposal: Writing the script, Director's roles & procedures, Visualization & sequencing, Shooting, Aesthetics of Editing, Role of audio & effects, Mix and composite, source material into a finished fine edit product		
Unit-5		**6 hours**
2D animation application software interface - Default setting and user preferences – Document setup. Import and export formats – Document and timeline window feature – Tools and commands palettes – Media-selection tools and techniques Asset-management features.		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the Audio-Video, Research methodologies, research discussion & publication		

Name of The Course	**Elective-I (4) -Audio-Video Editing Tool & Technology Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAP2063**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiments:

- Experiment for audio levels, color correction, audio mixing
- Experiment forimporting and applying compatible graphics files
- Working with Broadband and streaming video
- Create a trailer
- Give a tour
- Celebrate the holidays
- Re-create a moment in history
- Create a news channel
- Create a personal narrative
- Record interviews (in person or virtually)

Name of The Course	Elective-I - Advance DBMS	L	T	P	C
Course Code	BCAS2028	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

To study basic concepts and major techniques in DBMS implementations. These include concepts and techniques for data storage, query processing, and transaction management. Introduce research development ability in databases through technical survey and presentation

Course Outcomes

CO1	Understand advance database management system techniques.
CO2	Understand in detail query processing and techniques involved in query optimization.
CO3	Understand the principles of concurrency control.
CO4	Understand the principles of recovery management.
CO5	Know recent developments and active research topics in database

Text Book (s)

1. **Database system concepts'*, 5 th Edition –by Abraham Silberschatz, Henry Korth, S,Sudarshan, (McGraw Hill International**
2. **Data Mining: Concepts and systems'*, by Jiawei nan, Micheline Kamber, (Morgan Kaufmann publishers)**

Reference Books

1. **Database systems : "Design implementation and management", by Rob Coronel, 4th Edition, (Thomson Learning Press)**
2. **Database Management Systems by Raghu Ramkrishnan, Johannes Gehrke Second Edition, (McGraw Hill International)**
3. **Database Management System by Alexis Leaon, Mathews Leon, (leon press)**
4. **Fundamentals of Database Systems by Remez Elmasri , Shamkant Navathe**

Unit-1	OODBMBS & ORDBMS	6 hours

OODBMBS & ORDBMS:

Overview of Object-Oriented concepts & characteristics,Objects,

Database design for ORDBMS , Comparing RDBMS, OODBMS & ORDBMS

Advance Database Management System – Concepts & Architecture:

Spatial data management , Web based systems-Overview

of client server architecture, Databases and web architecture,

N-tier ,Architecture, Business logic – SOAP,

Multimedia databases , Mobile

database

Unit-2	Parallel databases and Distributed Databases	8 hours

Parallel databases: Introduction , Parallel database architecture , I/O parallelism , Inter-query and Intra-query parallelism, Inter-operational and Intra-operational parallelism , Design of parallel systems

Unit-3	Distributed Databases	8 hours

Introduction , DDBMS architectures , Homogeneous and Heterogeneous , Databases , Distributed data storage , Distributed transactions , Commit protocols , Availability , Concurrency control & recovery in distributed databases , Directory systems

Unit-4	Knowledge base Systems and Data Warehousing	8 hours

Knowledge base Systems: Integration of expert in database , application & object database overview Data Warehousing: Introduction to Data warehousing , Architecture , Dimensional data modeling- star, snowflake schemas, fact constellation , OLAP and data cubes , Operations on cubes , Data pre-processing -need for pre-processing , data cleaning, data integration and transformation, data reduction

Unit-5	Data Mining	6 hours

Introduction to data mining , Introduction to machine learning , Descriptive and predictive data mining , outlier analysis, clustering – k means algorithm , Classification - decision tree, association, rules - apriori algorithm , Introduction to text mining, Bayesian classifiers

Unit-6	Advancement & Research	4 hours

Advancement in the course, Research methodologies, research discussion & publication

Name of The Course	iOS, Android APP Development Lab	L	T	P	C
Course Code	BCA9003	0	0	2	1
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		70		30	100

Course Objectives:

1. To understand the design aspects of operating system.
2. To study the process management concepts & Techniques.
3. To study the storage management concepts.

Course Outcomes

CO1	To use of an operating system to develop software
CO2	To write software systems based on multiple cooperating processes or threads
CO3	To implement file organization techniques
CO4	To implement file allocation strategies
CO5	To implement process scheduling & synchronization algorithms

Text Book (s)

Reference Book (s)

List of Experiment:

1. Create a basic Android application to display a string ”Welcome to Android” using strings.xml and Explore the directory structure and components of android application.
2. Write a program to create a birthday card displaying greetings using Relative layout and TextViews.
3. Write an Android app that takes user’s name as input in an EditText box and on pressing button “OK” will Toast message Welcome <user name>.
4. Create an Android program for a simple Calculator app using UI controls and show arithmetic operations +, -, /, * and mod operations on two operands. Perform input validation and appropriate processing.
5. Write an Android App to display a menu of fast-food items and accepts users order, accordingly generate a Bill. Use Checkbox, Textview, Toast, and button.
6. Write a program using radio button that will select any one of option from movie type(comedy, horror, action, thriller) and toast the message on submit button is clicked.
7. Write an Android app for selecting <item> using spinner.
8. Write an Android app For Registration Form using Explicit Intent.
9. Write a program that accepts user’s orders for beverages (tea/coffee) and snacks (chips/cookies) and sends order confirmation email to the user with amount payable.
10. Write a program to start another activity using explicit intent to enter user’s information and process response from the activity started in main activity. Use StartActivityForResult.

Value Added Experiments

11. Write an android program for sending SMS using Implicit Intents
12. Write an android app using content provide to access the database.
13. Write an app to create a customized listview of contacts like whatsapp list.

Name of The Course	.Net technology Lab (PBL)	L	T	P	C
Course Code	BCAS2026	0	0	2	1
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		70		30	100

List of Experiments

1. Write a program in C# to add, subtract, multiply, and divide two numbers.
2. Write a program in C# to compute the area of a circle.
3. Write a program in C# to compute the sum of first 100 numbers.
4. Write a program in C# that uses Building class and displays the following output:
5. house has:

3 floors

4 occupants

6. 2500 total area
7. 625 area per person
8. Write a program in C# to handle divide- by-Zero exception.
9. Write a program in Visual Basic to compute the factorial of a number.
10. Write a program in Visual Basic to find the roots of quadratic equation.
11. Write a program in Visual Basic to convert temperature from Fahrenheit to Celsius and vice versa.
12. Write a program in Visual Basic to compute the area of triangle and rectangle.
13. Value Addition Experiments
14. Write a program to display holiday in calendar using ASP.Net.
15. Write a program to display the phone number of an author using database.

Name of The Course	**Linux Administration Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAS2022**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

S.No	**Title of the lab experiment**
1	Study of any Open source software
2	Process for installing ubuntu open source software
3	Study of general purpose utilities commands.
4	Study of user & session management commands.
5	Study of file system navigation commands, text processing tools, communication commands.
6	Study of VI editor.
7	Study of Shell Script
8	Execute C & C++ programs in Linux.
9	Installation of Linux operating system. a. Partitioning drives b. Configuring boot loader (GRUB/LILO) c. Network configuration d. Setting time zones e. Creating password and user accounts f. Shutting down
10	Do the following changes in Grub file a. Write the path where the grub file is located. b. Change the timeout and title of the system.
11	Bash shell a.buit-in commands b.arithmetic expressions c.functions

Name of The Course	**Mobile Application Development**	**L**	**T**	**P**	**C**
Course Code	**BCAS3002**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Introduce the fundamentals and abstract concepts of mobile application.**
2. **Provide students with the tools and knowledge necessary to create applications that can run on mobile devices**

Course Outcomes

CO1	**Understand the technical challenges posed by current mobile devices and wireless communications; be able to evaluate and select appropriate solutions.**

CO2	**Select and evaluate suitable software tools and APIs for the development of a particular mobile application and understand their strengths, scope and limitations.**
CO3	**Use an appropriate application development to design, write and test small interactive programs for mobile devices.**

Text Books

1. **Pogue, iPhone: The Missing Manual (4th ed.) , Pogue Press, 2010. ISBN: 978-1449393656**

Reference Books

1. Guy Hart-Davis, How to Do Everything iPod, iPhone & iTunes (5th ed.), McGraw-Hill Osborne Media, 2009. ISBN: 978-0071630245
2. W. Frank Ableson; Robi Sen; Chris King; C. Enrique Ortiz, Android in Action (3rd ed.), Manning Publications, 2012. ISBN: 978-1-61729-050-3 ISBN: 978-0-13-705842-6

Unit-1	**Mobile Application Development Overview**	**6 hours**
Mobile (Cellular) Telephony: mobile devices/radio communications, 1G/2G/3G/4G, carriers device and carrier dependence and independence, Categories of Mobile Apps: phone-related, Internet/Web-based, games, GPS-based, standalone utilities, integration utilities, Platform Overview, Mobile Devices Profiles, Mobile Software, Options for development, Common UI Elements		
Unit-2	**Architecture, interfaces**	**8 hours**
Software architecture, application models, user interfaces, **Data storage:** ordinary UNIX File System files, SQ Lite Databases, object persistence. **Networking:** Internet, Bluetooth, Near-Field Communication (NFC). **On-board instruments:** accelerometers, compass, GPS, etc. **Specific devices:** Apple iOS (iPhone/ iPad/ iPod Touch), Android devices		
Unit-3	**Platforms and Develop environments**	**8 hours**
Operating platforms: Apple iOS, Google Android, windows iPhone7, Development environments: Xcode /Cocoa Frameworks/Objective-C/ iOS simulator, Eclipse (w. Android Development Tools)/Android Application Framework/Java/Android device emulator		
Unit-4	**Introduction to Android Programming**	**8 hours**
Installing Android Development Tools , Core Java Concepts, Introduction of android Framework, Android Development Tools, Creating Android Application and Activities, All controls, View Groups (Gallery,Gridview..etc)		
Unit-5	**Android Application Development**	**6 hours**
Working with Menus, Intent, 2DGraphics, 2D animation, Audio, Video, Preferences(with all controls), Using File System (from Internal and External), Accessing Sdcard, Database and Content Provider Maps, Geo-coding and Location Based Services, Parsing: Dom Parsing, Json Parsing, Sax Parsing, Pull Parsing		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Computer Graphics**	**L**	**T**	**P**	**C**
Course Code	**BCAS3003**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **To introduce students to the basics of computer graphics.**
2. **Learn how concepts of computer graphics are useful.**

Course Outcomes

CO1	**Apply mathematics, physics and computer programming to computer graphics applications and write programmes for various output primitives.**
CO2	**Summarize and critically review the routines in computer graphics packages like Paint Brush.**
CO3	**Compare various object representation systems in Graphics systems.**
CO4	**Be immediately ready to contribute in a significant way to the computer graphics industry.**

CO5	**Demonstrate the knowledge, technical skills and personal discipline to be successful in a specialized, computer-based graphics field.**

Text Books

1. **D. Hearn, P. Baker, "Computer *Graphics - C Version"*, 2nd Edition, Pearson Education, 1997**

Reference Books

1. Heam Donald, Pauline Baker M: "Computer Graphics", PHI 2nd Edn. 1995.
2. Harrington S: "Computer Graphics - A Programming Approach", 2nd Edn. Mc GrawHill.
3. Shalini Govil-Pai, Principles of Computer Graphics, Springer, 2004.

Unit-1	**Overview of Graphics Systems**	**6 hours**
Video display devices, Raster-Scan System, Random-Scan, Systems. Random-Scan Systems Graphics monitors and work stations. Input devices: Hard copy devices. Graphics software		
Unit-2	**Output primitives**	**8 hours**
Line drawing algorithms circle generation algorithms. Ellipse Generating, Algorithm. Pixel Addressing. Filled-Area Primitives. Fill Area Function, Cell Array, Character, Generation		
Unit-3	**Attributes of Output Primitives**	**8 hours**
Line Attributes, Curve Attributes, Color and Gray-Scale levels. Area-Fill Attributes, Character Attributes. Bundled attributes. Inquiry functions. Two-dimensional geometric transformations: Basic transformations		
Unit-4	**Transformation**	**8 hours**
Homogenous coordinates, composite transformations, other transformations. Affine transformations, transformation functions, Roster methods for transformations		
Unit-5	**Two-dimensional viewing**	**6 hours**
The viewing pipeline, viewing transformation, viewing functions. Line clipping, Cohen Sutherland line clipping, Liang Barsky line clipping Polygon clipping: Sutherland-Hodgman polygon clipping, Weiler Amerton polygon clipping		

Name of The Course	**E-Commerce**	**L**	**T**	**P**	**C**
Course Code	**BCAS3004**	**3**	**0**	**0**	**3**

Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

To provide students with a good understanding in planning, design, development, deployment and management of e-commerce systems and applications

Course Outcomes

CO1	**Understand the basic concepts and technologies used in the field of MIS and e-commerce.**
CO2	**Policy and regulatory issues in E-commerce.**
CO3	**Implement information systems and e-commerce website.**
CO4	**Handle security threats in electronic commerce.**
CO5	**Use the basic concepts and technologies used in mobile Commerce**

Text Book (s):

1. Ravi Kalakota and Andrew B Whinston, Frontiers of Electronic Commerce, Add. Wesley

Reference Book (s):

1. Pete Loshin, Paul H Murphy, Electronic Commerce, II Edition, Jaico Publishers, 1996.
2. David Whiteley, E-Commerce: Strategy, Technologies and Applications, McGraw Hill, 2000.
3. Daniel Minoli & Emma Minoli – Web Commerce Technology – Tata McGraw Hill, 2002.

Unit-1	**Introduction**	**6 hours**
Infrastructure of Electronic Commerce – Networks – Packet Switched Networks – TCP/IP – Internet Protocol – Domain Name Services – Web Service Protocols – Internet Applications – Utility Programs – Markup Languages – Web Clients and Servers – Internets and Extranets – Virtual Private Network.		
Unit-2	**Core Technology**	**8 hours**
Electronic Commerce Models – Shopping Cart Technology – Data Mining – Intelligent Agents – Internet Marketing – XML and E-Commerce.		

Unit-3	Electronic Payment System	8 hours
Real World Payment Systems – Electronic Fund Transfer – Digital Payment – Internet Payment Systems – Micro Payments – Credit Card Transactions		
Unit-4	**Security and Threats**	**8 hours**
Threats to Network Security – Public Key Cryptography – Network Security Solutions – Firewalls		
Unit-5	**Inter/Intra Organizational Electronic Commerce**	**6 hours**
EDI – EDI Application in Business – Legal, Security and Privacy Issues – EDI and Electronic Commerce – Standards – Internal **IS**		

Name of The Course	Software Project Management	L	T	P	C
Course Code	BCAS3006	3	0	0	3
Prerequisite					
Co requisite		IA	MTE	ETE	TOT
Ant requisite		20	50	100	100

Course Objectives:

Course Outcomes

CO1	Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project.
CO2	Compare and differentiate organisation structures and project structures.
CO3	Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.
CO4	With increase of data size update project schedule and budget considering Big data concept.
CO5	Develop strategies to calculate risk factors involved in IT projects.

Text Book (s)

1. Clifford F. Gray, Erik W. Larson, "Project Management: The Managerial Process with MS", McGraw Hill

Reference Book (s)

1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. 2. Royce, Software Project Management, Pearson Education
3. 3. Kieron Conway, Software Project Management, Dreamtech Press
4. 4. S. A. Kelkar, Software Project Management, PHI Publication.

Unit-1	INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT	6 hours
Project Definition – Contract Management – Activities Covered By SoftwareProjectManagement – Overview Of Project Planning – Stepwise Project Planning		
Unit-2	**PROJECT EVALUATION**	**8 hours**
Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation		
Unit-3	**ACTIVITY PLANNING**	**8 hours**
Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control		
Unit-4	**MONITORING AND CONTROL**	**8 hours**
Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring –Earned Value – Priortizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance		
Unit-5	**MANAGING PEOPLE AND ORGANIZING TEAMS**	**6hours**
Introduction – Understanding Behavior – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The		

Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Elective-II(1) - Multimedia System**	**L**	**T**	**P**	**C**
Course Code	**BCAS3008**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

Get the Knowledge about the basics concepts of multimedia and its applications. Student will get the knowledge of its relevance with internet and its future aspects

Course Outcomes

CO1	**Understand the usage of Hardware and Software tools**
CO2	**Student will gain fundamental knowledge about multimedia and its applications**
CO3	Understand how to use Multimedia using Internet
CO4	**To obtain knowledge of Multimedia-looking towards Future**
CO5	**To understand multimedia using real life examples.**

Text Book (s)

1. **Tay Vaughan, "Multimedia: Making it work", TMH, 1999.**
2. **Ralf Steinmetz and Klara Naharstedt, "Multimedia: Computing, Communications Applications",Pearson, 2001.**

Reference Books

1. Keyes, "Multimedia Handbook", TMH, 2000.
2. Steve Heath, "Multimedia & Communication Systems", Focal Press, UK, 1999.
3. K. Andleigh and K. Thakkar, "Multimedia System Design", PHI, PTR, 2000.
4. Steve Rimmer, "Advanced Multimedia Programming", MHI, 2000.

Unit-1	**Introduction and Hardware & Software**	**6hours**
Introduction : Multimedia - Definitions, Basic properties and medium types.(Temporal and non temporal) . Multimedia applications, Uses of Multimedia, Introduction to making multimedia - The Stages of project, the requirements to make good multimedia, Multimedia skills and training . Hardware and Software for Multimedia: Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals - Connections, Memory and storage devices, Media software - Basic tools, making instant multimedia, Multimedia software and Authoring tools, Production Standards.		
Unit-2	**Building blocks Creating & Editing Media elements**	**10 hours**
Text, image, Sound, animation Analog/ digital video Data Compression: Introduction, Need, Difference of lossless/lossy compression techniques. Brief overview to different compression algorithms concern to text, audio, video and images etc		
Unit-3	**Multimedia and the Internet**	**10 hours**
History, Internet working, Connections, Internet Services, The World Wide Web, Tools for the WWW - Web Servers, Web Browsers, Web page makers,and editors, Plug-Ins and Delivery Vehicles, HTML, Designing for the WWW - Working ,on the Web, Multimedia Applications - Media Communication, Media Consumption, Media Entertainment, Media games		
Unit-4	**Multimedia-looking towards Future**	**10 hours**
Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing, Virtual Reality, Digital Camera. Assembling and delivering a Multimedia project-planning and costing, Designing and Producing, content and talent, Delivering, CD-ROM: The CD family, production,		

process, CD-i – Overview – Media Types Technology		
Unit-5	**Case Studies**	**6 hours**
Case Studies		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Elective-II(2) – Network Security**	**L**	**T**	**P**	**C**
Course Code	**BCAS3010**	**3**	**0**	**0**	**3**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**20**	**50**	**100**	**100**

Course Objectives:

1. **Required for the protection of data against accidental or intentional destruction, disclosure or modification.**
2. **Network security refers to the technological safeguards and managerial procedure which can ensure that organizational assets and individual privacy are protected over the network.**

Course Outcomes

CO1	**Describe the Network Security.**
CO2	**Understand different types of security threats.**
CO3	**Discuss the Security Mechanisms.**
CO4	**List of Access Control**
CO5	**System Security**

Text Books

1. **Stallings, "Cryptography & Network Security, Principles & Practice", 3rd Edition, Prentice Hall, 2002.**

Reference Books

1. Bruce, Schneier, "Applied Cryptography", 2nd Edition, Toha Wiley & Sons, 1996.
2. Man Young Rhee, "Internet Security", Wiley, 2003.
3. Pfleeger & Pfleeger, "Security in Computing", 3rd Edition, Pearson Education, 2003.

Unit-1	**Introduction: Basic Terminology**	**6 hours**
Attacks, Services, Mechanisms, Conventional Encryption, Classical and Modern Techniques, Encryption Algorithms, Confidentiality		
Unit-2	**Public Key Encryption**	**8 hours**
RSA, Elliptic Curve Cryptography, Number Theory Concepts		
Unit-3	**Message Authentication**	**8 hours**
Hash Functions, Digest Functions, Digital Signatures, Authentication Protocols		
Unit-4	**Network Security Practice**	**8 hours**
Authentication, Applications, Electronic Mail Security, IP Security, Web Security		
Unit-5	**System Security**	**6 hours**
Intruders, Viruses, Worms, Firewalls Design Principles, Trusted Systems		
Unit-6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication		

Name of The Course	**Computer Graphics Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAS3005**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiments

	Study of basic graphics functions defined in "graphics.h"
	To implement DDA(Digital Differential Algorithm) for line drawing
	To implement Bresenham's algorithm for line drawing
	To implement Bresenham's algorithm for circle drawing
	To implement Midpoint algorithm for circle drawing
	To implement Midpoint algorithm for ellipse drawing
	To perform 2D Rotation Transformation
	To perform 2-D Translation Transformation
	To perform 2-D Scaling Transformation
	To perform 2-D Reflection Transformation

	To perform a composite Transformation using 2D Transformation
	To implement Cohen-Sutherland 2D Line clipping
	To implement Sutherland Hodgeman Polygon clipping algorithm
	To implement window-viewport mapping
	Value Addition Experiments
	Designing simple animation using transformations
	Value Added Experiments
15	Create an App for calculating Body mass index (BMI)
16	Create an application to call specific entered number by user in the EditText.
17	Write an android program for sending SMS using Implicit Intents.

Name of The Course	**Mobile Application Development Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAS3007**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

List of Experiment:

Sr. No.	Title of Lab Experiments
1	Create an Android application that display an image and give description below it
2	Create an Android app that take name as input from TextBox and Toast a message "Welcome name"
3	Create an Android program for Calculator app
4	Write an android program for Camera app Using Implicit Intents
5	Write an Android program for Quiz app
6	Write an Android app For Registration Form
7	Write An Android program for Time and Date Picker
8	Write an Android app for selecting country using spinner
9	Write an android program for Progress Bar
10	Write an Android app for Rating Bar
11	Write a program for creating contact list using SQLite
12	Write a android App that display x, y, z plane movement of mobile using accelerometer Sensor
13	Write an android app for movement of an image on mobile screen
14	Publish Quiz App and use google analytics

Name of The Course	**Elective II lab (2) – Network Security Lab**	**L**	**T**	**P**	**C**
Course Code	**BCAS3011**	**0**	**0**	**2**	**1**
Prerequisite					
Co requisite		**IA**	**MTE**	**ETE**	**TOT**
Ant requisite		**70**		**30**	**100**

LIST OF EXPERIMENTS:

1. Study of Network Security fundamentals - Ethical Hacking, Social Engineering practices.
2. Implement the following SUBSTITUTION TECHNIQUES
a) Caesar Cipher b) Playfair Cipher c) Hill Cipher
3. Implement the Rail fence – row & Column Transpostition Techniques
4. Implement the DES Algorithm
5. Implement the RSA Algorithm
6. Implement the Diffiee-Hellman Algorithm
7. Implement the MD5 Algorithm e) SHA-1
8. Implement the Signature Scheme - Digital Signature Standard
9. Study and Implement Various IP Security Techniques
10. Study and Implement Various Web Security Techniques
11. Implement system firewall for network security
12. Study of system attacks and prevention methods

GALGOTIAS UNIVERSITY
(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

School of Computing Science and Engineering

Program: M.C.A

Scheme: 2020 – 2021

Curriculum

Semester 1									
Sl. No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
S No.	Course Code	Course Name	L	T	P	C	20	50	100
1	MCAN1110	Problem Solving Techniques	2	0	0	2	20	50	100
2	MCAN1120	Discrete Mathematics	3	1	0	4	20	50	100
3	MCAN1130	Operating System with Linux	3	0	0	3	20	50	100
4	MCAN1140	Database Management System	3	0	0	3	20	50	100
5	MCAN1150	Data Communication & Networking	3	1	0	3	20	50	100
6	MCAN1160	Research Methodology & IPR	2	0	0	2	20	50	100
7	MCAS1111	Problem Solving Techniques Lab	0	0	4	1	70		30
8	MCAN1131	Operating System with Linux Lab	0	0	2	1	70		30
9	MCAN1141	Database Management System Lab	0	0	2	1	70		30
10	MCAN1151	Data Communication & Networking Lab	0	0	2	1	70		30
11		Professional Communication-I	0	0	2	1	70		30
12		Technical Training-1	0	0	2	1	70		30
		Total Credits				22			
Semester II									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCAN1210	Object Oriented Programming with Java	2	0	4	3	20	50	100
2	MCAN1220	Data structure with Algorithm	3	0	2	4	20	50	100
3	MCAN1230	Web Technologies	2	0	2	3	20	50	100
4	MCAN1240	Software Engineering and Testing	3	0	0	3	20	50	100
5	MCAN12	Elective-I	3	0	2	4	20	50	100
6	MCAN12	Elective-II	3	0	2	4	20	50	100
7		Professional Communication-II	0	0	2	1	70		30
8	MCAN	Technical Training-II	0	0	2	1	70		30
9	MCAN5555	Project-I /Term Paper-I (Scopus Indexed Conferences)	0	0	0	2	70		30
		Total Credits				25			
Semester III									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MCAN2310	Android App Development	0	0	6	3	20	50	100
2	MCAN2320	Artificial Intelligence	3	0	2	4	20	50	100
3	MCAN2330	Design & Analysis of Algorithm	3	0	0	3	20	50	100

4	**MCAN23**	**Elective-III**	**3**	**0**	**2**	**4**	**20**	**50**	**100**
5	**MCAN2310**	**Elective-IV**	**3**	**0**	**2**	**4**	**20**	**50**	**100**
6	**MCAN2340**	**Python Programming**	**0**	**0**	**4**	**2**	**70**		**30**
7	**MCAN**	**Campus to Corporate**	**0**	**0**	**2**	**1**	**70**		**30**
8	**MCAN**	**Technical Training-III**	**0**	**0**	**2**	**1**	**70**		**30**
9	**MCAN6666**	**Project-II / Term Paper-II (Scopus Indexed Conferences/ Journal) 0-0-0(2)**	**0**	**0**	**0**	**2**	**70**		**30**
		Total Credits				**24**			
Semester IV									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	**MCAN2410**	**Software Project Management**	**3**	**0**	**2**	**4**	**20**	**50**	**100**
2	**MCAN2420**	**Web Development using Python**	**3**	**0**	**2**	**4**	**20**	**50**	**100**
3	**MCAN2430**	**Research/Technical Seminar (SCI & Unpaid Scopus Journals)**	**0**	**0**	**12**	**6**			
4	**MCAN7777**	**Project (During 4th Semester16 weeks)**				**10**	**50**		**50**
		Total Credits				**24**			

List of Electives

	Track-I	Track-II	Track-III	Trak-IV
Ele-I	**MCAN1211**	**MCAN1221**	**MCAN1231**	**MCAN1241**
	Statistics	Cryptography and Network Security – Ist	Cloud Computing	Java Script
Ele-I	**MCAN1212**	**MCAN1222**	**MCAN1232**	**MCAN1242**
	Probability for Data Science	Routing and Switching Essentials-Ist	Fundamentals of Virtualization & Cloud Computing	Internet Programming
Ele-II	**MCAN1213**	**MCAN1223**	**MCAN1233**	**MCAN1243**
	Data Visualization	Distributed Operating Systems-2nd	Cloud Deployment Model	User Interface Design
Ele-II	**MCAN1214**	**MCAN1224**	**MCAN1234**	**MCAN1244**
	Optimization	Wireless Sensor Networks-2nd	Cloud Organization & Architecture	Mobile Game Development
Ele-III	**MCAN2311**	**MCAN2321**	**MCAN2331**	**MCAN2341**
	Data analysis and handling	Cyber Laws & Security Policies-3nd	Cloud Storage & Disaster Recovery	Web Security
Ele-III	**MCAN2312**	**MCAN2322**	**MCAN2332**	**MCAN2342**
	Data Mining and Business Intelligence	Security Threats and Trends-3rd	Cloud Security & Management	Digital Marketing
Ele-IV	**MCAN2313**	**MCAN2323**	**MCAN2333**	**MCAN2343**
	Digital Marketing	Ethical Hacking-4th	Data Mining and Business Intelligence	E-Business
Ele-IV	**MCAN2314**	**MCAN2324**	**MCAN2334**	**MCAN2344**
	Machine learning	Block chain Technology-4th	Enterprise Resource Planning	Digital Marketing

Name of The Course	**Problem Solving Techniques**			
Course Code	**MCAN1110**			
Prerequisite	**None**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**4**	**3**

Course Objectives:

The objective of this course is to:

1. To introduce students to the concepts of C programming.
2. Provide more emphasis on several topic of C programming like -functions, arrays, pointers, structures, files handling.
3. Learn to develop program using 'C' language.

Course Outcomes

At the end of this course students will be able:

CO1	**Develops basic understanding about the C language.**
CO2	**Makes students gain a broad perspective about the uses of Arrays.**
CO3	**Implement and develop projects using C.**
CO4	**Student able to understand about the Union and Structure.**
CO5	**Develops basic understanding about the functions.**
CO6	**Understanding the latest advances and its applications.**

Text Book (s)

1. E. Balagurusamy – Programming in ANSIC – Tata McGraw Hill 3rd Edition– 2004.

Reference Book (s)

1. B.S. Gottfried – Programming with C – Schaum's Outline Series – Tata McGraw Hill 2nd Edition – 1998.
2. K.R. Venugopal, Sudeep R. Prasad – Programming with C – Tata McGraw Hill - 2002.
3. Yashavant Kanetkar – Let us C – BPB Publications- 5th Edition - 2004.

Unit-1 Introduction 13hours
Identifiers – Keywords– Data Types – Data Type Conversions – Operators – Conditional Controls – Loop Controls– Input/Output operations.
Unit-2 Function 8 hours
Function Prototyping – Function Arguments – Actual vs. Formal Parameters – Pointers – Pointer Variables – Pointers Concepts in Functions – Multiple Indirection
Unit-3 Arrays 8 hours
Arrays – Accessing Array Elements Pointers and Arrays – Arrays as Function Arguments – Function Returning Addresses – Dynamic Memory Allocation – Storage Classes.
Unit-4 Structure and Union 7 hours
Structures – Unions – typedef – enum – Array of Structures – Pointers to Structures – Macros and Pre-processor
Unit-5 File Handling 4 hours
Character I/O – String I/O – Formatting input/output – File I/O – Error Handling during I/O – Command line Arguments
Unit-6 Research 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Discrete Mathematics
Course Code	MCAN1120
Prerequisite	Mathematics
Corequisite	
Antirequisite	

	L	T	P	C
	3	1	0	4

Course Objectives:

The objective of this course is to:

1. Familiarize the students with the basic mathematical concepts and numerical methods.
2. To understand the concepts and results in Mathematical logic, Number theory, Group theory and Numerical methods.

Course Outcomes

At the end of the course student will be able to:

CO1	Understand basic mathematical concepts and numerical methods
CO2	Gain adequate knowledge to find the roots of transcendental equations
CO3	Effectively solve non-linear algebraic equations
CO4	Design and develop various algorithms for problems in Mathematical logic, Number theory, Group theory and Numerical methods
CO5	Easily able to evaluate complex integrals numerically
CO6	Understanding the latest advances and its applications.

Text Book (s)

1. Seymour Lipschutz and Marc Lipson – Discrete Mathematics – Second Edition – Tata McGraw Hill Edition – 2002.
2. Schaums Series – Discrete Mathematics – 2nd Edition.

Reference Book (s)

1. Steven C. Chopra and Raymond P. Canale – Numerical Methods for Engineers – Fourth Edition– McGraw Hill International Edition – 2004.
2. M.K. Venkatraman – Numerical Methods – 12th Edition -National Publications & Co. – 2004.
3. Schaums Series – Numerical Analysis – 2nd Edition

Unit I: Proposition and Logic 10 hours
Propositions and Compound Propositions – Logical Operations – Truth tables – Tautologies and Contradictions – Logical Equivalence – Algebra of propositions – Conditional and Biconditional Statements – Arguments – Logical Implications – Quantifiers – Negation of Quantified Statements – Basic Counting Principles – Factorial – Binomial Coefficients – Permutations – Combinations Pigeonhole Principle
Unit-2 Mathematical Induction 10 hours
Order and inequalities – Mathematical Induction – Division Algorithm – Divisibility – Euclidean Algorithm – Fundamental theorem of Arithmetic – Congruence relation – Congruence Equations – Semigroups – Groups – Subgroups – Normal subgroups – Homomorphisms – Rings – Integral Domains – Fields – Polynomials over a Field.
Unit-3Recurrence Relations 8 hours
Towers of Hanoi, Iterations, Homogeneous linear equations with constant coefficients, particular solution, difference table, finite order differences, Line in a plane in general position
Unit-4 Graph Theory 6 hours
paths, connectivity, subgraphs, isomorphism, trees, complete graphs, bipartite graphs, matchings colourability, planarity, digraphs;
Unit-5 Classification of Languages 6 hours
Overview of Formal Languages : Representation of regular languages and grammars, finite state Machines

Unit-6 **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Operating Systems with Linux			
Course Code	MCAN1130			
Prerequisite	Operating System Basics			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	2	4

Course Objectives:

The objective of this course is to:

1. Learn fundamentals of different operating systems and Linux operating system.
2. Learn how the operating system abstractions such as processes, threads, files, Semaphores, IPC abstractions, shell programming, etc.
3. Learn how the operating system abstractions can be implemented in memory management, and system administration in linux.
4. Learn the principles of file systems in windows and linux environment, protection and security.
5. Learn basics of desktop environments, Widgets and libraries, linux softwares.

Course Outcomes

CO1	**Understand functions and services of Operating system and recognize the command based Linux Operating System.**
CO2	**Understand different type of CPU Scheduling Algorithm and Shell Programming in Linux.**
CO3	**Analyze the memory mgt. concept of Operating System and basic administration in Linux.**
CO4	**Understand the X Window System and Widget Libraries or toolkits.**
CO5	**Understand latest softwares and security features in Linux operating system.**
CO6	**Understanding the latest advances and its applications in Linux.**

Text Book (s)

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2. D M Dhamdhere, “Operating Systems : A Concept based Approach”, 2nd Edition

Reference Book (s)

1. Sibsankar Halder and Alex A Aravind, “Operating Systems”, Pearson Education
2. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education
3. D M Dhamdhere, “Operating Systems : A Concept based Approach”, 2nd Edition.

Unit-1 Fundamentals Concepts of OS **8 hours**
Introduction – Types of Operating Systems, General System Architecture, Linux Basics: History of Linux: (History, FOSS, current Linux Distributions-Distros examples), Linux Operating System Layers, The Linux Shell (different kinds of shell),

Process: (parent and child processes), Files and Directories.
Unit-2 Process management and Shells 10 hours
Process Management: Process concept – Concurrent process scheduling concepts – CPU scheduling – Scheduling, Critical Section, Semaphores, Interprocess Communication. Deadlocks: Characterization, Prevention, Avoidance and Detection. Getting Started With Shell Programming: The bash shell, Shell commands, The role of shells in the Linux environment, Setting up permissions on a script, Execute a script, Variables in shell, Rules for Naming variable name, Display the value of shell variables, Unset shell and environment variables, Getting User Input Via Keyboard, Commonly Used Commands and Utilities.
Unit-3 Memory Management and Basic Administration in Linux 9 hours
Storage management – Swapping, single and multiple partition allocation – paging – segmentation – page segmentation, virtual memory – demand paging – page replacement and algorithms, thrashing. Basic System Administration (Run levels, User accounts), Kernel Administration: (Linux kernel sources, rebuilding kernel, installing kernel), Managing Users.
Unit-4 Files Systems and Editing Files 9 hours
Files and protection – file system organisation – file operations – access methods – consistency semantics – directory structure organisation – file protection – implementation issues – security encryption. File Systems: Linux Files, Directories and Archives, The vi editor, awk, sed
Unit-5 The X Window System 8 hours
Desktop (Desktop environments - GNOME, KDE, XFCE) The X Window System ,Xorg, Window manager, Display Managers, Widget Libraries or toolkits (Athena Widgets, Motif toolkit, Gtk, Qt, LessTif)
Unit-6 6 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered..

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**DATABASE MANAGEMENT SYSTEMS**			
Course Code	**MCAN1140**			
Prerequisite	**Computer fundamentals**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**2**	**4**

Course Objectives:

The aim of this course is to introduce the students to basic concepts of databases and database management systems with emphasize on relational databases. The entity relationship diagram helps the students to design the database and the concept of normalization. The SQL and PL/SQL are taught so as teach how to create tables, manipulate table and how to create stored procedure. The objective of the course is make the students well versed with relational database and introduce them to the concepts of object-oriented

database, multimedia database and distributed databases.

Course Outcomes

CO1	**Understand the relational database theory, application of database system in real life.**
CO2	**Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.**
CO3	**Learn and apply Structured query language (SQL) for database definition and database manipulation.**
CO4	**Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.**
CO5	**Understand various issues of transaction processing and concurrency control mechanism.**
CO6	**Understanding the latest advances and its applications in DBMS.**

Text Book (s)

1.Henry F. Korth and Abraham Silberschatz, Database System Concepts, McGraw Hill International Publications, 2002.

Reference Book (s)

1. Gerald V. Post – Database management systems – Designing and Building Business Applications – McGraw Hill International edition – 2nd Ed , 2002.
2. Thomas Connolly, Carolyn Begg - Database System – Pearson Education
3. Raghu Ramakrishnan – Database Management Systems – WCB/McGraw Hill , 3rd Ed, 2003.
4. Ivan Bayross - Pl Sql book
5. C.J.Date: Introduction to Database Systems, Pearson Education.
6. Elmasri Navrate: Data base Management System, Pearson Education.

Unit-1 Introduction to Database Management System 8 hours
An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models, schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.
Unit-2 Entity Relationship Model 8 hours
An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models, schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.
Unit-3 Relational Model and SQL Query 8 hours
Relational data model concepts, integrity constraints, entity integrity, referential integrity, **Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and** **domain calculus.** **Introduction on SQL, Characteristics of SQL, advantage of SQL. SQl data type and literals.** **Types of SQL commands. SQL operators and their procedure. Tables, views and indexes.** **Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins,** **Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PLSQL.**
Unit-4 Normalization 8 hours
Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, Alternative approaches to database design.
Unit-5 Overview of Transaction Management and Concurrency Control 8 hours
Overview of Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of transaction, Lock Based Concurrency Control, Performance Locking, Transaction Support in SQL, Introduction to Crash recovery.

Concurrency Control: Serializability, and recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Dead Locks, Specialized Locking Techniques, Concurrency without Locking.
Unit-6 **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**DATA COMMUNICATION & NETWORKING**				
Course Code	**MCAN1150**				
Prerequisite	**Fundamental of Information Technology**				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**2**	**2**	**4**	

Course Objectives:

Students are expected to learn basics of Communication Technologies and data communication which will help them to build fundamentals for learning Computer Networks in higher semester. The course is designed to let students demonstrate an understanding of the fundamentals of data communication, types of transmission mediums and interfacing standards along with current edge of the data compression techniques.

Course Outcomes

At the end of the course student will be able to:

CO1	**To develop knowledge about physical structure of computer network**
CO2	**To analyse the problem in different layer during the communication in network**
CO3	**To identify the issues in network during the data transfer**
CO4	**Able to understand the different types of routing**
CO5	**Able to understand the connection management in network at transport layer**
CO6	**Understanding the latest advances and its applications in Data Communications and networking**

Text Book (s)

1. L. L. Peterson and B. S. Davie, Computer Networks: A Systems Approach, 4th Ed, Elsevier India,

2. A. S. Tanenbaum, Computer Networks, 4th Ed, Pearson India

Reference Book (s)

1. Forouzen, "Data Communication and Networking", TMH

2. A.S. Tanenbaum, Computer Networks, Pearson Education

3. W. Stallings, Data and Computer Communication, Macmillan Press

4. S. Keshav, An Engineering Approach to Computer Networking, 1st Ed, Pearson India, 1999.

4. J. F. Kurose and K. W. Ross, Computer Networking: A Top Down Approach, 3rd Ed, Pearson India, 2005

Unit-1 Introduction to Computer Network and Data communication 8 hours
Introduction to Computer Network: Definition and Uses of

Computer Network, Criteria for a Data Communication Network, Classification of Computer network, Network Architecture, OSI Reference Model.
Data communication: Data Communication, Transmission Impairments, Transmission Medium.
Data Encoding: Line Encoding, Types of Line Coding, Analog-to-Digital Conversion- Pulse code modulation (PCM), Delta modulation (DM);Transmission Modes.

Unit-2 Data Link Layer
8 hours

Error Detection and Correction- One and two dimensional parity checks, Hamming code, Cyclic redundancy check (CRC); Framing- Character stuffing, Bit stuffing; Flow and Error Control

Error Correction and Detection Protocols: Protocols for Noiseless Channels- Simplest protocol, Stop-and-wait protocol; Protocols for Noisy Channels- Stop-and-wait automatic repeat request, Go – back – N – automatic repeat request, Selective repeat automatic repeat request.
Data Link Control protocols: High- level Data Link Control Protocol (HDLC), Point-to-Point Protocol (PPP). MAC and LLC Sub-layers-Channel Allocation Problem, Pure ALOHA and Slotted ALOHA, Persistent and non-persistent CSMA.
Wired LANs: Ethernet: IEEE 802 Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet.

Unit-3 Routing
8 hours

Traffic Engineering
Principles: Congestion Control Algorithms- General principles of congestion control, Congestion prevention policies; Quality of Service- Traffic shaping, Leaky bucket algorithm, Token bucket algorithm; Integrated Services.

Network Layer: IP Addressing Scheme, Subnet Addressing, Subnet Masks, IPV4 Addressing, IPV6 Addressing, Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP).

Unit-4 Memory Unit
8 hours

Unicast Routing: Routing Characteristics, Routing Algorithms, Comparison of Routing Algorithms.

Broadcast and Multicast Routing: Broadcast Routing, Multicast Routing, Routing in Ad Hoc Networks.

Unit-5 Transport and Application Layer
8 hours

Transport Layer: Services of Transport Layer, Connection Establishment, Connection Release, Transport Layer Protocols- TCP protocol, UDP protocol; Congestion.

Application Layer: Simple Mail Transfer Protocol (SMTP), Sendmail Tool, File Transfer Protocol (FTP), Telnet Protocol.

Internet and WWW: Internet basics, Hypertext Transfer Protocol (HTTP), World Wide Web (WWW), Security in Internet, E-mail Security.

Unit-6 Advance Research Topics of Networking

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	**30**	**50**	**100**

Course Code: MCAN1151	**Data Communication and Networking Lab**	L	T	P	C
Version No. 01	**Date of Approval:**	**0**	**0**	**2**	**1**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVE:

This course covers the concepts of data communication and computer networks.

It comprises of the study of the standard models for the layered protocol architecture to communicate between autonomous computers in a network and also the main features and issues of communication protocols for different layers. Topics covered comprise of introduction to OSI and TCP/IP models also.

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Describe the hardware, software components of a network and their interrelations.
2. Compare OSI and TCP/IP network models.
3. Describe, analyze and compare different data link, network, and transport layer protocols.
4. Design/implement data link and network layer protocols in a simulated networking environment.

LIST OF EXPERIMENTS:

1.Study of different types of Network cables and Practically implement the cross-wired cable and

straight through cable using clamping tool.

2.Install and Configure Wired and Wireless NIC and transfer files between systems in LAN and WirelessLAN.

3 Install and configure Network Devices: HUB, Switch and Routers.

4 Connect the computers in Local Area Network.

5 Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).

6 Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.

7 Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the

network issues.

8 Transfer files between systems in LAN using FTPConfiguration, install Print server in a LAN and share the printer in a network.

9 Study of basic network command and Network configuration commands

10 Configure a Network topology using packet tracer software

11 Configure a Network topology using packet tracer Software

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	**30**	**100**

Name of The Course	PROFESSIONAL COMMUNICATION-1			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	2	1

Course Outcomes

At the end of the course student will be able to:

CO1	**Student will understand about the barriers and communication.**
CO2	**Student will learn about the non verbal communication.**
CO3	**Student will learn about the writing of business letter.**
CO4	**Student will understand about the pronunciation.**
CO5	**Student will able to learn structure of letter.**
CO6	**Understanding the latest advances and its applications in professional communication.**

Unit -1	**Professional Communication**	**8 hours**
Purpose, Process & Classification of Communication Barriers of Communication **7Cs of Communication**		
Unit -2	**Non-Verbal Communication**	**8 hours**
Role of Non-Verbal Communication Classification of Non-Verbal Communication Guidelines for developing Non-Verbal Communication		
Unit -3	**Written Communication**	**8 hours**
Structure & Layout of Business letters **Type of Letters: Sales, Order, Complaint, Enquiry, Memo, Circular, Notice, etc.**		
Unit -4	**Spoken**	**8 hours**
Introduction to Pronunciation **Group Discussion, Mock Interviews**		
Unit -5	**Practical**	**8 hours**
Exercises		
Unit -6	**Advancement & Research**	**4 hours**
Advancement in the course, Research methodologies, research discussion & publication.		

Research Methodology & IPR

Technical Training-1

Name of The Course	OBJECT ORIENTED PROGRAMMING WITH JAVA			
Course Code	MCAN1210			
Prerequisite	None			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	2	4

Course Outcomes

CO1	Overview of OOP and Java basics
CO2	Understand about dynamic modelling concepts
CO3	Understand the use and write program based functional modelling
CO4	Understand multithreading and I/O in Java Programming
CO5	Know the software development practices in java programming language
CO6	Understanding the latest advances and its applications in Object oriented programming with JAVA.

Text Book (s)

1. Venugopal – Mastering C++ - Tata McGraw Hill-2001.

Reference Book (s)

1. James Rumbaugh etal, “Object Oriented Modeling and Design”, PHI

2. Herbert Schieldt, “The Complete Reference: Java”, TMH.

3. E. Balagurusamy, “Programming in JAVA”, TMH.

References:

1. Booch Grady, “Object Oriented Analysis & Design with application 3/e”, Pearson Education, New Delhi.

2. Bjarne Stroustrup, “C++ Programming Language”, Addison Wesley

3. E. Balagurusamy, “Object Oriented Programming with C++”, TMH

Unit-1 Introduction 8 hours
Object Modeling: Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, Meta data, candidate keys, constraints.
Unit-2 Dynamic Modelling 8 hours
Dynamic Modeling: Events and states, operations, nested state diagrams and concurrency, advanced dynamic modeling concepts, a sample dynamic model.
Unit-3 Functional Modelling 8 hours
Functional Modeling: Data flow diagram, specifying operations, constraints, a sample functional model. OMT (object modeling techniques) methodologies, examples and case studies to demonstrate methodologies, comparisons of methodologies, SA/SD, JSD.
Unit-4 Java Programming Language 8 hours
Java Programming: Introduction, Operator, Data types, Variables, Methods & Classes, Multithread Programming, I/O, Java Applet. **Java Library: String Handling, Input/Output exploring Java.io, Networking, Applets classes, Event Handling, Introduction to AWT, Working with window, Graphics, AWT Controls, Layout Manager and Menus, Images, Additional packages**
Unit-5 Software Development using java 8 hours
Software Development using Java:Java Beans, Java Swing, Java Servlets, Migrating from C++ to java, Application of java, Dynamic Billboard Applet, Image Menu: An image based menu, Lavatron Applets, Scrabblets, JDBC, Brief functioning of upper layer E-mail and their applications

Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Data Structure with Algorithm			
Course Code	MCAN1220			
Prerequisite	C Programming			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	2	4

Course Objectives:
The objective of this course is to:

- Be familiar with basic techniques of algorithm analysis
- Be familiar with writing recursive methods
- Master the implementation of linked data structures such as linked lists and Stack and binary trees
- Understanding with several sorting algorithms including quicksort, mergesort and heapsort
- Understanding with some graph algorithms such as shortest path and minimum spanning tree and file Organization
- Master analyzing problems and writing program solutions to problems using the above techniques

Course Outcomes

CO1	**To identify and define the most appropriate data structure(s) for a given problem. Analyse complexity of algorithms**
CO2	**To become expert in using linear data structures like Stacks, Queues and Linked Lists**
CO3	**To be conversant in using non-linear data structure,Tree**
CO4	**To become proficient in using non linear data structure, Graph**
CO5	**To understand all popular Searching and Sorting algorithms and learn when to use which sorting and searching algorithm**
CO6	**Understanding the latest advances and its applications in Data structure and Algorithm.**

Text Book (s)

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data Structures” \

Reference Book (s)

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication Using C and C++” , PHI
2. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
3. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
4. G A V Pai, “Data Structures and Algorithms”, TMH.

Unit-1 Introduction 8 hours
Abstract Data Types, Asymptotic Notations , Time and space complexity of algorithms.,

Elementary data structures and their applications. **Array Definition, Single and Multidimensional Arrays, application of arrays, String Operation, Ordered List, Sparse Matrices, Lower and Upper Triangular matrices, and tri-diagonal matrices.**
Unit-2 Stacks, Queues and Linked lists **8 hours**
Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Linked Representation of Stack, Operations Associated with Stacks, Applications of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Deque, and Priority Queue
Unit-3 Trees **8 hours**
Trees – Binary Trees – Binary Tree Traversals – Binary Tree Representations – Binary Search Trees – Threaded binary Trees – Application of Trees (Sets) – Binary Search Tree (BST), Insertion and Deletion in BST, AVL Trees
Unit-4 Graphs **8 hours**
Representation of Graphs, Graph Traversal algorithms, Applications of Graphs, Minimum Cost Spanning Treess, Shortest Path Problems, Topological Sorting, Strongly connected Component
Unit-5 Sorting and Searching **8 hours**
Linear & Binary search, Hash table and Hashing. **Sorting: Bubble sort, Insertion sort,Selection sort, Quicksort, Shellsort, Mergesort.**
Unit-6 **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Web Technology**			
Course Code	**MCAN1230**			
Prerequisite	**None**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**

Course Objectives:

The objective of this course is to:

1. Enable the students to understand web-based site planning, management and maintenance.
2. Explain the concept of developing advanced HTML,ASP,JavaScript, XML pages.
3. This course enables students to develop web sites which are secure and dynamic in nature.
4. Design and implement an internet database application using existing tools and techniques.

Course Outcomes

CO1	**To develop web page using HTML with formatting, links, tables, list and frames.**
CO2	**To learn the basics of DHTML**
CO3	**To understand the basics of java script and how to embed it in HTML**
CO4	**To learn dynamic web page creation**
CO5	**To know the basics of VB script and ASP.net**

CO6	**Understanding the latest advances and its applications in Web Technology.**

Text Book (s)

1.Bates C, "Web Programming - Building Internet Application", Second Edition, Wiley-Dreamtech India Pvt. Ltd., 2002.

2. Pitter K, Amato S and Callahan J et al, "Every students guide to the Internet", Tata McGraw

Reference Book (s)

1. Deitel, "Java for programmers", Pearson Education
2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication.
3. Jackson, "Web Technologies" Pearson Education
4. Patel and Barik, "Introduction to Web Technology & Internet", Acme Learning.

Unit-1 Introduction 8 hours
Introduction to Web Designing – Web Server, Web Client – Browser & Web Server Communication – HTTP Protocol – HTML Document Basic Structure – Creating Links between Documents – Creating Tables – Creating Forms – The Input Element – Select Element – Text Area Element.
Unit-2 DHTML and VB Script 8 hours
DHTML Object Model – Underlying Principles of the DHTML – Basic Components of DHTML – Introduction of Scripting – Scripts in HTML – VBScript – Variables – Functions – Intrinsic Functions – Conditional & Loops – VBScript Objects – Building a Sample Form.
Unit-3 Java Script 8 hours
JavaScript – Introduction to JavaScript – Variables – Conditional and Loops – Events – Functions – Frames – HTML document – Predefined Objects – Image Object – Layers – Drag and Drop – Building a Sample Form.
Unit-4 Cascading Style Sheets 8 hours
CSS – Introduction to Cascading Style Sheets – Inline Styles – Style Sheets – Grouping & Short Hand Properties – Inheritances – Classes – Link – Cascading Styles – Dynamic Style – Multimedia on the Web – Playing Multimedia – Streaming Multimedia – Animated GIFs – Creating Video Audio for the Web.
Unit-5 Active Server Page 8 hours
Web Services – ASP Fundamentals – ASP Objects – Application Object – Session Object – Request Object – Response Object – Session Object – Design a Simple Web Page Using ASP –Design a simple web page with database connectivity.
Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Software Engineering and Testing**			
Course Code	**MCAN1240**			
Prerequisite	**Software**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

1. Develop complex systems (including analysis, design, construction, maintenance, quality assurance and project management) using the appropriate theory, principles, tools and processes.
2. Use appropriate computer science and mathematics principles in the development of software systems.
3. Solve problems in a team environment through effective use of written and oral communication skills.
4. Have knowledge of current issues presently involved in effectively performing duties as a software practitioner in an ethical and professional manner for the benefit of society.
5. Practice the lifelong learning needed in order to keep current as new issues emerge.
6. Develop software in at least one application domain.

Course Outcomes

CO1	**The ability to apply software engineering theory, principles, tools and processes, as well as the theory and principles of computer science and mathematics, to the development and maintenance of complex software systems.**
CO2	**The ability to design and experiment with software prototypes.**
CO3	**The ability to select and use software metrics.**
CO4	**The ability to participate productively on software project teams involving students from both software engineering and other majors.**
CO5	**Effective communications skills through oral and written reports and software documentation evaluated by both peers and faculty**
CO6	**Understanding the latest advances and its applications in software engineering.**

Text Book (s)

1.R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill

2. Pankaj Jalote, Software Engineering, Wiley

Reference Book (s)

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International
3. Publishers.
4. S. Desikan and G. Ramesh, “Software Testing: Principles and Practices”, Pearson Education.
5. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.
6. Naik and Tripathy, “Software Testing and Quality Assurance”, Wiley

Unit-1 Introduction **8 hours**
Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models, Selection of Software Process models.
Unit-2Requirement Engineering Process **8 hours**
Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. **Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.**

Unit-3Software Design 8 hours
Software design, Abstraction, Modularity, Software architecture, Effective modular design, Cohesion and Coupling, Architectural design and procedural design, Data flow oriented design, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures. Design Strategies:Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. User Interface Design: User Interface design, Human factors, Human computer interaction, Human, Computer interface design, Interface design, Interface standards.
Unit-4 Coding & Testing 8 hours
Coding:Language classes, Structured Programming, need for structured programming, Coding standards, Coding style, Maintainability of programs, Code documentation – Code efficiency Testing :Software testing , Testing Objectives, Levels of testing– Unit Testing, Integration Testing, System testing, Acceptance Testing, Path testing – Control structures testing –Verification vs Validation and system testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing , Incremental vs Nonincremental testing. Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suite Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code. Inspection, Compliance with Design and Coding Standards. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Bang Metrics, Cyclomatic Complexity Measures: -Control Flow Graphs, DD Graph.
Unit-5Maintenance 8 hours
Maintenance: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.
Unit 6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Android App Development			
Course Code	MCAN2310			
Prerequisite	XML, Java			
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	6	3

Course Objectives:

1. Basics of Android OS
2. Develop Basic and advance Android Apps
3. Publishing and Monetizing the app

Course Outcomes

CO1	**Understand about Android OS and its Development Environment**
CO2	**Concept of concepts of android application development, user interface design, shared preferences.**
CO3	**DevelopBasic and advance android app development for android devices.**
CO4	**Publish the app**
CO5	**Monetize from app development.**
CO6	**Understanding the latest advances and its applications in android app development.**

Text Book (s)

1. W.M Lee, "Begning Android 4 Application Development",Wiley
2. Retro Meier,"Android 4 Application Development",Wiley

Reference Book (s)

1. B. Phillips et al., Android Programming: Big Nerd Ranch Guide (as mentioned above);
2. Christian Keur and Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 6th edition, 2016;
3. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004;
4. Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O'Reilly Media, 2016;
5. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Java 8 in Action: Lambdas, Streams, and Functional-Style Programming, Manning Publications, 2015;

Unit-1 Introduction and Architecture of Android 5 hours
History of Android, Features of Android, Android Devices, Android Versions, Open Handset Alliance (OHA) , Advantages of Android, Comparing Android with other platform, Architecture of Android. Android Directory Structure, Structure of Manifest files, Android Development Tools.
Unit-2 User Interfaces 10 hours
Views, Views Group, Widgets – Button, EditText, CheckBox, TextView, ToggleButton, Layouts, Styles, Themes, Orientation, Screen Size and Density, Unit of measurement - px, dp, sp and dpi,pt, conversion of dp to px
Unit-3 Component s of Android 10 hours
Activities, Activity life cycle,Intents, types of intents, Intent Filter, Fragment, fragment lifecycle, Services, Broadcast receivers, Content providers, Starting a new activity, Sending and Receiving of data.
Unit-4 Advance App Development 10 hours
SQLite database, Cursors and content values, Opening and closing Database, Sensors, Bluetooth, GeoLocation, SMS & MMS, Graphics and Animation
Unit-5 Security, Publishing, Monetizing 5 hours
Security Creating a signing certificate, Signing your applications for distribution, Publishing on Google Play, Monetization strategies, Application promotion strategies, Using Google Analytics
Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	ARTIFICIAL INTELLIGENCE			
Course Code	MCAN2320			
Prerequisite	None			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

The objective of this course is to learn:

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence
2. To provide a basic exposition to the goals and methods of Artificial Intelligence
3. To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
4. Distinguish between a conventional system and an intelligent system.
5. Artificial Intelligent techniques in solving problems of a particular domain

Course Outcomes

CO1	**Understand different types of AI agents and knows various AI search algorithms**
CO2	**Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving .**
CO3	**Know how to build simple knowledge-based systems**
CO4	**Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information**
CO5	**Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems**
CO6	**Understanding the latest advances and its applications in artificial intelligence.**

Text Book (s)

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 2nd Edition,
Pearson Education / Prentice Hall of India, 2004.

Reference Book (s)

1. **Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003**

Unit-1 Introduction 8 hours
Various definitions of AI, Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning – forward & backward chaining Intelligent agents – agents and environments - good 367odelling – the nature of Environments – structure of agents – Problem Solving – problem solving agents – example problems – searching for solutions – uniformed search strategies – avoiding repeated states – searching with partial information.
Unit-2 Searching Techniques 8 hours
Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments – Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems – Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.
Unit-3 Knowledge Representation 8 hours
First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic –

prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation – Ontological Engineering - Categories and objects – Actions – Simulation and events – Mental events and mental objects
Unit-4 Learning 8 hours
Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning – Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming – Statistical learning methods – Learning with complete data – Learning with hidden variable – EM algorithm – Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning
Unit-5 Uncertainty 8 hours
Different types of uncertainty – degree of belief and degree of truth, various probability constructs – prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to 368 odelling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic
Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Design & Analysis of Algorithm**				
Course Code	**MCAN2330**				
Prerequisite	**Mathematics**				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**0**	**2**	**4**	

Course Objectives:

To introduce students, the concepts of algorithm analysis for find out the space and time complexity of different algorithms. Different design techniques such as greedy method, divide and conquer, backtracking, dynamic programming, branch and bound are to be studied for finding the solution to the different problems. It also provides an insight into the basic concepts of NP and NP-hard problems and their relevance in research.

Course Outcomes

CO1	**Ability to analyze the performance of algorithms**
CO2	**Ability to choose appropriate algorithm design techniques for solving problems**
CO3	**Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.**
CO4	**To clear up troubles the usage of set of rules design methods including thegrasping approach, divide and overcome, dynamic programming, backtracking and department and certain**
CO5	**To understand the variations among tractable and intractable problems.**
CO6	**Understanding the latest advances and its applications in algorithms.**

Text Book (s)

T. Cormen, C.E. Leiserson, R.L. Rivest& C. Stein – Introduction to Algorithms – PHI – 2nd Edition, 2005

Reference Book (s)

1. Knuth E. Donald, Art of Computer Programming Sorting and Searching Vol3, Second Edition, Pearson Education.
2. Brassard Bratley, "Fundamental of Algorithms", PHI
3. A V Ahoetal, "The Design and analysis of Algorithms", Pearson Education
4. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia

Unit-1Introduction to Algorithms 8 hours
Introduction to Algorithms & Analysis-Mathematical Preliminaries , Design of Algorithms, Growth of function, Complexity of Algorithms, Asymptotic Notations, Recurrences. Sorting: Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix sort, Bucket Sort, Counting sort, Sorting in linear time, Medians and order statistics.
Unit-2Advance Data Structure 8 hour
Advanced Data Structure: Binary Search Trees, Red Black Trees, Augmenting Data Structure Binomial Heap, B-Tree, Fibonacci Heap, and Data Structure for Disjoint Sets, Union-find Algorithm, Dictionaries and priority Queues.
Unit-3Advance Design and Analysis Techniques 8 hours
Advanced Design and Analysis Techniques: Dynamic programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis
Unit-4Graph Algorithms 8 hours
Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem
Unit-5Special Topics in AAD 8 hours
Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials & FFT, Number Theoretic Algorithms.
Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Python Programming**			
Course Code	**MCAN2340**			
Prerequisite	**Programing language**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

Upon the successful completion of this course, the student will be able to:

• Install and run the Python interpreter
• Create and execute Python programs
• Understand the concepts of file I/O
• Be able to read data from a text file using Python
• Plot data using appropriate Python visualization libraries

Course Outcomes

At the end of the course student will be able to:

CO1	**Familiarity about concepts of Python Programming. Broaden the knowledge about Variables, expressions and Functions in Python.**
CO2	**Broaden the knowledge about Branching and Iteration. To have hands on skills on String Manipulation, Guess and Check, Approximations, Bisection**
CO3	**To learn about Abstractions, Tuples, Lists, Dictionaries and Illustrative programs**
CO4	**Files, Modules, Packages and Testing, Debugging, Exceptions, Assertions:**
CO5	**Understanding and analyzing Object Oriented Programming:**
CO6	**Understanding the latest advances and its applications in python.**

Text Book (s)

Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

Reference Book (s):

1. Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173

2. Data Structures and Algorithms in Python by Michael T Goodrich and Robertto Thamassia, Micheal S Goldwasser, Wiley Publisher (2016)

3. Fundamentals of Python first Programmes by Kenneth A Lambert, Copyrighted material Course Technology Inc. 1 st edition (6th February 2009)

4. R. Nageswara Rao, "Core Python Programming", dreamtech

5. Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall

6. Luke Sneeringer, "Professional Python", Wrox

Other useful resource(s):

1. https://onlinecourses.nptel.ac.in/noc18_cs35/preview

2. https://nptel.ac.in/courses/106106145/

3.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introductionto-computer-science-and-programming-in-python-fall-2016/index.htm

4. https://docs.python.org/3/tutorial/index.html

Unit-1: Getting Started with Python 8 hours
Informal introduction to Python programming language: What is a program?, What is debugging?, Formal and natural languages, Downloading and installing Python., The first program, Debugging Variables, expressions and Functions in Python Values and types, Variables, Variable names and keywords, Operators and operands, Expressions and statements, Interactive mode and script mode, Order of operations, String operations, Function calls, Type conversion functions, Math functions, Composition, Adding new functions, and uses, Flow of execution Parameters and arguments, Branching and Iteration: Loops, Multiple assignment, Updating variables, The while statement, Break
Unit-2: Diving Into Python 8 hours **String Manipulation, Guess and Check, Approximations, Bisection: String manipulation, Guess and check algorithms (e.g: find Square Root etc), Approximate solutions (e.g Successive approximation), Bisection method. Abstraction Tuples, Lists, Dictionaries, Illustrative programs: - Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; - Tuples: tuple assignment, tuple as return value; - Dictionaries: operations and methods; advanced list**

processing – list comprehension; Exception Handling
Unit-3: Object Oriented Oriented **8 hours**
Files, Modules, Packages: Files and exception: text files, reading and writing files, format operator, Packages, Illustrative programs: word count, copy file. Testing, Debugging, Exceptions, Assertions: Unit testing framework(unit test), debugger for Python program(pdb), Handling an exception **Classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects - OOP, inheritance, polymorphism, operator overloading, abstract classes.**
Unit-4: Data Structure and Algorithms **8 hours**
Algorithm and Data Structure: Stack, Queue, Linked List, Tree, ordered list, Searching, and Sorting, Introduction to Recursion, Divide and Conquer Strategy, Greedy Strategy, Graph Algorithms.
Unit-5: Database and Advanced Topics **8 hours**
Database Concepts and connecting using Python, Creating Database and Tables with Python, Inserting Data and retrieving data, Updating Data in a Table, Deleting data from Table/Deleting Table, **Advanced Topics: Regular Expression, Networking and Multithreaded Programming – Sockets, Threads and Processes, Chat Application**
Unit -6 **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Software Project Management**			
Course Code	**MCAN2410**			
Prerequisite	**Software**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

This course is aimed at introducing the primary important concepts of project management related to managing software development projects. They will also get familiar with the different activities involved in Software Project Management. Further, they will also come to know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.

Course Outcomes

CO1	**The ability to apply software engineering theory, pri well as the theory and principles of computer science development and maintenance of complex software s**
CO2	**The ability to design and experiment with software p**
CO3	**The ability to select and use software metrics.**
CO4	**The ability to participate productively on software pr from both software engineering and other majors.**
CO5	**Effective communications skills through oral and wr documentation evaluated by both peers and faculty**
CO6	**Understanding the latest advances and its applicatio management.**

Text Book (s)

1. Software Project Management by M. Cotterell

Reference Book (s)

1. Information Technology Project Management
2. Management Information and Control by
3. Software Project Managemnet by S. A. Kelkar

Unit-1 **8 hours**
Introduction and Software Project Planning Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.
Unit-2 **8 hours**
Project Organization and Scheduling Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.
Unit-3 **8 hours**
Project Monitoring and Control Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.
Unit-4 **8 hours**
Software Quality Assurance and Testing Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.
Unit-5 **8 hours**
UNIT-V: Project Management and Project Management Tools Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.
Unit-6 **5hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**

20	**30**	**50**	**100**

Name of The Course	**Cloud Computing**			
Course Code	**MCAN1231**			
Prerequisite	**Networking**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

To create a framework that effectively makes use of the computational powers and resources of the computer systems within that framework.

Course Outcomes

At the end of the course student will be able to:

CO1	**Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.**
CO2	**Apply fundamental concepts in cloud infrastructures to understand the trade offs in power, efficiency and cost, and then study how to leverage and manage single and multiple data centers to build and deploy cloud applications that are resilient, elastic and cost-efficient.**
CO3	**Discuss system, network and storage and outline their role in enabling the cloud computing system model.**
CO4	**Analyze various cloud security models and apply them to solve problems on the cloud**
CO5	**Design & develop quality strategies for cloud data based on features.**
CO6	**Understanding the latest advances and its applications in cloud computing.**

Text Book (s)

1. Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)

2. Enterprise Cloud Computing by Gautam Shroff,Cambridge

3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

Reference Book (s)

1. Google Apps by Scott Granneman, Pearson

2. Cloud Security & Privacy by Tim Malhar, S. Kumaraswammy, S. Latif (SPD,O'REILLY)

3. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,

4. Cloud Computing Bible by Barrie Sosinsky, Wiley India

5. Stefano Ferretti et.al.,‖QoS–aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing

Unit-1 Introduction to Cloud Computing 8 hours
Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS. Cloud computing platforms: Infrastructure as service:
Unit-2 Introduction to Cloud Technologies 8 hours
Study of Hypervisors Compare SOAP and REST Webservices, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services ,Virtualization Technology: Virtual

machine technology, virtualization applications in enterprises, Pitfalls of virtualization,Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenance using cloud data stores, Data access control for enterprise applications,
Unit-3 Data in the cloud 8 hours
Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model
Unit-4 Cloud security fundamentals 8 hours
Vulnerability assessment tool for cloud, Privacy and Security in cloud Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management-virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.
Unit-5 Issues in cloud computing 8 hours
Issues in cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issue

Unit-6 Advance Research 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Cloud Computing Lab			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	2	1

Course Outcomes

At the end of the course student will be able to:

CO1	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO2	Apply fundamental concepts in cloud infrastructures to understand the trade offs in power, efficiency and cost, and

	then study how to leverage and manage single and multiple data centers to build and deploy cloud applications that are resilient, elastic and cost-efficient.
CO3	**Discuss system, network and storage and outline their role in enabling the cloud computing system model.**
CO4	**Analyze various cloud security models and apply them to solve problems on the cloud**
CO5	**Design & develop quality strategies for cloud data based on features.**

Text Book (s)/

Reference Book (s)

1. To study in detail about cloud computing.
2. Steps to create an application in SAlesForce.com by declarative model
3. Creating an Application in SalesForce.com using Apex programming Language
4. To study & Implement Web services in SOAP for JAVA Applications
5. To study cloud architecture and cloud computing model
6. Installation and Configuration of virtualization using KVM
7. To study and implementation of Infrastructure as a Service
8. To study and implementation of identity management
9. To study and implementation of Storage as a Service
10. To Study Cloud security management

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	**Fundamentals of Virtualization & Cloud Computing**				
Course Code	**MCAN1232**				
Prerequisite	**Networking**				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

Course Objectives:

1. Understand the Importance of Virtualization in Cloud.
2. Gain knowledge on Cloud Computing
3. Understands Cloud Delivery and Cloud Deployment models

Course Outcomes

At the end of the course student will be able to:

CO1	**To Understand the Importance of Virtualization in Cloud.**
CO2	**To Introduce the Cloud deployment models and Cloud delivery models**
CO3	**To Learn the stepping stones for the development of cloud**
CO4	**To Learn the Decision Factors for Cloud Implementations**
CO5	**To Understands the Public, Private and Hybrid ClouD**
CO6	**Understanding the latest advances and its applications in cloud computing.**

Text Book (s)

Text Books

1. Introduction to Virtualization and Cloud Computing by IBM ICE Publication

2. IBM Redbooks | System x Virtualization Strategies

3. PowerVM Virtualization on IBM System p: Introduction and Configuration Fourth Ed**.**

Reference Books

1 Gruman, Galen (2008-04-07). "What cloud computing really means". InfoWorld.

2 "What is Cloud Computing?". Amazon Web Services. 2013-03-19.

3 "Baburajan, Rajani, "The Rising Cloud Storage Market Opportunity Strengthens Vendors,

infoTECH, August 24, 2011". It.tmcnet.com. 2011-08-24. Retrieved 2011-12-02.

Unit-1 Introduction to Virtualization 8 hours
Traditional IT Infrastructure, Benefits of Virtualization, Types of Virtualization, History of Virtualization.
Unit-2 Server, Storage, Network and Application Virtualization 8 hours
Types of Server Virtualization, Hypervisors, Anatomy of Server Virtualization, Benefits of Storage Virtualization, Types of Storage Virtualization, VPN, VLAN, Benefits of Application Virtualization
Unit-3 Introduction to Cloud 8 hours
History, Importance of Virtualization in Cloud, Anatomy of Cloud, Cloud deployment models, Cloud delivery models, Stepping stones for the development of cloud, Grid Computing, Cloud Computing
Unit-4 Cloud Implementations / Cloud Deployment Models 8 hours
Cloud Delivery Models Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Overview,Infrastructure as a Service (IaaS) Cloud Delivery Model, Platform as a Service (PaaS) Cloud Delivery Model, Software as a Service (SaaS) Cloud Delivery Model
Unit-5 Case Study On Virtualization, Cloud Workloads 8 hours
Customer IT Landscape, Triggers of Virtualization, Preparation for Virtualization, Transition Tools for Virtualization, Cost savings , Cloud workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud.
Unit-6 Advance Research 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Fundamentals of Virtualization & Cloud Computing Lab				
Course Code					
Prerequisite					
Corequisite					
Antirequisite					
	L	T	P	C	
	0	0	2	1	

Course Outcomes

At the end of the course student will be able to:

CO1	**To Understand the Importance of Virtualization in Cloud.**
CO2	**To Introduce the Cloud deployment models and Cloud delivery models**
CO3	**To Learn the stepping stones for the development of cloud**
CO4	**To Learn the Decision Factors for Cloud Implementations**
CO5	**To Understands the Public, Private and Hybrid ClouD**

1. Installation of VMWare Workstation.
2. Creation of VM image of Windows XP.

3. Creation of VM image of base operating system.
4. Installation of QEMU on Ubuntu 12.10.
5. Creating and Using Virtual Machine Using QEMU.
6. KVM on Ubuntu 12.10 and managing a VM on it.
7. KVM and guest operating system on CentOS6.3.
8. Installing Guest OS in KVM using Command Line.
9. Installation of VMware ESX Server.

Continuous Assessment Pattern

	Internal Assessment (IA)	End Term Test (ETE)	Total Marks
	70	30	100

Name of The Course	Probability for Data Science			
Course Code	MCAN1212			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Outcomes

At the end of the course student will be able to:

CO1	**To Understand the Importance of data science.**
CO2	**Understanding about the correlation and regression.**
CO3	**To Learn the stepping stones for the sampling and estimation theory.**
CO4	**To Learn the Decision Factors for Tests of Hypothesis and Significance.**
CO5	**To Understands the Public, Private and Hybrid ClouD**
CO6	**Understanding the latest advances and its applications in data science.**

Unit I

Random Variables and probability Distributions: Review of Probability, Probability density function, Cumulative distribution function, Expectation and Variance. Binomial, Poisson and Geometric distributions, Probability density function, Cumulative distribution function, Expectation and Variance, Uniform, Normal, Exponential distributions, Joint distribution and joint density functions, Conditional distribution.

Unit II

Correlation and Regression: Curve fitting by method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Rank correlation, Regression analysis, Linear and non-linear regression, Multiple regression.

Unit III

Sampling and Estimation Theory: Population and sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statistics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Estimators, Point and Interval Estimation, Confidence Interval estimates of population parameters, Confidence intervals for variance of a Normal distribution, Maximum likelihood estimates.

Unit IV

Tests of Hypothesis and Significance: Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value, Special tests of significance for Large and Small samples (F, chi- square, z, t- test), one way ANOVA.

Unit VI

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Name of The Course	Cryptography and Network Security			
Course Code	MCAN1221			
Prerequisite	Networking			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	2	4

Course Objectives:

1. To understand Cryptography Theories, Algorithms and Systems.
2. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes

CO1	Understand OSI security architecture and classical encryption techniques.
CO2	Acquire fundamental knowledge on the concepts of finite fields and number theory
CO3	Understand various block cipher and stream cipher models
CO4	Describe the principles of public key cryptosystems, hash functions and digital signature
CO5	Ability to understand the current legal issues towards information security
CO6	Understanding the latest advances and its applications in Cryptography and network security.

Text Book (s)

1. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6 th Edition
2. Cryptography and Network Security : Atul Kahate, Mc Graw Hill, 3rd Edition

Reference Book (s)

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, Cengage Learning
6. Network Security and Cryptography: Bernard Menezes, Cengage Learning

Unit-1Security Concepts 8 hours
Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.
Unit-2 Symmetric key Ciphers 8 hours
Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.
Unit-3 Cryptographic Hash Functions 8 hours
Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure
Unit-4 Transport-level Security 8 hours

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, **Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security**
Unit-5 E-Mail Security **8 hours**
Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.
Unit-6 **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Cloud Computing**			
Course Code	**MCAN1231**			
Prerequisite	**Networking**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**2**	**4**

Course Outcomes

CO1	**Learn knowledge of Cloud Computing.**
CO2	**Understand cloud computing delivery models.**
CO3	**Understand briefly cloud computing deploymen**
CO4	**Understand briefly cloud computing by deployin**
CO5	**Understanding of security and workload in cloud**
CO6	**Understanding the latest advances and its applicatio**

Text Book (s)

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

Reference Book (s)

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

Unit-1 Introduction **8 hours**
Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning
Unit-2 CLOUD ENABLING TECHNOLOGIES 8 hours
Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation

Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.
Unit-3 CLOUD ARCHITECTURE, SERVICES AND STORAGE 8 hours
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.
Unit-4 RESOURCE MANAGEMENT AND SECURITY IN CLOUD 8 hours
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.
Unit-5 CLOUD TECHNOLOGIES AND ADVANCEMENTS 8 hours
Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.
Unit- 6
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	JavaScript			
Course Code	MCAN1241			
Prerequisite	HTML, CSS			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

- Develop familiarity with the JavaScript language.
- Learn to use best-practice idioms and patterns.
- Understand concepts commonly used in dynamic language programming, such as introspection, higher-order functions, and closures.
- Understand advanced language features such as prototypical inheritance.
- Become adept at implementing client-side interfaces through the use of the DOM, jQuery and AJAX.
- Become familiar with common libraries and tools that are used in web application development.

Course Outcomes

At the end of the course student will be able to:

CO1	**Understand all the basics concept of JavaScript Structure.**
CO2	**Create anonymous functions and closures, and use them.**
CO3	**Design and implement Object classes using class diagrams, constructors, encapsulation, inheritance, and polymorphism.**

CO4	**Student Understand in Web Browser Object and Document Object Model.**
CO5	**Create event listeners and callbacks to respond to user-interface**
CO6	**Understanding the latest advances and its applications in Javascript.**

Text Book (s)

1. **David Flanagan, JavaScript: The Definitive Guide, Oreilly Publication**
2. **Alexei White, JavaScript Programmer's Reference, Wiley Publication**

Reference Book (s)

1. Jon Duckett, Javascript and JQuery: Interactive Efront-End Web Development, **Wiley Publication**
2. Danny Goodman, "JavaScript Bible", Hungery Minds

Unit-1 Introduction to JavaScript 8 hours
JavaScript in Web Pages, Advantages of JavaScript, Writing JavaScript into HTML and Structure of JavaScript, Lexical Structure: Character Set, Comments, Literals, Identifiers and Reserved Words, Optional Semicolon, Type, Values and Variables: Data types, Creating Variables, Global Object, Wrapper Object, Immutable Primitive Value and Mutable Object Reference, Type Conversion, Variable Declaration and Scope, Expression and Operators: Types of Operators, Primary Expression, Function Definition Expression, Property Access Expression, Invocation Expression, Object Creation Expression. Statement: Expression Statement, Compound and Empty Statement, Declaration Statement, Conditional Statements, Looping (while, for, do…While), Jumps(Labeled Statement, break, Continue, return)
Unit-2 JavaScript Object, Arrays and Functions 8 hours
Objects: Creation on Object, Object Literals, Prototypes, Object.create(), Querying and Setting Properties, Deleting, Testing, Enumerating Properties, Properties Getters and Setters, Property Attribute and Object Attribute, Serializing Object. Arrays: Creating Array, Reading and Writing Array Elements, Sparse Array, Array Length, Adding, Deleting and Iterating Arrays, Array Methods(join(), reverse(),sort(), concat(), slice(), splice(),push() and pop(), unshift() and shift(), toString()), Array-Like Object, Staing as Array. Functions: Defining and Invoking Functions, Function Arguments and Paramenters, Functions as Values, Functions as Namespaces, Closures, Function Properties, Methods and Constructor.
Unit-3 JavaScript Classes, Module and Pattern Matching 8 hours
Classes and Modules: Classes and Prototypes, Classes and Constructors, Java-style Classes in JavaScript, Augmenting Classes, instanceof operator, Object-Oriented Technique in JavaScript, Inheritance. Pattern Matching: Defining Regular Expression, String Matching for Pattern Matching. The RegExp Object.
Unit-4 JavaScript Document Object Model 8 hours
Error Handling: try, catch, throw, finally.

Placing Text in Browser: Alert Dialog Box, Prompt Dialog Box, Confirm Dialog Box. **Document Object Model: Introduction, Instance, JavaScript, Assisted Style Sheets DOM, Understanding Object in HTML, Browser Objects, Object Hierarchy.** **JavaScript in Web Browser: Clint Side JavaScript (JavaScript in Web Documents and JavaScript in Web Applications).**
Unit-5 Forms Object and Handling Events 8 hours
Scripting Document: Selecting Document Elements (Selecting Element by ID, Selecting Element by Name, Selecting Element by Type, Selecting Element by CSS Class, Selecting Element by CSS Selector). **Form Object and Methods: Text Element, Password Element, Button (Submit, Reset), CheckBox, RadioButton, Select and Option Element, Multichoice Select List.** **Event Model: onclick, onload, onerror, onmouseover, onmouseout, on focus, onblur, onsubmit, onreset, more DHTML events.** **Other Built-in Objects: String Object, Math Object, Date Object, Object within Object**
Unit-6 **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MCAN1242	Internet Programming	L	T	P	C
		3	0	0	3
Prerequisite/Exposure	C,C++, Java, Python (Any one is sufficient)				
Co-requisites					

Course Objectives

1. To learn the fundamentals of Basic network and SGML.
2. To study the socket programming through Java.
3. To understand the Scripting language.
4. To know about the Dynamic HTML.
5. To have an introductory knowledge about server-side programming.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the internet protocol and concept of URL.
2. Understand the Socket programming through Java.
3. Apply the scripting language to form GUI.
4. Implement the concept of dynamic HTML and CSS.
5. Apply the knowledge of Servlets and JDBC.
6. Understanding the latest advances and its applications in internet programming.

REFERENCES:

1. Deitel, Deitel and Nieto, "Internet and World Wide Web – How to program", Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004.
4. Thomno A. Powell, "The Complete Reference HTML and XHTML", fourth edition, Tata McGraw Hill, 2003.

Course Content

UNIT I BASIC NETWORK AND WEB CONCEPTS 9 hours

Internet standards – TCP and UDP protocols – URLs – MIME – CGI – Introduction to SGML.

UNIT II JAVA PROGRAMMING 9 hours

Java basics – I/O streaming – files – Looking up Internet Address - Socket programming – client/server programs – E-mail client – SMTP - POP3 programs – web page retrieval – protocol handlers – content handlers - applets – image

Course Code: M	**Internet Programming Lab**	L	T	P	C
		0	**0**	**2**	**1**
Prerequisite/Exposure	Any computer Procedural or Object Oriented Languages..				
Co-requisites					

handling - Remote Method Invocation.

UNIT III SCRIPTING LANGUAGES 9 hours

HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.

UNIT IV DYNAMIC HTML 9 hours

Dynamic HTML – introduction – cascading style sheets – object model and collections – event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data

UNIT V SERVER SIDE PROGRAMMING 9 hours

Servlets – deployment of simple servlets – web server (Java web server / Tomcat / Web logic) – HTTP GET and POST requests – session tracking – cookies – JDBC – simple web applications – multi-tier applications.

Unit VI Research 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.

The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	**30**	**50**	**100**

LIST OF EXPERIMENTS

1. Write programs in Java to demonstrate the use of following components Text fields, buttons, Scrollbar, Choice, List and Check box
2. Write Java programs to demonstrate the use of various Layouts like Flow Layout, Border Layout, Grid layout, Grid bag layout and card layout
3. Write programs in Java to create applets

incorporating the following features:

- Create a color palette with matrix of buttons
- Set background and foreground of the control text area by selecting a color from color palette.
- In order to select Foreground or background use check box control as radio buttons
- To set background images

4. Write programs in Java to do the following.

- Set the URL of another server.
- Download the homepage of the server.
- Display the contents of home page with date, content type, and Expiration date. Last modified and length of the home page.

5. Write programs in Java using sockets to implement the following:

- HTTP request
- FTP
- SMTP
- POP3

6. Write a program in Java for creating simple chat application with datagram sockets and datagram packets.

7. Write programs in Java using Servlets:

- To invoke servlets from HTML forms
- To invoke servlets from Applets

8. Write programs in Java to create three-tier applications using servlets

- for conducting on-line examination.
- for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

9. Create a web page with the following using HTML

i) To embed a map in a web page
ii) To fix the hot spots in that map
iii) Show all the related information when the hot spots are clicked.

10. Create a web page with the following.

i) Cascading style sheets.
ii) Embedded style sheets.
iii) Inline style sheets.
iv) Use our college information for the web pages.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	Routing and Switching Essentials				
Course Code	MCAN1222				
Prerequisite	Networking				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

The course should enable the student to understand switch and router specifications, configurations and their protocols.

Course Outcomes

At the end of the course student will be able to:

CO1	Students should know about routing concepts.
CO2	Students should learn about static routing
CO3	Students able to identify the real time problems in switched networks
CO4	Students can analyze the VLAN configurations
CO5	Students can configure and create access control list
CO6	Students can understand the current research trends in networking

Text Book (s)

1. Routing and Switching Essentials Companion Guide by Cisco networking academy. ISBN-10: 1-58713-318-0

2. Scott Empson, CCNA Routing and Switching Portable Command Guide, ISBN10 1587205882, Publisher: Pearson Education.

Reference Book (s)

1. Wendell Odom, CCNA Routing and Switching,

2. https://courses.cs.ut.ee/all/MTAT.08.033/mat/2mrs/

Unit-1 Routing Concepts 8 hours

Introduction, Router Initial Configuration-Router functions, Connect devices, router basic settings, Connectivity of directly connected network. Routing Decisions-switching packets between networks, path determination, Router operation-analyze the routing table, directly connected routes, statically learned routes, dynamic routing protocols
Unit-2 Static Routing 8 hours
Introduction, Implement static route-static routing, types of static routes, Configure static and Default routes-Configure IPv4 static routes, configure IPv4 default routes, configure IPv6 static routes, configure IPv6 default routes, configure floating static routes, configure floating host routes. Troubleshoot static and default route-Packet processing with static routes, troubleshoot IPv4 static and default route configuration. Dynamic routing protocol, RIPv2
Unit-3 Switched networks 8 hours
Introduction, LAN design-coverage networks, elements of converged networks, growing complexity of networks, switched networks, form factors, identify switch hardware, role of switched networks, the switched environment- frame forwarding , switching domains-collision domains, broadcast domains. Switch configuration- basic switch configuration, configure a switch with initial settings, configure switch ports, Switch security-secure remote access, switch port security.
Unit-4 VLANs 8 hours
VLAN segmentation- VLAN definitions, benefits VLANs, types of VLANs, VLAN assignments- VLAN trunks, troubleshoot VLANs and trunks. Inter VLAN routing using routers- Inter-VLAN routing operation, configure legacy Inter VLAN routing, configure router-on-a-stick Inter-VLAN routing.
Unit-5 Access Control List 8 hours
ACL operation-ACL definition, packet filtering, ACL operation, ACL wildcard masking, wildcard mask examples, calculating the wildcard mask, creating ACLs, ACL best practices, Activity-ACL operation, where to place ACLs, Standard ACL placement.
Unit-6 Advance Research Topics of Networking
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Routing and Switching Essential LAB			
Course Code				
Prerequisite	Computer Networks			
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	2	1

Course Outcomes

At the end of the course student will be able to:

CO1	Students should know about routing concepts.

CO2	**Students should learn about static routing**
CO3	**Students able to identify the real time problems in switched networks**
CO4	**Students can analyze the VLAN configurations**
CO5	**Students can configure and create access control list**

Text Book (s)

Book: Cisco Networking Academy (2014), Introduction to Networking, CISCO Press

Hardware Tools: Refer on the link: https://www.netacad.com/group/program/equipment - information Software Tools: CISCO Packet tracer 6.0 or higher.

SL No	List of Experiments	Method
1	**Understand and describe basic switching concepts and the operation of Cisco switches**	**Theory**
2	**Understand and describe the purpose, nature, and operations of a router, routing tables, and the route lookup process**	**Theory**
3	**Understand and describe how VLANs create logically separate networks and how routing occurs between them**	**Theory**
4	**Understand and describe dynamic routing protocols, distance vector routing protocols, and link-state routing protocols**	**Theory**
5	**Configure and troubleshoot static routing and default routing (RIP and RIPng)**	**Practical**
6	**Configure and troubleshoot an Open Shortest Path First (OSPF) network**	**Practical**
7	**Understand, configure, and troubleshoot access control lists (ACLs) for IPv4 and IPv6 networks**	**Practical**
8	**Analyze the current research techniques in routing and switching from IEEE, Springer, ACM transaction papers**	**Research paper - review**

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
50	**50**	**100**

Name of The Course	**Cloud Deployment Model**			
Course Code	**MCAN1233**			
Prerequisite	**Web Application Development**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

This module is focused on developing web and mobile applications in the cloud. By the end of this module the student will have a detailed overview of the design and development process involved in creating a cloud based application.

Course Outcomes

At the end of the course student will be able to:

CO1	**Design and develop elegant and flexible cloud software solutions.**
CO2	**Evaluate the security issues related to the development of cloud applications.**
CO3	**Manage and deploy a cloud based application**
CO4	**Research and critique a topic related to Software development in the cloud**

CO5	**Analyze a real world problem and develop a cloud based software solution.**
CO6	**Understanding the latest advances and its applications in cloud deployment model.**

Text Book (s)

1. Jim Webber, Savas Parastatidis, Ian Robinson, "REST in Practice" O'Reilly Media; 1 edition, [ISBN: 978-0596805821] 2010.
2. Eugenio Pace, Dominic Betts, Scott Densmore, Ryan Dunn, Masashi Narumoto, MatiasWoloski, "Developing Applications for the Cloud on the Microsoft Windows Azure Platform" Microsoft Press; 1 edition, [ISBN: 9780735656062] 2010.
3. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

Reference Book (s)

1. Dan Wellman, "jQuery UI 1.6" Packt Publishing [ISBN: 9781847195128] 2009.
2. Peter Lubbers, Brian Albers, Frank Salem, Ric Smith, "Pro HTML5 Programming" A press, [ISBN: 9781430227908] 2010.
3. Lee Babin, "Beginning Ajax with PHP" A press; 1 edition, [ISBN: 9781590596678] 2006.
4. Richard York, "Beginning JavaScript and CSS development with jQuery", Wiley Pub. Indianapolis, IN [ISBN: 9780470227794] 2009.
5. Edward Benson, "The art of Rails", Wiley Pub. Indianapolis, IN [ISBN: 9780470189481] 2008..

Unit-1 DESIGNING CLOUD BASED APPLICATIONS 8 hours
Role of business analyst, requirements gathering, UML, use of state diagrams, wire frame prototypes, use of design tools such as Balsamiq. Selecting front end technologies and standards, Impact of growth in mobile computing on functional design and technology decisions.
Unit-2 CLOUD APPLICATION DEVELOPMENT 8 hours
Technical architecture considerations – concurrency, speed and unpredictable loads. Agile development, team composition (including roles/responsibilities), working with changing requirements and aggressive schedules. Understanding Model View Controller (MVC). Advanced understanding of "views", location, and the presentation layer: Advanced Ajax and JQuery. Presenting to different browsers and devices. Localization and internationalization; Understanding client location and device type. Mobile application development – Android, iOS, WP, RIM, Symbian.
Unit-3 STORING OBJECTS IN THE CLOUD 8 hours
Session management. Advanced database techniques using MySQL and SQL Server, blob storage, table storage. Working with Third Party APIs: Overview of interconnectivity in cloud ecosystems. Working with Twitter API, Flickr API, Google Maps API. Advanced use of JSON and REST.
Unit-4 CLOUD APPLICATIONS AND SECURITY ISSUES 8 hours
Understanding cloud based security issues and threats (SQL query injections, common hacking efforts), SSL, encrypted query strings, using encryption in the

database. Authentication and identity. Use of oAuth. OpenID; Understanding QA and Support: Common support issues with cloud apps: user names and passwords, automated emails and spam, browser variants and configurations. Role of developers in QA cycle. QA techniques and technologies. Use of support forums, trouble ticketing.
Unit-5 APPLICATION DEVELOPMENT 8 hours
Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.
Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Cloud Organization & Architecture
Course Code	MACN1234
Prerequisite	Grid Computing
Corequisite	
Antirequisite	

	L	T	P	C
	3	0	0	3

Course Objectives:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

At the end of the course student will be able to:

CO1	**Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing**
CO2	**Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.**
CO3	**Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing.**
CO4	**Collaboratively research and write a paper on the state of**

	the art (and open problems) in cloud computing.
CO5	**Choose the appropriate technologies, algorithms, and approaches for the related issues.**
CO6	**Display new ideas and innovations in cloud computing.**

Text Book (s)

1. Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M.Kanfman, F.Halper (Wiley India Edition).
2. Enterprise Cloud Computing by Gautam Shroff,Cambridge.
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

Reference Book (s)

1. Google Apps by Scott Granneman,Pearson.
2. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY).
3. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill.
4. Cloud Computing Bible by Barrie Sosinsky, Wiley India.
5. Cloud Computing, Michael Miller, Que Publishing.

Unit-1 Introduction to Cloud Computing 8 hours
Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloud computing - Business driver for adopting cloud computing. Cloud Computing - Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers. Properties, Characteristics & Disadvantages - Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing. Role of Open Standards.
Unit-2 Cloud Computing Architecture 8 hours
Cloud computing stack - Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services. Service Models (XaaS) - Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS). Deployment Models, Public cloud, Private cloud, Hybrid cloud, Community cloud
Unit-3 IaaS, PasS & SaaS 8 hours
Infrastructure as a Service (IaaS): Introduction to IaaS - IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM). Resource Virtualization - Server, Storage, Network. Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service). Renting, EC2 Compute Unit, Platform and Storage, pricing, customers. **Platform as a Service (PaaS): Introduction to PaaS - What is PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management - computation, storage** **Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS**
Unit-4 Service Management in Cloud Computing 8 hours

Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data - Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing
Unit-5 Cloud Security 8 hours
Infrastructure Security - Network level security, Host level security, Application level security. Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location: Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations
Unit-6 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Web Security**			
Course Code	**MCAN2341**			
Prerequisite	**Basic understanding of SQL**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Outcomes

At the end of the course student will be able to:

CO1	**Get an overview of basics of web and web security**
CO2	**Understand security principles of web**
CO3	**Understand client, server, web service attacks**
CO4	**Recognize common vulnerabilities and its prevention**
CO5	**Provide insights on API security, URL redirection and web application security**
CO6	**Understanding the latest advances and its applications in web security.**

Text Book (s)

- Garfinkel, S., & Spafford, G. (2002). Web security, privacy & commerce. " O'Reilly Media, Inc.".

Reference Book (s)

- Zwicky, E. D., Cooper, S., & Chapman, D. B. (2000). Building Internet Firewalls: Internet and Web Security. " O'Reilly Media, Inc.".
- Bhasin, S. (2002). Web Security Basics. Premier Press.
- Ferrari, E., & Thuraisingham, B. (Eds.). (2005). Web and information security. IGI Global.

Unit-1 8 hours
Web Basics: HTML, CSS, JS, URLs, DOM, Frames, HTTP, Navigation, web server, web browser, Architecture of WWW. Introduction to the web security, Web Security Threats, web security model and recent evolution towards client-centric security.

Unit-2 8 hours
Connection Security, SSL, Transport security layer (TLS), Understanding the dangers of an insecure communication channel, HTTPS, latest evolutions for HTTPS deployments. Limitations of HTTPS. Unauthorized access, authentication, authorization and session management. Cryptography basics: public key, symmetric key, message digest function.
Unit-3 8 hours
Client based attacks: Phishing, Session Hijacking, Browser Extension Exploitation, and Man - in - the - Browser Attack. Server based attacks: Directory Traversal, File Inclusion. Application based attacks: Buffer overflow Web service attacks : XML injection, XPATH injection
Unit-4 8 hours
SQL Injection: SQL Basics, Introduction to Database Queries Using SQL, Detecting SQL Injection, Error-Based SQL Injection, Boolean-Based SQL Injection, Time-Based SQL Injection, Preventing SQL Injection Vulnerabilities. CSRF- Cross site request forgery, CSRF defenses, XSS (cross site scripting)
Unit-5 8 hours
API security, API Security Vulnerabilities, API security tools, securing API. URL Redirection, URL Redirection Attacks, Preventing URL Redirection Vulnerabilities. Introduction to web application security, Web Application Vulnerabilities.
Unit-6 Advance Research 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.**
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Web Security Lab**			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Outcomes

At the end of the course student will be able to:

CO1	**Identify web security threats and development of countermeasures**
CO2	**Understand the use of web based password capturing and implementation of hash function**
CO3	**Simulate buffer overflow attack and detects Browser Extension Exploitation**
CO4	**Identify SQL injection, XSS, and CSRF attacks.**
CO5	**Understand different types of vulnerabilities for hacking a websites.**

Text Book (s)

Reference Book (s)

- William Stallings, Lawrie Brown , Computer Security - Principles and Practice , Addison Wesley Professional, 2008
- Ferrari, E., & Thuraisingham, B. (Eds.). (2005). Web and information security. IGI Global.

Unit-1 8 hours
Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome) Study different web security threats and countermeasures.
Unit-2 8 hours
Study of Techniques uses for Web Based Password Capturing Implementation of Hash Functions
Unit-3 8 hours
Implement a code to simulate buffer overflow attack Steps to detect Browser Extension Exploitation
Unit-4 8 hours
To study SQL injection, XSS, and CSRF attacks. Analysis of SQL injection vulnerabilities
Unit-5 8 hours
Study of different types of vulnerabilities for hacking a websites / Web Applications. Analysis of security vulnerabilities of E-Mail Application
Unit-6 Advance Research Topics of Networking
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	DATA MINING AND BUSINESS INTELLIGENCE			
Course Code	MCAN2312			
Prerequisite	Data base			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. Students will be able to use mining tool.
2. Students are able to perform various data warehouse related exercise.

Course Outcomes

At the end of the course student will be able to:

CO1	The student will define the importance of business intelligence by Describing key business intelligence terms.
CO2	The student will identify how various business intelligence systems can contribute to organizational success.
CO3	The students can examine DM concepts and solutions.
CO4	The students will learn data warehouse concepts and solutions
CO5	The students can explore data mining concepts and solutions.
CO6	Understanding the latest advances and its applications in business intelligence software.

Text Book (s)

J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann
2. M. Kantardzic, “Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.

Reference Book (s)

1.Paulraj Ponnian, “Data Warehousing Fundamentals”, John Willey.

2. M. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education.
3. G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, Wiley India.

Unit-1 Overview and concepts
Introduction to reporting and Analyzing data, Raw data to valuable information- Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.
Unit-2 The Architecture of BI and DW
BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations
Unit-3 Introduction to data mining (DM)
Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD process
Unit-4 Data Pre-processing
Introduction to pre-processing of data - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.
Unit-5 Concept Description and Association Rule Mining
Concept of description - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets:

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	DATA MINING AND BUSINESS INTELLIGENCE Lab			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

1. Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
2. Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
3. Understand the data sets and data preprocessing.
4. Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
5. Exercise the data mining techniques with varied input values for different parameters.
6. To obtain Practical Experience Working with all real data sets.
7. Emphasize hands-on experience working with all real data sets.

COURSE OUTCOMES:

1. Ability to understand the various kinds of tools.
2. Demonstrate the classification, clustering and etc. in large data sets.
3. Ability to add mining algorithms as a component to the exiting tools.
4. Ability to apply mining techniques for realistic data.

List of Experiments:

1. Build Data Warehouse and Explore WEKA
2. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets
3. Demonstrate performing classification on data sets.
4. Demonstrate performing clustering on data sets.
5. Demonstrate performing Regression on data sets.
6. Credit Risk Assessment. Sample Programs using German Credit Data
7. Sample Programs using Hospital Management System
8. Simple Project on Data Preprocessing

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	Security Threats and Trends			
Course Code	MCAN2322			
Prerequisite	Computer network, cryptography			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

Objective is to describe fundamental security component in computing along with the security features in programming and operating systems. Identify security requirement both for database and network. Discuss various security management techniques as well as emerging research topics in security threats

Course Outcomes

At the end of the course student will be able to:

CO1	Describe the fundamental security component in computing

CO2	**Apply security features in programming and operating systems**
CO3	**Identify security requirements in database**
CO4	**Differentiate various threats in network security**
CO5	**Apply security management techniques**
CO6	**Understanding the latest advances and its applications in security threats**

Text Book (s)

Charles P.Pfleeger, Shari Lawrence Pfleeger , "Security in Computing" – (3rd Edition). PHI.

Reference Book (s)

A. Kahate , "Cryptography and Network Security" TMH.

Behrouz A. Forouzan, "Cryptography and Network Security", TMH.

Unit-1 : Basic Security in Computing 8 hours
The meaning of computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption algorithms, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions, Uses of Encryption.
Unit-2 Program and Operating System Security 6 hours
Secure Programs, Nonmalicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General- Purpose operating system protected objects and methods of protection memory and addmens protection, File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples.
Unit-3: Security in Data base 6 hours
Introduction to databases, security requirements of database:integrity of the database, access control,user authentication, Reliability and integrity:two-phase update, Redundency/internal consistency, recovery, database disclosure
Unit-4 : Network security 6 hours
Network concepts : network transmission media, protocol layers, addressing and routing, network security attacks:threats to network communications, wireless network security, Denial of service.
Unit-5: Security Management 8 hours
Security Planning, Risk Analysis, Organizational Security policies, Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, case studies of Ethics
Unit-6 Emerging Research Topics 6 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Digital Marketing			
Course Code	MCAN2342			
Prerequisite	No prior knowledge about marketing or digital marketing is required			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

- To understand the detailed spectrum of Digital Marketing.
- To assess present social media presence and Industry benchmarking.
- To understand the application of Social Media tools for marketing, advertising and networking.

Course Outcomes

At the end of the course student will be able to:

CO1	Understand the digital marketing spectrum and Develop insights on current trends - info-graphics.
CO2	Learn basics of Search Engine Optimization (SEO) and Search Engine Positioning.
CO3	Understand Digital Marketing Platforms like Facebook, Twitter, YouTube, etc
CO4	Develops insights on Search engine marketing and importance of Email marketing
CO5	Understand mobile marketing and use of web analytics tools
CO6	Understanding the latest advances and its applications in Digital Marketing.

Text Book (s)

- Seema Gupta (2018) Digital Marketing, Tata Mc GrawHill

Reference Book (s)

- Chaffey, D. (2019). Digital marketing. Pearson UK.
- Damian Ryan, Calvin Jones, and Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page, India.
- Stokes, R. (2011). eMarketing: The essential guide to digital marketing. Quirk eMarketing.
- Zarrella, D. (2009). The social media marketing book. " O'Reilly Media, Inc.".
- Tuten, T. L., & Solomon, M. R. (2017). Social media marketing. Sage.
- Karwal, S. (2015). Digital Marketing Handbook: A Guide to Search Engine Optimization, Pay per Click Marketing, Email Marketing, Content Marketing, Social Media Marketing. CreateSpace Independent Publishing Platform.
- Nitin C Kamat & Chinmay Nitin Kamat (2018) Digital Social Media Marketing, Himalaya Publishing House

Unit-1 8 hours
Introduction to Digital Marketing **Evolution of Digital Marketing from traditional to modern era, Benefits & Opportunity of Digital Marketing, Digital vs. Real Marketing, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Principles and Drivers of New Marketing Environment, Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Content management, SWOT analysis, Digital marketing models, Digital Marketing Channels.**
Unit-2 8 hours
Search Marketing (SEO): Introduction to Search Engine **Ecosystem of a search engine, importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, Meta Tags and Meta Description, On-page & Off-page optimization, Back Link, Internal & External Links, Ranking,**

Local SEO Strategies, Penguin & Panda update recovery process, Revenue Models in Search Engine Positioning.
Unit-3 **8 hours**
Social Media Optimization (SMO) **Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page-Setup and Profile, Social Media Content, Basic concepts – CPC, PPC, CPM, CTR, CR. Advanced Facebook Marketing, Word Press blog creation, Twitter marketing, LinkedIn Marketing, Google plus marketing, Social Media Analytical Tools.**
Unit-4 **8 hours**
Search Engine Marketing **Introduction to Search Engine Marketing, Tools used for Search engine Marketing, PPC /Google AdWords Tool, Display advertising techniques and Report generation.** **Email Marketing:** **Introduction to Email Marketing, Elements of Email, Email List Generation, Email Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing & its use in email marketing.**
Unit-5 **8 hours**
Introduction to Mobile Marketing **Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging** **Web Analytics: Introduction to Web Analytics, Web Analytics – Types & Levels, Introduction of Analytics Tools and it's use case (Google Analytics and others), Analytics Reporting, Traffic and Behaviour Report, Evaluate Conversions**
Unit-6 Advance Research Topics **5 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Digital Marketing Lab				
Course Code					
Prerequisite	NA				
Corequisite					
Antirequisite					
	L	T	P	C	
	0	0	2	1	

Course Outcomes

At the end of the course student will be able to:

CO1	Understand digital marketing tools and conduct of SWOT analysis
CO2	Understand Google Panda Algorithm and SEO strategies
CO3	Create Advertising campaign and a blog
CO4	Understand Ad word algorithm and email marketing software
CO5	Demonstrate the working of App analytics tools

Text Book (s)

Reference Book (s)

- Chaffey, D. (2019). Digital marketing. Pearson UK.

- Damian Ryan, Calvin Jones, and Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page, India.
- Stokes, R. (2011). eMarketing: The essential guide to digital marketing. Quirk eMarketing.

Unit-1 8 hours
Study digital marketing tools and their working **Steps for performing SWOT analysis**
Unit-2 **8 hours**
Create SEO strategy of a business (any). **Understanding Google Panda Algorithm in detail**
Unit-3 **8 hours**
Creating Facebook advertising campaign **Create one blog through any CMS**
Unit-4 **8 hours**
Understanding AdWords algorithm (ad rank) in detail **To Study email marketing software's & understand how to use them**
Unit-5 8 hours
Measuring performance of marketing campaigns via Google analytics **Demonstrate working of App Analytics tools.**
Unit-6 Advance Research Topics of Networking
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	Digital Marketing			
Course Code	MCAN2313			
Prerequisite	No prior knowledge about marketing or digital marketing is required			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

- To understand the detailed spectrum of Digital Marketing.
- To assess present social media presence and Industry benchmarking.
- To understand the application of Social Media tools for marketing, advertising and networking.

Course Outcomes: At the end of the course student will be able to:

CO1	**Understand the digital marketing spectrum and Develop insights on current trends - info-graphics.**
CO2	**Learn basics of Search Engine Optimization (SEO) and Search Engine Positioning.**
CO3	**Understand Digital Marketing Platforms like Facebook, Twitter, YouTube, etc**
CO4	**Develops insights on Search engine marketing and importance of Email marketing**
CO5	**Understand mobile marketing and use of web analytics tools**
CO6	**Understanding the latest advances and its applications in digital marketing**

Text Book (s)

- Seema Gupta (2018) Digital Marketing, Tata Mc GrawHill

Reference Book (s)

- Chaffey, D. (2019). Digital marketing. Pearson UK.
- Damian Ryan, Calvin Jones, and Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page, India.
- Stokes, R. (2011). eMarketing: The essential guide to digital marketing. Quirk eMarketing.
- Zarrella, D. (2009). The social media marketing book. " O'Reilly Media, Inc.".
- Tuten, T. L., & Solomon, M. R. (2017). Social media marketing. Sage.
- Karwal, S. (2015). Digital Marketing Handbook: A Guide to Search Engine Optimization, Pay per Click Marketing, Email Marketing, Content Marketing, Social Media Marketing. CreateSpace Independent Publishing Platform.
- Nitin C Kamat & Chinmay Nitin Kamat (2018) Digital Social Media Marketing, Himalaya Publishing House

Unit-1 8 hours
Introduction to Digital Marketing **Evolution of Digital Marketing from traditional to modern era, Benefits & Opportunity of Digital Marketing, Digital vs. Real Marketing, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Principles and Drivers of New Marketing Environment, Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Content management, SWOT analysis, Digital marketing models, Digital Marketing Channels.**
Unit-2 **8 hours**
Search Marketing (SEO): Introduction to Search Engine **Ecosystem of a search engine, importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, Meta Tags and Meta Description, On-page & Off-page optimization, Back Link, Internal & External Links, Ranking, Local SEO Strategies, Penguin & Panda update recovery process, Revenue Models in Search Engine Positioning.**
Unit-3 **8 hours**
Social Media Optimization (SMO) **Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page- Setup and Profile, Social Media Content, Basic concepts – CPC, PPC, CPM, CTR, CR. Advanced Facebook Marketing, Word Press blog creation, Twitter marketing, LinkedIn Marketing, Google plus marketing, Social Media Analytical Tools.**
Unit-4 **8 hours**
Search Engine Marketing **Introduction to Search Engine Marketing, Tools used for Search engine Marketing, PPC /Google AdWords Tool, Display advertising techniques and Report generation.** **Email Marketing:** **Introduction to Email Marketing, Elements of Email, Email List Generation, Email Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing & its use in email marketing.**
Unit-5 8 hours
Introduction to Mobile Marketing **Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging** **Web Analytics: Introduction to Web Analytics, Web Analytics – Types & Levels, Introduction of Analytics Tools and it's use case (Google Analytics and others), Analytics Reporting, Traffic and Behaviour Report, Evaluate Conversions**
Unit-6 Advance Research Topics
The advances and the latest trends in the course as well as the latest applications of the

areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

MCAN2323	**Ethical Hacking**	**L 3**	T 0	P 0	C 3
Prerequisite	CSE409,CNCS6				
co-requisites	Networking				

Course Objectives

The objective of this course is to:

1. Introduce Student to learn technical foundation of cracking and ethical hacking
2. Aspects of security, importance of data gathering, foot printing and system hacking
3. evaluation of computer security
4. Practical tasks will be used to re-enforce and apply theory to encourage an analytical and problem based approach to ethical hacking

Course Outcomes:

After completion of this course the student will be able to:

Sl. No.	Course Outcomes (COs)
CO1	Learn various hacking methods.
CO2	Perform system security vulnerability testing.
CO3	Perform system vulnerability exploit attacks.
CO4	Produce a security assessment report
CO5	Learn various issues related to hacking
CO6	Understanding the latest advances and its applications in ethical hacking.

Text Books

1. Patrick Engbreston: "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy",1st Edition, Syngress publication,2011.
2. Ankit Fadia : "Unofficial Guide to Ethical Hacking", 3rd Edition , McMillan India Ltd,2006.

Reference Books

1. Simpson/backman/corley, "HandsOn Ethical Hacking & Network Defense International", 2nd Edition, Cengageint, 2011.

Course Content/Syllabus Content

Unit I	**Hacking Windows**	**8**
BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies, URL History, The Registry, Baby Sitter Programs.		
Unit II	**Advanced Windows Hacking**	
Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS		

without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.	
Unit III	**Getting Past the Password**
Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords	
Unit IV	**The Perl Manual**
Perl: The Basics, Scalars, Interacting with User by getting Input, Chomp() and Chop(), Operators, Binary Arithmetic Operators, The Exponentiation Operator(**), The Unary Arithmetic Operators, Other General Operators, Conditional Statements, Assignment Operators. The?: Operator, Loops, The While Loop, The For Loop, Arrays, THE FOR EACH LOOP: Moving through an Array, Functions Associated with Arrays, Push() and Pop(), Unshift() and Shift(), Splice(), Default Variables, $_, @ARGV, Input Output, Opening Files for Reading, Another Special VariableS.	
Unit V	**How does a Virus Work**
What is a Virus?, Boot Sector Viruses (MBR or Master Boot Record), File or Program Viruses, Multipartite Viruses, Stealth Viruses, Polymorphic Viruses, Macro Viruses, Blocking Direct Disk Access, Recognizing Master Boot Record (MBR) Modifications, Identifying Unknown Device Drivers, How do I make my own Virus?, Macro Viruses, Using Assembly to Create your own Virus, How to Modify a Virus so Scan won‟t Catch it, How to Create New Virus Strains, Simple Encryption Methods.	
Unit 5 hours	**6**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**DATA MINING AND BUSINESS INTELLIGENCE**				
Course Code	**MCAN2333**				
Prerequisite	**Database**				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

Course Objectives:

1. Students will be able to use mining tool.
2. Students are able to perform various data warehouse related exercise.

Course Outcomes

At the end of the course student will be able to:

CO1	**The student will define the importance of business intelligence by Describing key business intelligence terms.**

CO2	**The student will identify how various business intelligence systems can contribute to organizational success.**
CO3	**The students can examine DM concepts and solutions.**
CO4	**The students will learn data warehouse concepts and solutions**
CO5	**The students can explore data mining concepts and solutions.**
CO6	**The students can examine and present current trends in business intelligence software.**

Text Book (s)

J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.

Reference Book (s)

1.Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.
2. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
3. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India.

Unit-1 Overview and concepts
Introduction to reporting and Analyzing data, Raw data to valuable information- Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.
Unit-2 The Architecture of BI and DW
BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations
Unit-3 Introduction to data mining (DM)
Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD process
Unit-4 Data Pre-processing
Introduction to pre-processing of data - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.
Unit-5 Concept Description and Association Rule Mining
Concept of description - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets:

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	DATA MINING AND BUSINESS INTELLIGENCE Lab			
Course Code	MCAN2333			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

1. Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
2. Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
3. Understand the data sets and data preprocessing.
4. Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
5. Exercise the data mining techniques with varied input values for different parameters.
6. To obtain Practical Experience Working with all real data sets.
7. Emphasize hands-on experience working with all real data sets.

COURSE OUTCOMES:

1. Ability to understand the various kinds of tools.
2. Demonstrate the classification, clustering and etc. in large data sets.
3. Ability to add mining algorithms as a component to the exiting tools.
4. Ability to apply mining techniques for realistic data.

List of Experiments:

2. Build Data Warehouse and Explore WEKA
2. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets
9. Demonstrate performing classification on data sets.
10. Demonstrate performing clustering on data sets.
11. Demonstrate performing Regression on data sets.
12. Credit Risk Assessment. Sample Programs using German Credit Data
13. Sample Programs using Hospital Management System
14. Simple Project on Data Preprocessing

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	Block Chain			
Course Code	MCAN2324			
Prerequisite	• Cryptography Techniques • Data Structures and Algorithms • Introduction to Programming			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

The objective of this course is to provide conceptual understanding of how block chain technology can be used to innovate and improve business processes. The course covers the technological underpinning of block

Chain operations in both theoretical and practical implementation of solutions using block Chain technology.

Course Outcomes

At the end of the course student will be able to:

CO1	**Blockchain technology landscape**
CO2	**Applications and implementation strategies**
CO3	**Learn about crypto currency**
CO4	**Learn about blockchain consensus**
CO5	**Understanding Block chain for Enterprises**
CO6	**Understanding the latest advances and its applications in block chain.**

Text Book (s)

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming".

Reference Book (s)

1. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing
3. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.

Unit-1 Introduction to Block Chain 8 hours
Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain.

Unit-2 Blockchain Consensus 8 hours
Basic Primer: Blockchain Consensus Protocol, consensus mechanism, Types of consensus algorithms: Proof of Work , Proof of Stake , Delegated Proof Of Stake, Delegated Byzantine Fault Tolerance, Byzantine Generals Problem.
Unit-3 Understanding Block chain with Crypto currency 8 hours
Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.
Unit-4 Understanding Block chain for Enterprises 8 hours
Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain.
Unit-5 Block chain application development 8 hours
Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda.
Unit-6 Advance Research Topics of Networking
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas**

covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Enterprise Resource Planning			
Course Code	MCAN2334			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

Enterprise systems include Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM) and other enterprise level systems that are critical to all dynamic, globally aware companies. With a diversified global market, technology is being utilized to overcome distance, language and culture. Today's information systems have permeated well beyond the traditional functional applications, and even more technologically current client-server applications, to mission focused enterprise systems. The course thus focuses on the components of an ERP system and provides an introduction in to the process of implementing a successful system in today's organizations

Course Outcomes

At the end of the course student will be able to:

CO1	Identify the important business functions provided by typical business software such as enterprise resource planning
CO2	Describe basic concepts of Business Process Reengineering
CO3	Describe concepts of ERP Marketplace and Marketplace Dynamics
CO4	Describe ERP implementation
CO5	Describe ERP & E-Commerce, Future Directives
CO6	Understanding the latest advances and its applications in ERP.

Text Book (s)

1) Enterprise Systems for Management by Luvai Motiwalla, Guido Tabelliniad, Jeffrey Thompson, Pearson

Reference Book (s)

1. ERP in Practice: ERP Strategies for Steering Competence & Competitive Advantage by Jagannathan Vamanan, 2007, TMH

Unit-1 8 hours
ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, The Evolution of ERP, The Structure of ERP
Unit-2 8 hours
Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management(PLM),LAP, Supply chain Management.
Unit-3 8 hours
ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, The Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.
Unit-4 8 hours
ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees,

Unit-5 8 hours
ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study
Unit-6 Advance Research
ERP Case Studies In Hrm, Finance, Production, Product Database, Materials, Sales & Distribution.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Enterprise Resource Planning Lab			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	2	1

Course Outcomes

At the end of the course student will be able to:

CO1	Identify the important business functions provided by typical business software such as enterprise resource planning
CO2	Describe basic concepts of Business Process Reengineering
CO3	**Describe concepts of Business Process Reengineering**
CO4	**Describe ERP implementation**
CO5	**Describe ERP & E-Commerce, Future Directives**

Unit-1 8 hours
Introduction to ERP System and Review on different ERP packages.
Unit-2 8 hours
Study on Odoo ERP package. Identification and brief introduction of different Modules in Odoo ERP package
Unit-3 8 hours
Detail study of odoo erp modules
Unit-4 8 hours
Identify different process of the odoo erp modules.
Unit-5 8 hours
Study on odoo erp business functions.
Unit-6 Advance Research Topics of Networking
ERP Implementation life cycle at Huck International Inc.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	Digital Marketing				
Course Code	MCAN2344				
Prerequisite	No prior knowledge about marketing or digital marketing is required				
Corequisite					
Antirequisite					
	L	T	P	C	
	3	0	0	3	

Course Objectives:

- To understand the detailed spectrum of Digital Marketing.
- To assess present social media presence and Industry benchmarking.

- To understand the application of Social Media tools for marketing, advertising and networking.

Course Outcomes

At the end of the course student will be able to:

CO1	**Understand the digital marketing spectrum and Develop insights on current trends - info-graphics.**
CO2	**Learn basics of Search Engine Optimization (SEO) and Search Engine Positioning.**
CO3	**Understand Digital Marketing Platforms like Facebook, Twitter, YouTube, etc**
CO4	**Develops insights on Search engine marketing and importance of Email marketing**
CO5	**Understand mobile marketing and use of web analytics tools**
CO6	**Understanding the latest advances and its applications in digital marketing**

Text Book (s)

- Seema Gupta (2018) Digital Marketing, Tata Mc GrawHill

Reference Book (s)

- Chaffey, D. (2019). Digital marketing. Pearson UK.
- Damian Ryan, Calvin Jones, and Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page, India.
- Stokes, R. (2011). eMarketing: The essential guide to digital marketing. Quirk eMarketing.
- Zarrella, D. (2009). The social media marketing book. " O'Reilly Media, Inc.".
- Tuten, T. L., & Solomon, M. R. (2017). Social media marketing. Sage.
- Karwal, S. (2015). Digital Marketing Handbook: A Guide to Search Engine Optimization, Pay per Click Marketing, Email Marketing, Content Marketing, Social Media Marketing. CreateSpace Independent Publishing Platform.
- Nitin C Kamat & Chinmay Nitin Kamat (2018) Digital Social Media Marketing, Himalaya Publishing House

Unit-1 8 hours
Introduction to Digital Marketing **Evolution of Digital Marketing from traditional to modern era, Benefits & Opportunity of Digital Marketing, Digital vs. Real Marketing, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Principles and Drivers of New Marketing Environment, Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Content management, SWOT analysis, Digital marketing models, Digital Marketing Channels.**
Unit-2 **8 hours**
Search Marketing (SEO): Introduction to Search Engine **Ecosystem of a search engine, importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, Meta Tags and Meta Description, On-page & Off-page optimization, Back Link, Internal & External Links, Ranking, Local SEO Strategies, Penguin & Panda update recovery process, Revenue Models in Search Engine Positioning.**
Unit-3 **8 hours**
Social Media Optimization (SMO) **Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page- Setup and Profile, Social Media Content, Basic concepts – CPC, PPC, CPM, CTR, CR. Advanced Facebook Marketing, Word Press blog creation, Twitter marketing, LinkedIn Marketing, Google plus marketing, Social Media Analytical Tools.**
Unit-4 **8 hours**
Search Engine Marketing **Introduction to Search Engine Marketing, Tools used for Search engine Marketing, PPC /Google AdWords Tool, Display advertising techniques and Report generation.** **Email Marketing:** **Introduction to Email Marketing, Elements of Email, Email List Generation, Email**

Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing & its use in email marketing.
Unit-5 8 hours
Introduction to Mobile Marketing **Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging** **Web Analytics: Introduction to Web Analytics, Web Analytics – Types & Levels, Introduction of Analytics Tools and it's use case (Google Analytics and others), Analytics Reporting, Traffic and Behaviour Report, Evaluate Conversions**
Unit-6 Advance Research Topics
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Digital Marketing Lab**			
Course Code	**MCAN2344**			
Prerequisite	**NA**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Outcomes

At the end of the course student will be able to:

CO1	**Understand digital marketing tools and conduct of SWOT analysis**
CO2	**Understand Google Panda Algorithm and SEO strategies**
CO3	**Create Advertising campaign and a blog**
CO4	**Understand Ad word algorithm and email marketing software**
CO5	**Demonstrate the working of App analytics tools**
CO6	**Understanding the latest advances and its applications in digital marketing**

Text Book (s)/

Reference Book (s)

- Chaffey, D. (2019). Digital marketing. Pearson UK.
- Damian Ryan, Calvin Jones, and Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page, India.
- Stokes, R. (2011). eMarketing: The essential guide to digital marketing. Quirk eMarketing.

Unit-1 8 hours
Study digital marketing tools and their working **Steps for performing SWOT analysis**
Unit-2 **8 hours**
Create SEO strategy of a business (any). **Understanding Google Panda Algorithm in detail**
Unit-3 **8 hours**
Creating Facebook advertising campaign **Create one blog through any CMS**
Unit-4 **8 hours**

Understanding AdWords algorithm (ad rank) in detail **To Study email marketing software's & understand how to use them**
Unit-5 8 hours
Measuring performance of marketing campaigns via Google analytics **Demonstrate working of App Analytics tools.**
Unit-6 Research
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. **Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.** **Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.**

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Name of The Course	**Ethical hacking**			
Course Code	**MCAN2323**			
Prerequisite	**Computer Network, cryptography**			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

Explore ethical hacking basics
Explore cryptography
Investigate trojans and other attacks
Investigate how to attack a computer system
Explore wireless network hacking

Course Outcomes

At the end of the course student will be able to:

CO1	**Describe fundamentals of hacking and security threats to computer systems**
CO2	**Apply CrypTool for hacking activity**
CO3	**Differentiate worm, virus and Trojan Horse and configure ARP poisoning**
CO4	**Implement DoS(Dnial of Service) Attack**
CO5	**Apply WiFi(Wireless) Hackingtechniques**
CO6	**Understanding the latest advances and its applications in ethical hacking**

Text Book (s): HEIN SMITH, HILARY MORRISON, "ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking"

Reference Book (s):Ujjwal Sahay, Saurabh Tripathi, " hack-x-crypt: a straight forward guide towards ethical hacking and cyber security"

Unit-1 : Introduction to hacking and security threats to computer systems 6 hours
Hacking-Definition, hackers, Types of hackers, what is cybercrime, types of cybercrime, Ethical hacking, why ethical hacking, legality of ethical hacking, Security threats, Physical and non-physical threats.
Unit-2 :Cryptography: cryptanalysis, RC4, CrypTool 6 hours
Introduction to cryptography, cryptanalysis, cryptology. Encryption algorithms, hacking activity:use of

CrypTool, Creating the RC4 stream cipher, attacking stream cipher
Unit-3: Worm, virus and Trojan Horse and ARP entries in windows 6 hours
Introduction:worm,virus, Trojan Horse, worms,virus and trojan counter measures and their differential table. IP and MAC address, what is ARP Poisoning ,ARP Poisoning Countermeasures Address Resolution Protocol (ARP), hacking activity:configure ARP entries in windows.
Unit-4 : DoS(Dnial of Service) Attack 8 hours
Introduction: What is DoS attack, types of DoS attacks, how DoS works, DoS attack tools, DoS protection, hacking activity: ping of Death, Launch a DoS attack
Unit-5: WiFi(Wireless) Hacking 8 hours
Brief about wireless network, how to access wireless network, wireless network authentication, WEP,WPA, WEP cracking of wireless network, cracking wireless network WEP/WPA keys
Unit-6 research concept 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

GALGOTIAS UNIVERSITY
(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

School of Computing Science and Engineering

Program: B.Sc. Computer Science

Scheme: 2020 – 2021

Curriculum

Semester 1									
Sl. No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BSCS1110	Discrete Mathematics	3	1	0	4	20	30	50
2	BSCS1120	Computer System Organization	3	0	0	3	20	30	50
3	BSCS1130	Computer Programming using ‘C’	3	0	0	3	20	30	50
4	PHYS1011	Applied Physics	3	0	0	3	20	30	50
5	BSCS1131	Computer Programming using ‘C’ Lab	0	0	2	1	70	-	30
6	BSCS1141	Computer System Organisation Lab	0	0	2	1	70	-	30
7	JAPA1001	Japanese-I	0	0	2	1	70	-	30
8	SLBC1001	Basic English	0	0	4	2	70	-	30
Semester II									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	EVS 101	Environment Studies	2	1	0	3	20	30	50
2	BSCS1210	Numerical Methods for Problem solving	3	0	0	3	20	30	50
3	BSCS1220	Data Structure and Algorithms	3	0	0	3	20	30	50
4	BSCS1230	Operating Systems	3	0	0	3	20	30	50
5	BSCS1240	Object Oriented Programming with C++	3	0	0	3	20	30	50
6	BSCS1260	Introduction to Data Science	3	0	0	3	20	30	50
7	BSCS1221	Data Structures and Algorithms Lab	0	0	2	1	70	-	30
8	BSCS9011	iOS, Android APP Development Lab	0	0	4	2	70	-	30
9	BSCS1241	Object Oriented Programming with C++ Lab	0	0	2	1	70	-	30

10	BSCS1251	Application oriented programming using Python	0	0	4	2	70	-	30
11	SLBC1002	Professional Communication	2	0	2	3	70	-	30
12	JAPA1002	Japanese-II	0	0	2	1	70	-	30

Semester III

Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BSCS2311	Engineering Economics and Management	3	0	0	3	20	30	50
2	BSCS2312	Database Management System	3	0	0	3	20	30	50
3	BSCS2313	Java Programming	3	0	0	3	20	30	50
4	BSCS2314	Computer Graphics	3	0	0	3	20	30	50
5	BSCS2315	Design and Analysis of Algori thms	3	0	0	3	20	30	50
6		Elective-I	3	0	0	3	20	30	50
7	LLL235	Aptitude Building	0	0	4	2	70	-	30
8	BSCS2322	Database Management System Lab	0	0	2	1	70	-	30
9	BSCS2323	Java Programming Lab	0	0	2	1	70	-	30
10	BSCS2324	Computer Graphics Lab	0	0	2	1	70	-	30
11	BSCS2325	Design and Analysis of Algorithms Lab	0	0	2	1	70	-	30
12	JAPA2301	Japanese-III	0	0	2	1	70	-	30

Semester IV

Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BSCS2460	Artificial Intelligence and Machine Learning	3	0	0	3	20	30	50
2	BSCS2470	Cryptographic and Network Security	3	0	0	3	20	30	50
3	BSCS2430	Computer Networks	3	0	0	3	20	30	50
4	BSCS2440	Software Engineering	3	0	0	3	20	30	50
5	BSCS2450	Internet and Web Technology	3	0	0	3	20	30	50
6		Elective-II	3	0	0	3	20	30	50

7	LLL245	Campus-to-Corporate	0	0	4	2	70	-	30
8	BSCS2461	Artificial Intelligence and Machine Learning using Python Lab	0	0	4	2	70	-	30
9	BSCS2471	Cryptographic and Network Security Lab	0	0	2	1	70	-	30
10	BSCS2431	Computer Networks Lab	0	0	2	1	70	-	30
11	BSCS2441	Software Engineering Lab	0	0	2	1	70	-	30
12	BSCS2451	Internet and Web Technology Lab	0	0	2	1	70	-	30
Semester V									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BSCS3510	Open Source Technologies	3	0	0	3	20	30	50
2	BSCS3520	Advances in Databases	3	0	0	3	20	30	50
3	BSCS3530	Data Mining and Data Warehousing	3	0	0	3	20	30	50
4	BSCS3540	Object Oriented Analysis and Design	3	0	0	3	20	30	50
5	BSCS3550	Microprocessor and Microcontroller	3	0	0	3	20	30	50
6	BSCS3560	Linux Administration	3	0	0	3	20	30	50
7		Elective-III	3	0	0	3	20	30	50
8	BSCS3511	Open Source Lab	0	0	2	1	70	-	30
9	BSCS3521	Advances in Databases Lab	0	0	2	1	70	-	30
10	BSCS3541	Object Oriented Analysis and Design Lab	0	0	2	1	70	-	30
11	BSCS3551	Microprocessor and Microcontroller Lab	0	0	2	1	70	-	30
12	BSCS3561	Linux Administration Lab	0	0	2	1	70	-	30
13	BSCS3571	Project Work - 1	0	0	0	5	70	-	30
Semester VI									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		

			L	T	P	C	IA	MTE	ETE
1	BSCS3611	Project Work-2	0	0	30	15	70	-	30

List of Electives

Bucket-1

Sl No	Course Code	Name of the Electives (Choose one)					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BSCS3001	Human Computer Interaction	3	0	0	3	20	30	50
2	BSCS3002	Big Data Technology	3	0	0	3	20	30	50
3	BSCS3004	Introduction to Cyber Security	3	0	0	3	20	30	50

Bucket-2

Sl No	Course Code	Name of the Electives (Choose one)					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BSCS4001	Cloud Computing	3	0	0	3	20	30	50
2	BSCS4002	Distributed Systems	3	0	0	3	20	30	50
3	BSCS4003	Operational Research for Computer Science	3	0	0	3	20	30	50

Bucket-3

Sl No	Course Code	Name of the Electives (Choose one)					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BSCS5001	Disruptive Technology	3	0	0	3	20	30	50
2	BSCS5002	Software Project Management	3	0	0	3	20	30	50
3	BSCS5003	Internet of Things	3	0	0	3	20	30	50

Course Code: BSCS1110	**Discrete Mathematics**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	1	0	4
Prerequisite/Exposure	Basic knowledge of Mathematical function				
Co-requisites					

Course Objectives

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Apply logical reasoning to solve a variety of problems.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the concept of mathematical logic and mathematical induction.
2. Learning the concept of Combinatorics and Stack and their applications.
3. Apply the mathematical knowledge to solve the recurrence relations.
4. Understanding the concept of Graph and their applications.
5. Understanding the concept of Boolean algebra their applications**.**
6. Understanding the latest advances and its applications in Discrete Mathematics.

Course Content

Unit I: Mathematical Logic **8 lecture hours**

Introduction – Propositions – Connectives – Truth tables – Tautologies and Contradictions –Equivalences implications – Normal forms – Methods of proof rules of inference for quantified propositions – Mathematical induction.

Unit II: Combinatorics **8 lecture hours**

Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Basics of counting – Combinations of permutations – Enumeration of combination and permutation – Pigeonhole principle – Inclusion – Exclusion principle – Ordered and unordered portions.

Unit III: Recurrence Relations **8 lecture hours**

Generating function of sequences – Calculating coefficients of generating functions – Recurrence relations – Solving recurrence relations by substitutious and generating functions – Method of characteristic roots – Solution of homogenous recurrence relations.

Unit IV: Graph Theory **8 lecture hours**

Basic concepts of graph theory – Diagraph – Paths – Reachability connectedness – Matrix representation of graphs – Subgraphs – Isomorphisms trees – Properties – Directed tress – Binary trees.

Unit V: Boolean Algevra **8 lecture hours**

Post – Hasse diagrams – Lattices – Types of Lattices – Boolean Algebra – Basic theorems –Applications.

Unit VI Research

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course with latest research.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas.

Text Books

1. J.L. Mott, A. Kandelad T.P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, PHI, 2nd Edition, 1999.

Reference Books

1. J.P. Trembley and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill – 13th reprint 2001.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1120	**Computer System Organization**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Fundamental of Computers				
Co-requisites					

Course Objectives

1. Discuss the basic concepts and structure of computers.
2. Understand concepts of register transfer logic and arithmetic operations.
3. Explain different types of addressing modes and memory organization.
4. Learn the different types of serial communication techniques.
5. Summarize the Instruction execution stages

Course Outcomes

At the end of the course, students will be able to:

6. Understand the basic organization of computer and different instruction formats and addressing modes.
7. Analyze the concept of pipelining, segment registers and pin diagram of CPU.
8. Understand and analyze various issues related to memory hierarchy.
9. Evaluate various modes of data transfer between CPU and I/O devices.
10. Examine various inter connection structures of multi processors.
11. Understanding the latest advances and its applications CSO.

Course Content

Unit I: OVERVIEW & INSTRUCTIONS **9 lecture hours**

Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

Unit II: ARITHMETIC OPERATIONS **9 lecture hours**

ALU – Addition and subtraction – Multiplication – Division – Floating Point operations.

Unit III: PROCESSOR AND CONTROL UNIT **9 lecture hours**

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions..

Unit IV : PARALLELISM **9 lecture hours**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors.

Unit V: MEMORY AND I/O SYSTEMS **9 lecture hours**

Memory hierarchy – Memory technologies – Cache basics – Measuring and improving cache performance – Virtual memory, TLBs – Input/output system, programmed I/O, DMA and interrupts,I/O processors.

Unit VI : Research

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course with the latest research.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas.

Text Books

3. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman / Elsevier, Fifth edition, 2014.

Reference Books

4. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI th edition,Mc Graw-Hill Inc, 2012.
5. William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education,2006.
6. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition,Pearson Education, 2005
7. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1130	**Computer Programming using 'C'**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Fundamental of Computers				
Co-requisites					

COURSE OBJECTIVE:

The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves a lab component which is designed to give the student hands-on experience with the concepts.

COURSE OUTCOMES:

1. Identifysituations where computational methods and computers would be useful.
2. Given a computational problem, identify and abstractthe programming task involved.
3. Approach the programming tasks using techniques learned and write pseudo-code.
4. Choose the right data representation formats based on the requirements of the problem.
5. Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.
6. Understanding the latest advances and its applications in computer programming.

COURSE CONTENT

UNIT I INTRODUCTION **8 lecture hours**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS **10 lecture hours**

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS **9 lecture hours**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS **9 lecture hours**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS **9 lecture hours** Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

UNIT VI RESEARCH

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas.

TEXT BOOKS

1. Gottfried, Byron S., Programming with C, Tata McGraw Hill
2. Balagurusamy, E., Computing Fundamentals and C Programming, Tata McGraw-Hill

REFERENCE BOOKS

1. Jeri R. Hanly & Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley.
2. Yashwant Kanetker, Let us C, BPB
3. Rajaraman, V., Computer Programming in C, PHI

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: PHYS1011	APPLIED PHYSICS	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Physics				
Co-requisites					

COURSE OBJECTIVE:

The Objectives of Applied Physics are:

1. An ability to apply profound understanding of Quantum Mechanics and its applications.
2. An understanding of free electron gas model
3. An ability to design a Laser system and its component, or process to meet desired needs within realistic constraints such as health and safety, manufacturability
4. The broad education necessary to understand special theory of relativity.
5. A knowledge of upcoming technologies like photonics

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

1. CO-1 Students would be able to describe the Quantum Mechanics and its applications.
2. CO-2 Students would be able to write down the band theory of Solids.
3. CO-3 to enable student to learn and to apply concepts learnt in Quantum optics in Industry and in real life.
4. CO-4 to enable students to learn the idea of **Global Positioning System (GPS)** and to explore its further applications and importance in advancement of technologies
5. CO-5 To identify the applications of electrodynamics using Maxwell equations
6. CO-6 Understanding the latest advances and its applications in applied physics..

COURSE CONTENT:

Unit 1 –Semiconductor fundamentals **8 lecture hours**

Intrinsic and extrinsic semiconductors, elemental and compound semiconductor, carrier concentration and Fermi level of intrinsic and extrinsic semiconductor, thermal effects, conductivity and carrier mobility in semiconductors.

Unit 2 –Junction Theory and diodes **8 lecture hours**

PN junction , junction potential , biasing of PN junction , I-V characteristics , static and dynamics resistances , breakdown phenomena- avalanche and Zener process, Zener diode and applications of diode.

Unit 3 – Number system and Boolean algebra **8 lecture hours**

Decimal/Binary/Octa/Hexa number system and conversions, Basic theorem and properties of Boolean algebra, Logic operations and gates, Adder and subtractor, comparator.

Unit 4 –Optics **8 lecture hours**

Snell's Law, Total Internal reflection , graded index, Interference- Interference of Light, Division of wavefronts: amplitude, interference in thin films, Newton's rings; Diffraction-Single slit, Diffraction grating, Grating spectra, Rayleigh's criterion and resolving power of grating.

Unit 5 -LASER **8 lecture hours**

Einstein's coefficients, Population Inversion, Three level and four level laser, Laser characteristics, He-Ne laser and applications.

Unit VI Research **8 lecture hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas.

Text Books

1. Kanaan kano , semiconductor devices , PHI, 2005

2. S.O. Pillai, Solid state physics , New Age International Pvt Ltd, 7th edition, 2015.

3. Arthur Beiser, S Rai Choudhury, Shobhit Mahajan, (2009), Concepts of Modern Physics, 6th Edition, Tata-McGraw Hill. ISBN- 9780070151550..

4. M. Morris Mano, Digital Design, Pearson Education; 5th edition , 2014

Reference Books

1. D.A. Neamen , Semiconductor physics and devices .3rd edition , Mcgraw-Hill, 2003.

2. M.S . Tyagi , Introduction to semiconductor materials and devices , John Wiley & Sons, 2004.

3. B.B. Laud, Lasers and Non-Linear Optics (2011), 3rd Edition, New Ages International.

4. William Silfvast (2002), Laser Fundamentals, Cambridge University Press.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1131	Computer Programming using 'C' Lab	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	C Language				
Co-requisites					

COURSE OBJECTIVE:

This course emphasizes the nature of C language using many applications and helps to understand the need to choose the language for solving the problem. The students can understand the art of computer programming.

LIST OF EXPERIMENTS:

1. C Programming using Simple statements and expressions
2. Scientific problem solving using decision making and looping.
3. Simple programming for one dimensional and two dimensional arrays.
4. Solving problems using String functions
5. Programs with user defined functions – Includes Parameter Passing
6. Program using Recursive Function and conversion from given program to flow chart.
7. Program using structures and unions.

TEXT BOOKS

1. Gottfried, Byron S., Programming with C, Tata McGraw Hill
2. Balagurusamy, E., Computing Fundamentals and C Programming, Tata McGraw-Hill

REFERENCE BOOKS

1. Jeri R. Hanly & Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley.
2. Yashwant Kanetker, Let us C, BPB
3. Rajaraman, V., Computer Programming in C, PHI

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS1141	Computer System Organization Lab	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES

This course is designed to provide a comprehensive introduction to digital logic

1. Design leading to the ability to understand number system representations, binary codes, binary arithmetic and Boolean algebra, its axioms and theorems, and its relevance to digital logic design.
2. To Analyze and design simple systems composed of programmable logic, such as
3. ROMs and PLAs. Aiming at conducting Tutorial, seminars and remedial classes.

COURSE OUTCOME:

Upon successful completion of this course, students will be able to

1. Demonstrate knowledge of binary number theory, Boolean algebra and binary codes.
2. Analyze and design combinational systems using standard gates and minimization methods (such as Karnaugh maps).
3. Analyze and design combinational systems composed of standard combinational modules, such as multiplexers flip-flops, demultiplexer and decoders.
4. Demonstrate knowledge of simple synchronous sequential systems.
5. Analyze and design sequential systems composed of standard sequential modules, such as counters and registers.
6. Analyze and design simple systems composed of programmable logic, such as ROMs and PLAs.
7. Perform basic arithmetic operations with signed integers represented in binary.

LIST OF EXPERIMENTS:

1. Study the basic architecture of computer system and ALU operations.
2. Study the memory and I/O system of Computer.
3. Study the processor and control unit function.
4. Study the complete instruction set of 8085 and write the instructions in the instruction set of 8085 along with examples.
5. Write the working of 8085 simulators GNUsim8085 and basic architecture of 8085 along with small introduction.
6. Write an assembly language code in GNUsim8085 to add two numbers.
7. Write an assembly language code in GNUsim8085 to add n consecutive numbers.
8. Write an assembly language code in GNUsim8085 to count the numbers of 1’s.

9. Write an assembly language code in GNUsim8085 to implement multiply two 8 bit numbers without shifting.
10. Write an assembly language code in GNUsim8085 to addition of two numbers using lxi.
11. Write an assembly language code in GNUsim8085 to find the smallest and largest number from the given serives.
12. Write an assembly language code in GNUsim8085 to find the factorial of a number.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: JAPA**1001**	**JAPANESE-I**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure					
Co-requisites					

1.0 Course Description

Knowledge of Japanese Language is essential and valuable in the field of all engineering streams like electrical, electronics, mechanical and civil. Knowledge of Japanese will help engineering students to widen their horizons and will open up new avenues for higher education in Japan. Foreign Language Teaching will also make the students multi-disciplinary and not focusing only on engineering psubjects. Thus, it is the stepping stone in the process of creating professionals with a global outlook and outreach. In a globalized world, understanding of other cultures constitutes an important component of soft skills. This can be enhanced by foreign language teaching. This will also promote an interdisciplinary approach in students.

2.0 Course Objectives

1. This course attempts to give the students working knowledge of Japanese Language with emphasis on communicative competence.
2. This course will focus on listening and speaking.
3. Basic Japanese sentences will be introduced and practiced.
4. Sufficient vocabulary will be given to the students to converse in different situations using the language patterns taught.
5. Introduction to Japanese history, politics, culture and society will be given.
6. This course aims to give the students an interdisciplinary approach in order to compete in the globalized world.
7. This course will expose the students to a new culture which promotes respect for the 'others' and inculcates tolerance.

3.0 Course Outcomes

1. On the completion of the course, the students will be able to understand simple Japanese and answer question in Japanese.
2. They will be able to introduce themselves in Japanese and talk on simple topics such as 'My family', 'My city' etc.
3. They will have a basic understanding of Japanese society and culture.

4. Prescribed Texts

1. Shokyuu Nihongo, Japanese Language Center for International Students, Tokyo University of foreign Studies, Japan.
2. Nihongo Kana nyuu mon, Japan foundation, Japan.

3. Shin Nihongo no KISO-1, AOTS, 3A Corporation, Japan.

5. Additional References

1. Random House Japanese-English Dictionary
2. Japanese for Busy people, Video CD , AJALT, Japan.

COMMUNICATIVE JAPANESE-I (JAPL-1001)			L	T	P	C
			0	0	2	1
Session No	**Module**	**Topics**	**Core Reading**		**Additional Reference**	
1 – 4	**1**	Introduction to Japanese syllabary, Vowels and Consonants, Romaji, Hiragana, Katakana, Japanese Numerals, Demonstrative pronouns, Greetings, Set phrases – One gaishimasu – Sumimasen, wakarimashita Parts of body (look and learn)				
5-8	**2**	1.Hajimemashite. 2.Hon no Kimochi.	LESSON 1 & 2			
9-12	**3**	3.kore wo kudasai. 4.Sochira wa nanjikara nanji made desu ka.	LESSON 3 & 4			
13- 16	**4**	5.Kooshi en e ikimasu ka. 6.Issho ni ikimasen ka.	LESSON 5 & 6			

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: SLBC1001	Basic English	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure					
Co-requisites					

COURSE CONTENT

Unit I: Reading Writing Level 1 **8 lecture hours**

Listening: Identifying the key words
Reading and Writing: Textual Essay: Advertising
Letter Writing: Informal letters
Functional Grammar: Basics of grammar
Vocabulary: Identifying jumbled letters and framing sentences

Unit II: Reading Writing Level 2 **8 lecture hours**

Listening: Conversations
Reading and Writing: Textual Essay: Art of Listening
Letter Writing: Permission Letters
Functional Grammar: Tenses
Vocabulary: Commonly used phrasal verbs.

Unit III: Reading Writing Level 3 **8 lecture hours**

Listening: Listening to songs and answering multiple choice questions
Reading and Writing: Textual Essay: An Astrologer's Day
Letter Writing: To the editor
Functional Grammar: Active and Passive voice
Vocabulary: Prefix and Suffix

Unit IV: Laboratory **8 lecture hours**

English Master- Exercises 1-10, Cambridge Advanced Learners' Dictionary.

Text Books

1. Compiled and prepared by English Division, SSH, VIT

Reference Books

1 Developing Communication Skills by Krishna Mohan & Meera Banerji
2 Communication Skill for you by Dharmendra Mittal

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: EVS101	Environment Studies	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	2	1	0	3
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES

1. The students will understand the objective of environmental studies and importance of natural resources conservation.
2. The will realize the effect of toxic chemicals available in the environment. The students will learn about the sources, effects and control measures of air, water, soil, noise, thermal pollution. They will also be made aware of natural disaster management.
3. The students will understand the need of sustainable development, environment laws, role of information technology in the environment.
4. The students will be explained basic principles of green Chemistry and concept of atom economy.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Identify the scope and importance of studying the environment and analyze the problems associated with various natural resources.
2. Determine the harmful effects of toxic chemicals on living beings and environment.
3. Identify the harmful effects of environmental pollution and apply suitable control methods.
4. Analyze the different social issues affecting the society and environment
5. Interpret and utilize the different tools of Green Chemistry towards generating a zero waste environment.
6. Understanding the latest advances and its applications in environment studies.

COURSE CONTENT:

Unit I: Environment & Natural Resources **9 lecture hours**

Definition, scope, importance, need for public, Natural Resources – forest resources – use, exploitation, deforestation, construction of multipurpose dams – effect on forests, Water resources – use of surface and subsurface water; effect of floods, drought, water conflicts, food resources – food problems, advantage and disadvantage of fertilizers & pesticides, effect on environment, Energy resources – need to develop renewable energy, land resources – Land degradation, land slides, soil erosion, desertification & case studies.

Unit II: Ecology & Bio-Diversity **9lecture hours**

Concept of ecosystem, structure & function of an ecosystem, producers, consumers and decomposers, energy flow, ecological succession, food chains, food webs and ecological pyramids. Bio diversity: Definition, genetic, species and ecosystem diversity, bio-geographical classification of India, hotspots, threats related to habitat loss, poaching of wildlife, man-wildlife conflicts, Conservation of bio-diversity.

Unit III: Environmental Pollution **9 lecture hours**

Definition – Causes, pollution effects and control measures of Air, Water, Soil, Marine, Noise, Thermal, Nuclear hazards. Solid `waste management: causes, effects and control measures of urban and industrial wastes, pollution measures, case studies, Disaster management: floods, earthquake, cyclone and landslides.

Unit IV: Social Issues and the Environment **9 lecture hours**

Urban problems related to energy & sustainable development, water conservation, rain water harvesting, watershed management, problems related to rehabilitation – case studies, Wasteland reclamation, Consumerism and waste products - Environment Protection Act, Air, Water, Wildlife, Forest Conservation Act, Environmental legislation and public awareness.

Unit V: Human Population and the Environment **9 lecture hours**

Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/ AIDS, Women and Child Welfare, Role of Information Technology – Visit to local polluted site / Case Studies.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books

2. Kurian Joseph & R. Nagendran, "Essentials of Environmental Studies", 1st Edition , Pearson Education, 2004.

Reference Books

1. Keerthinarayana & Daniel Yesudian,"Environmental Science and Engineering",1st Edition, Hi-Tech publications, 2004.
2. Erach Bharucha, “A Text Book for Environmental Studies”, Text Book of University Grants Commission, 2004.
3. Metcalf & Eddy,"Wastewater Engineering: Treatment and Reuse", New Delhi, TMH

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1210	**Numerical Methods for Problem solving**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Engineering Mathematics				
Co-requisites					

COURSE OBJECTIVE:

The objectives of the course are to make the students,

1 To develop the mathematical skills of the students in the areas of numerical methods.
2 To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems, finding eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs and dealing with statistical problems like testing of hypotheses.
3 To lay foundation of computational mathematics for post-graduate courses specialized studies and research.

COURSE OUTCOME:

1 Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
2 Apply various interpolation methods and finite difference concepts.
3 Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
4 Work numerically on the ordinary differential equations using different methods through the theory of finite differences.
5 Work numerically on the partial differential equations using different methods through the theory of finite differences.
6 Understanding the latest advances and its applications in NM.

COURSE CONTENT:

Unit I: Solution Of Equations and Eigenvalue Problems 10 Hours

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method- Solution of linear system of equations – Gauss elimination method – Pivoting – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Matrix Inversion by Gauss Jordan method – Eigen values of a matrix by Power method.solving: Bisection Method, Newton-Raphson method, Iteration method.

Unit II: Interpolation and Approximation 9 Hours

Interpolation with unequal intervals - Lagrange's interpolation – Newton‟s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton‟s forward and backward difference formulae.

Unit III: Numerical Differentiation and Integration 9 Hours

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson‟s 1/3 rule – Romberg‟s method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson‟s 1/3 rules.

Unit IV: Initial Value Problems For Ordinary Differential Equations 10 Hours

Single Step methods - Taylor‟s series method - Euler‟s method - Modified Euler‟s method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne‟s and Adams-Bash forth predictor corrector methods for solving first order equations.

Unit V: Boundary Value Problems in Ordinary and Partial Differential Equations 9 Hours

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace‟s and Poisson‟s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods –One dimensional wave equation by explicit method.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books:

1. Grewal. B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6 th Edition, New Delhi, 2006.

Reference Books:

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
2. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1220	**Data Structure and Algorithms**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Fundamentals of Algorithms				
Co-requisites					

OBJECTIVES:

The objective of this course is to teach students various data structures and to explain• them algorithms for performing various operations on these data structures.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to

1. Demonstrate familiarity with major algorithms and data structures.
2. Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.
3. Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.
4. Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.
5. Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.
6. Understanding the latest advances and its applications in DS.

COURSE CONTENT:

UNIT 1 – INTRODUCTION **9**

The concept of data structure, Abstract data type, data structure operations, algorithms complexity, time-space tradeoff. Introduction to strings, storing strings, string operations, pattern matching algorithms.

UNIT 2 – LINKED LIST **9**

Linked list: Introduction and basic operations, Header nodes, Doubly Linked List, Circular Linked List, Applications of Linked List. Stack: primitive operation on stack, Representation of Stack as Linked List and array, Stacks applications.

UNIT 3 – QUEUES AND TREES **9**

Introduction to queues, Primitive Operations on the Queues, Circular queue, Priority queue, Representation of Queues as Linked List and array, Applications of queue.

Trees - Basic Terminology, Binary Trees, Tree Representations using Array & Linked List, Basic operation on Binary tree, Traversal of binary trees:- In order, Preorder & post order, Applications of Binary tree.

UNIT 4 – GRAPHS **9**

Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs.

UNIT 5 – SEARCHING & SORTING **9**

Searching: linear search, Binary search, Sorting: Insertion sort, Selection sort, Quick sort, Bubble sort.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOKS

1. Seymour Lipschutz, "Data Structures", Tata McGraw- Hill Publishing Company Limited, Schaum's Outlines, New Delhi.
2. Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, "Data Structures Using C", Prentice Hall of India Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. Trembley, J.P. And Sorenson P.G., "An Introduction to Data Structures With Applications", Mcgrraw- Hill International Student Edition, New York.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Addison- Wesley, (An Imprint Of Pearson Education), Mexico City.Prentice- Hall Of India Pvt. Ltd., New Delhi.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1230	**Operating Systems**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Fundamentals of Computers				
Co-requisites					

COURSE OBJECTIVES

The course familiarizes the student with basic knowledge of computer operating systems. The objective of the course is to provide basic knowledge of computer operating system structures and functioning.

COURSE OUTCOMES

Upon successful completion of this course, students will be able to

1. Understand the difference between different types of modern operating systems, virtual machines and their structure of implementation and applications.
2. Understand the difference between process & thread, issues of scheduling of user level processes / threads and their issues & use of locks, semaphores, monitors for synchronizing multiprogramming with multithreaded systems and implement them in multithreaded programs.
3. Gain knowledge about the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.
4. Demonstrate the design and management concepts along with issues and challenges of main memory, virtual memory and file system.
5. Understand the types of I/O management, disk scheduling, protection and security problems faced by operating systems and how to minimize these problems.
6. Understanding the latest advances and its applications in OS.

COURSE CONTENT:

UNIT I OPERATING SYSTEMS OVERVIEW 9

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT 9

Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads-Overview, Multicore Programming, Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semophores, Monitors; CPU Scheduling and Deadlocks.

UNIT III STORAGE MANAGEMENT 9

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV I/O SYSTEMS 9

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

UNIT V CASE STUDY **9**

Linux System- Basic Concepts;System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES:

1. William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.
3. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw HillEducation”, 1996.
4. D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, Second Edition, TataMcGraw-Hill Education, 2007. 5. http://nptel.ac.in/.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1240	**Object Oriented Programming with C++**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	C Language				
Co-requisites					

COURSE OBJECTIVES:

1. To get a clear understanding of object-oriented concepts.
2. To understand object oriented programming through C++.

COURSE OUTCOME:

Upon successful completion of this course, Student will be able to

1. Gain the basic knowledge on Object Oriented concepts.
2. Develop applications using Object Oriented Programming Concepts
3. Demonstrate the differences between traditional imperative design and objectoriented design
4. Explain class structures as fundamental, modular building blocks
5. Understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code
6. Understanding the latest advances and its applications in OOP.

COURSE CONTENT:

Unit – I: STRUCTURED PROGRAMMING – I **9**

Programming Languages – Programming Paradigms - Background of C++ - First Program in C++ - Structure of C++ Program - Data Types - Basic Data Types – User Defined Data Types– Expressions – Tokens, Keywords and Identifiers – Constants and Variables - Operators– Statements – Assignment - Input Output Objects – Manipulators -Control Structures – Selection Statement – Iteration Statements – Arrays and Strings.

Unit – II: STRUCTURED PROGRAMMING - II **9**

Structures, Unions and Enumerations – Functions – Function Prototyping – Call by Value, Call by Reference- Inline Functions- Recursion - Pointers - Default Arguments - Passing arrays to Functions – Passing Structures to Functions – Function Overloading – Using Pointers as Function Arguments and Parameters - File I/O – File Classes – File Operations – Random Access

Unit – III: CLASSES AND OBJECTS **9**

Characteristics of Object Orient Programming - Classes and Objects – Data Members - Member Functions - Constructors and Destructors – Friend Functions – Friend Classes – Static Class Members – Object Pointers.

Unit – IV: INHERITANCES AND POLYMORPHISM **9**

Operator Overloading – Inheritance – Protected Members – Inheriting Multiple Base Classes – Virtual Base Classes – Polymorphism – Virtual Functions – Virtual Base Classes – Dynamic versus Static Binding.

Unit – V: TEMPLATES AND EXCEPTION HANDLING **9**

Templates – Generic Functions – Applying Generic Functions – Generic Classes - Exception handling – Standard Template Library – Container Classes – Lists – Maps – Algorithms – String.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXTBOOK

1. Balagurusamy E, “Object Oriented Programming with C++”, Tata McGraw Hill, 2006.

REFERENCES

1. Andrew C. Staugaard JR, “Structured and Object-Oriented Problem Solving Using C++”, Third Edition, Prentice Hall, 2002.
2. Herbert Schildt, “C++: The Complete Reference”, Third Edition, Tata McGraw Hill, 1999
3. Yashavant Kanethkar, “Let us C++”, BPB Publications, 1999.
4. Bruce Eckel, “Thinking in C++”, Second Edition, Pearson Education, 2001.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1260	Introduction to Data Science	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Mathematics and Statistics				
Co-requisites					

Course Objectives:

Understanding Data Science Process and learning techniques, tools, Statistical Methodologies and Machine learning algorithms used in the process.

Course Outcomes

At the end of the course, students will be able to:

1. Represent problems using linear algebra
2. Apply statistical techniques for data pre processing
3. Build predictive model for data science
4. Develop R code for Data science problems
5. Visualize and evaluate model
6. Understanding the latest advances and its applications in Data science.

COURSE CONTENT:

UNIT I INTRODUCTION TO DATA SCIENCE: 9

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.

UNIT II MODELING METHODS: 9

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

UNIT III INTRODUCTION TO R Language: 9

Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.

UNIT IV MAP REDUCE - I 9

Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture.

UNIT V MAP REDUCE - II **9**

Writing Hadoop Map Reduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution- . Case studies.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
2. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.
3. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012.
4. W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”, 2013.
5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, “Practical Data Science Cookbook”, Packt Publishing Ltd., 2014.
6. Nathan Yau, “Visualize This: The FlowingData Guide to Design, Visualization, and Statistics”, Wiley, 2011.
7. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS1221	**Data Structure and Algorithm Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVE:

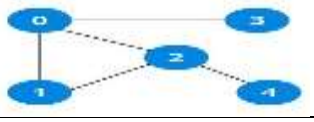
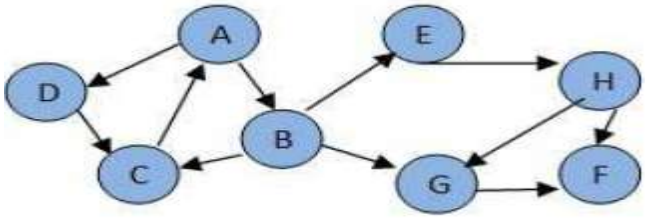
1. To develop skills to design and analyze simple linear and non linear data structures
2. To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
3. To Gain knowledge in practical applications of data structures.

COURSE OUTCOME:

Upon successful completion of this course, students will be able to

1. Design and analyze the time and space efficiency of the data structure
2. Capable to identity the appropriate data structure for given problem
3. Get practical knowledge on the application of data structures
4. Implement linked list data structure to solve various problems.
5. Apply graph and tree traverse technique to various applications.
6. Implement Dijkstra‟s algorithm, Btrees and hash tables.
7. Understand and apply various data structure such as stacks, queues, trees and graphs to solve various computing problems using C-programming language.

S.No	Topic	Pg.No.
1.	Develop a C program get an input from user and perform PUSH, POP, Overflow, Underflow operations and display the result by a stack implemented using array.	
2.	Develop a C program get an input from user and perform enqueue, dequeue operations and display the result through a queue implemented using array.	
3.	A Queue is maintained as linked list and F and R are front and rear location of the queue respectively. Write a C program to implement the following operation. 1. Obtain the formula for N, the number of elements in the queue in terms of F and R. 2. Write a function to delete an element in the queue. 3. Write a function to insert an item X into the queue. 4. Test the program with a set of 10 inputs.	
4.	Develop a C program get an input from user and perform enqueue, dequeue operations and display the results by a Circular Queue Using array.	
5.	Develop a C program get an input from user and perform enqueue, dequeue operations and display the results by a Circular Queue Using Linked list.	
6.	Create a C program using singly linked list and get an input from user and perform the following operations: Insert, Delete on (first, Middle, Last) and display the output.	
7.	Create a C program using Double linked list and get an input from user and perform the following operations: Insert, Delete on (first, Middle, Last) and display the output.	
8.	Create a C program using circular linked list and get an input from user and perform the following operations: Insert, Delete on (first, Middle, Last) and display the output.	

9.	Develop a C program to implement depth first Graph traversal for the following graph. 	
10.	Create a C program to implement Breadth first Graph traversal for the following graph. 	
11.	Create a C program to the graph traversal and perform infix, prefix and postfix expressions. Write two functions Intopo() and Potopr() to accept an infix expression and convert it from infix from postfix notation and postfix to prefix notation. Test the program with the following example. (A+B)*(C-D)^2*((I-J)^6).	
12.	Using Divide and Conquer Strategy, write a c program to perform sorting on the following list given. (Hint: Quick Sort procedure shall be used) 23, 12, 4,109, 34, 55, 77, 11, 6, 55,111, 33.	
13.	Using Divide and Conquer Strategy, write a C program to perform sorting on the following list given. (Hint: Insertion Sort procedure shall be used) 23, 12, 4,109, 34, 55, 77, 11, 6, 55,111, 33.	
14.	Using Divide and Conquer Strategy, create a C program to perform sorting on the following list given. (Hint: Selection Sort procedure shall be used) 23, 12, 4,109, 34, 55, 77, 11, 6, 55,111, 33.	
Value Added List of Experiments		
15	Write a program in C to implement Dijkstra's shortest path algorithm for a given directed graph. 	
16	Write a C program for bubble sort. Apply bubble sort algorithm for the following list of elements: 5 1 12 -5 16 10 -3 -9 9	

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS1241	Object Oriented Programming with C++ Lab	L	T	P	C

Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	C++				
Co-requisites					

COURSE OBJECTIVE:

To make the student learn an object oriented way of solving problems.

1. To make the student to identify and practice the object-oriented programming concepts and techniques.
2. To practice the use of C++ classes and class libraries, modify existing C++ classes.
3. To develop C++ classes for simple applications

COURSE OUTCOME:

Upon successful completion of this course, students will be able to

1. Apply object-oriented programming features to program design and implementation
2. Understand object-oriented concepts and how they are supported by C++
3. Understand implementation issues related to object-oriented techniques.
4. Analyze, use, and create functions, classes, to overload operators.
5. Use inheritance and Pointers when creating or using classes and create templates
6. Understand and use Exception handling and file handling mechanism.

S.No	**Title of Lab Experiments**
1	Demonstration of C++ Programs to Implement Various Control Structures. a. If statement b. Switch case statement and do while loop c. For loop d. While loop
2	Demonstration of Programs to Understand Structure & Unions. a. Structure b. union
3	Demonstration of Programs to Understand Pointer Arithmetic using C++.
4	Demonstration of Functions & Recursion using C++.
5	Design and implementation of Inline Functions in C++.
6	Demonstration and implementation of Programs to Understand Different Function Call Mechanism using C++. a. Call by reference b. Call by Value
7	Implementation of Programs to Understand Storage Specifiers in C++
8	Demonstration of Constructors & Destructors in C++
9	Demonstration of Use of “this” Pointer Using class
10	Programs to Implement Inheritance and Function Overriding. a. Multiple inheritances –Access Specifiers b. Hierarchical inheritance – Function Overriding /Virtual Function
11	Programs to Overload Unary & Binary Operators as Member Function & Non Member Function. a. Unary operator as member function **b.** Binary operator as non member function
12	Programs to Understand Friend Function & Friend Class. a. Friend Function b. Friend class

13	Programs on Class Templates using C++.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS1251	**Application oriented programming using Python**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	4	2
Prerequisite/Exposure	Python				
Co-requisites					

COURSE OBJECTIVE:

The objective is to introduce various concepts of programming to the students using Python.

COURSE OUTCOME:

Upon completion of this course the student should be able to:

1. Develop Python Programs on their own
2. Understand File Processing.
3. Develop GUI.
4. Understand Client Server Programming.
5. Apply problem solving skills and implement any real world problems.

List of Experiments	
1	Implement Python script to read person's age from keyboard and display whether he is eligible for voting or not.
2	Implement Python script to find biggest number between two numbers.
3	Implement Python Script to generate prime numbers series up to n
4	Implement Python Script to check given number is palindrome or not.
5	Implement Python script to print factorial of a number.
6	Implement Python Script to perform various operations on string using string libraries
7	Implement Python Script to check given string is palindrome or not.
8	Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.
9	Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000.
10	Define a function which generates Fibonacci series up to n numbers
11	a) Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program:34,67,55,33,12,98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34', '67', '55', '33', '12', '98'). b) With a given tuple (1,2,3,4,5,6,7,8,9,10), write a program to print the first half values in one line and the last half values in one line.

12	a) Write a python script to perform basic dictionary operations like insert, delete and display. b) Write a python script to find frequency of words in a file using dictionaries.
13	a) Write Python script to display file contents. b) Write Python script to copy file contents from one file to another.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: SLBC1002	**Professional Communication**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES:

1. Advance leadership knowledge and skills based upon communication principles.
2. Increase understanding of relating to others at work.
3. Improve knowledge and skills in characteristics of effective collaboration
4. Develop awareness of managing time and wellness in the workplace
5. Develop verbal and written presentation skills.

COURSE OUTCOMES:

Upon completion, successful students will be able to

1. send and interpret verbal and nonverbal messages with accuracy and effectiveness.
2. recognize differences that impact members of an organization and enact appropriate communication strategies to help attain diversity.
3. prepare personal career goals.
4. develop communication and critical thinking skills necessary for securing a job and succeeding in the diverse, ever-changing workplace.
5. demonstrate knowledge of leadership styles and approaches
6. build positive interpersonal relationships in the workplace.
7. plan and conduct an interview in both interviewee and interviewer roles.
8. distinguish groups and teams and recall communication factors that influence the effective development of teams.
9. demonstrate competence in making a decision as a team.
10. identify and overcome common obstacles in group meetings.
11. demonstrate knowledge of leadership and problem solving communication in teams.
12. create and deliver a business presentation.
13. anticipate and respond to questions during a presentation.
14. plan and create proper business documents.
15. demonstrate knowledge of research and theories regarding wellness in the workplace.
16. demonstrate awareness and knowledge of workplace ethics.
17. demonstrate knowledge of workplace and professional etiquette.

COURSE CONTENT:

Unit I: Basics of Technical Communication **9 lecture hours**

Technical Communication: features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Importance of technical communication; Barriers to Communication.

Unit II: Constituents of Technical Written Communication **8 lecture hours**

Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods -Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.

Unit III: Forms of Technical Communication **8 lecture hours**

Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Job application and Resumes. Official Letters: D.O. Letters; Govt. Letters, Letters to Authorities etc. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Technical Paper, Project. Dissertation and Thesis Writing: Features, Methods & Writing.

Unit IV: Presentation Strategies **7 lecture hours**

Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time- Dimension.

Unit V: Fundamentals of Human Relations: **8 lecture hours**

Intra-personal, Interpersonal and Group Relationships, Transactional Analysis Implications for Managers in Organizational Context. Formal Written Communication: Official Letters, Report, Writing: Categories Formats, Memorandums and Circulars, Agenda and Minutes, Resume, Drafting Advertisements. Enquires and Replies, Quotations, Voluntary Offers, Placing of Order, Cancellation of Order, Complains and Adjustments. Formal Verbal Communication: Group Discussion, Interview, Extempore, Business Negotiation, Public Speaking, Meeting, Toasting, Counselling, Business Presentation. Negotional Skills. Social Skills for Managers: Update of Etiquettes a Manager should observe in Various Formal and Informal Situations; The Knowledge of Body Language.

Text Books

1. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi .
2. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press 2007, New Delhi.

Reference Books

1. Effective Technical Communication by Barun K. Mitra, Oxford Univ. Press, 2006, Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
3. How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London.
4. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors; Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Banerji- Macmillan India Ltd. Delhi.
6. Manual of Practical Communication by L.U.B. Pandey & R.P. Singh; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, Delhi.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: JAPA1002	**Japanese-II**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	**Communicative Japanese –I**				
Co-requisites					

COURSE CONTENT:

1. Course Description

Knowledge of Japanese Language is essential and valuable in the field of all engineering & science streams .Knowledge of Japanese will help engineering students to widen their horizons and will open up new avenues for higher education in Japan. Foreign Language Teaching will also make the students multi-disciplinary and not focusing only on science Subjects. Thus, it is the stepping stone in the process of creating professionals with a global outlook and outreach. In a globalized world, understanding of other cultures constitutes an important component of soft skills. This can be enhanced by foreign language teaching. This will also promote an interdisciplinary approach in students.

2. **Course Objectives**

1. This course attempts to give the students a working knowledge of Japanese Language with emphasis on communicative competence.
2. This course will introduce reading and writing Japanese scripts, Hiragana and Katakana.
3. Basic Japanese sentences will be introduced and practiced thoroughly.
4. Sufficient vocabulary will be given to the students to enable them to use the language patterns taught in various contexts.
5. This course aims to give the students an interdisciplinary approach in order to compete in the globalized world.
6. This course will expose the students to a new culture which promotes respect for the 'others' and inculcates tolerance.

3. Course Outcomes

1. On completion of the course, the students will be able to read and write Hiragana and Katakana; speak short sentences and answer questions in Japanese.
2. They will be able to read short passages written in Hiragana.
3. They will acquire a basic understanding of Japanese society and culture.

4. Prescribed Texts

1. Shokyuu Nihongo, Japanese Language Center for International Students, Tokyo University of foreign Studies, Japan.
2. Nihongo Kana nyuu mon, Japan foundation, Japan.
3. Shin Nihongo no KISO-1, AOTS, 3A Corporation, Japan.

5. Additional References

1. Random House Japanese-English Dictionary
2. Japanese for Busy people, Video CD , AJALT, Japan.

6. Pedagogy

The delivery of course will be a mix of classroom instruction, role play, conversation practice and question-answer sessions.

7. Evaluation Scheme

Internal Assessment	Marks	External assessment	Marks
Marks based on written report (Based on continuous assessment of Lab/ Practical works, considering regularity and timely submission of lab records).	20	Written practical file	15
Regularity in carrying out Lab Examination/ practical	10	Conduction of communication by listening and test	15
Internal Viva-Voce	20	External Viva-Voce	20
Total	50	Total	50

8. Detailed Outlines of the Course

SESSION WISE INSTRUCTION PLAN

Japanese: An Introduction-II (JAPA-1002)			L	T	P	C
			0	0	2	1
Session No	**Module**	**Topics**	**Core Reading**		**Additional Reference**	
1 – 5	**1**	1.Gomen kudasai (audio Practice) 2.Soro soro shitsurei shimasu. (audio Practice)				
6-10	**2**	1.Gin-nen de. (audio Practice) 2.Chiri-- so—su wa arimasuka. (audio Practice)	LESSON-1&2			
11-15	**3**	1.Kore onegai shimasu. (audio Practice) 2.Omatsuri wa doo deshitaka. (audio Practice)	LESSON 3&4			
16-20	**4**	1.Betsu betsu ni onegai shimasu. (audio Practice) 2.KURIKAESU	LESSON -5 &6			

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS9011	**iOS, Android APP Development Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	4	2
Prerequisite/Exposure	Java and OS				
Co-requisites					

COURSE OBJECTIVES:

The student should be made to:

1. Know the components and structure of mobile application development frameworks for iOS, Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

1. Design and Implement various mobile applications using emulators.
2. Deploy applications to hand-held devices.

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2310	Engineering Economics and Management	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Economics				
Co-requisites					

COURSE OUTCOMES:

The course is intended to provide basic understanding of Economics and Management to engineering students with following aspects:

To impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.

To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.

COURSE OUTCOME:

After learning the course the students should be able to:

1. Students will describe basic concepts of Metrology.
2. Students will select linear measuring instrument for measurement of various components.
3. Students select angular and taper measurement devices for measurement of various components.
4. Students will discriminate between various screws by measuring their dimensions.
5. Students will separate different gears through measurement of various dimensions of gears.
6. Understanding the latest advances and its applications in engg. economics.

COURSE CONTENT:

Unit I 9 hours

Introduction to Economics; Definitions, Nature, Scope, Difference between Micro economics & Macro economics. Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity.

Unit II: 9 hours

Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly).- National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.

Unit III: 9 hours

Introduction to Management; Definitions, Nature, scope Management & Administration, skill, types and roles of managers, Management Principles; Scientific principles,Administrative principles, Maslow's Hierarchy of needs theory - Functions of Management; Planning, Organizing, Staffing, Directing and Controlling.

Unit IV: 9 hours

Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation- Introduction to Finance Management; meaning, scope, sources, functions.

Unit V: 9 hours

Introduction to Production Management; definitions, objectives, functions, plant layout- plant location- Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books:

1. Engineering Economics, R.Paneerselvam, PHI publication
2. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
3. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
4. Principles and Practices of Management by L.M.Prasad
5. Principles of Management by Tripathy and Reddy
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2320	Database Management System	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	1	0	4
Prerequisite/Exposure	Query Languages				
Co-requisites					

COURSE OBJECTIVES

To educate students with fundamental concepts of Data Base Management System, Data Models, Different Data Base Languages.

COURSE OUTCOME

Upon successful completion of this course, students will be able to

1. Analyze Database design methodology.
2. Acquire knowledge in fundamentals of Data Base Management System.
3. Analyze the difference between traditional file system and DBMS.
4. Handle with different Data Base languages.
5. Draw various data models for Data Base and Write queries mathematically.
6. Understanding the latest advances and its applications in DBMS.

COURSE CONTENT:

Unit I Introduction **9**

Introduction: An overview of database management system- database system vs file system-Database system concept and architecture- data model schema and instances- interfaces-DDL-DML-Overall Database Structure.

Unit II ER Modelling & SQL **9**

Data Modeling using the Entity Relationship Model: ER model concepts-notation for ER diagram-mapping constraints- keys- Concepts of Super Key- candidate key-primary key-Generalization- aggregation-reduction of an ER diagrams to tables-extended ER model-Relational Algebra-Introduction to SQL- Basic Queries – Complex SQL Queries – Views

Unit III Database Normalization **9**

Functional dependencies-normal forms- first- second- third normal forms- BCNF- inclusion dependence-loss less join decompositions

Unit IV Transaction Processing Concept **9**

Transaction system- Testing of serializability - serializability of schedules- conflict & view serializable schedule-recoverability-Recovery from transaction failures- log based recovery- checkpoints-deadlock handling.

Unit V: Concurrency Control Techniques **9**

Concurrency control-Locking Techniques for concurrency control-Time stamping protocols for concurrency control-validation based protocol- multiple granularity.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Book:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Fourth Edition, McGraw-Hill, 2002.

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Third Edition, Pearson Education, 2003.
2. Raghu Ramakrishnan, "Database Management System", Tata McGraw- Hill Publishing Company, 2003.
3. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- "Database System Implementation"- Pearson Education- 2000.
4. Peter Rob and Corlos Coronel- "Database System, Design, Implementation and Management", Thompson Learning Course Technology- Fifth edition, 2003

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2330	**Java Programming**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Object Oriented Programming				
Co-requisites					

COURSE OBJECTIVE

To introduce students to the Java programming language.

1. To create Java programs that leverage the object-oriented features of the Java.
2. language, such as encapsulation, inheritance and polymorphism; use data types, arrays and other data collections;
3. To implement I/O functionality to read from and write to text files.

COURSE OUTCOMES:

Upon successful completion of this course, student will be able to

1. Understanding of the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
2. Implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.
3. Demonstrate the principles of object oriented programming;
4. Use simple data structures like arrays in a Java program.
5. Understand the concept of package, interface, multithreading and File handling in java.
6. Understanding the latest advances and its applications in Java.

COURSE CONTENT:

Unit I: Introduction: 9 lecture hours

Introduction - Object oriented fundamentals, History-Java and the Internet-Java Applets and Applications, Features of Java, Java Virtual Machine (JMV), Byte-Code ,JAVA buzzwords, JAVA Environments, Command Line Arguments, Java program structure, Reserved keywords, Identifiers, Literals, Operators, Separators, Variables, Declaring a variable, Scope and lifetime of variables, Data types, Type conversion, casting.

Unit II: 8 lecture hours

Control Statements, Arrays- One-Dimensional Arrays, Two-dimension Array, Vectors, Operators-Arithmetic, Boolean logical, Relational and Bitwise operators-Operator Precedence. Class :Fundamentals ,The General Form of a Class ,A Simple Declaring Objects, Assigning Object Reference Variables, Methods: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing ,Returning Objects, Recursion Introducing Access Control, Overriding Methods, Final Variables and Methods, Final class, Finalizer Methods, Abstract Methods and Class, Visibility Control, Constructors.

Unit III: 8 lecture hours

String : Strings, String Constructors, String length, String Literals, String Concatenation, data types-String conversion. Inheritance : basic, Types of Inheritance, Member Access, Creating a Multilevel Hierarchy, When

Constructors Are Called Method Overriding, Why Overridden Methods?, Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding . Using final to Prevent Inheritance, Packages and Interfaces.

Unit IV: **7 lecture hours**

Exception Handling: Exceptions Exception hierarchy, Try, Catch, Finally, Throw.

Unit V: **8 lecture hours**

Java.io Package-I/O Basics-Reading console Input-Writing console output Print Writer class -Reading and Writing files-Java I/O classes, Byte Stream Classes, Character Stream.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books

1. R. Naughton and H. Schildt – Java2 (The Complete Reference) – Fifth Edition – TMH – 2004.

Reference Books

1. K. Arnold and J. Gosling – The Java Programming Language – 3rd Edition., Pearson Edu,2005
2. David Flanagan – Java in a Nutshell: A Desktop Quick Reference for Java Programmers–O'Reilly & Associates, Inc. 1999
3. Bruce Eckel –Thinking in Java – Prentice Hall, 2nd Ed 2002.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2340	Computer Graphics	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Graphics Drawing				
Co-requisites					

COURSE OBJECTIVES

This course is designed to provide a comprehensive introduction to computer

1. Graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.

COURSE OUTCOME:

Upon successful completion of this course, students will be able to

1. Demonstrate an understanding of contemporary graphics hardware.
2. Create interactive graphics applications in C++ using one or more graphics application programming interfaces.
3. Write program functions to implement graphics primitives.
4. Write programs that demonstrate geometrical transformations.
5. Demonstrate an understanding of the use of object hierarchy in graphics applications.
6. Understanding the latest advances and its applications in CG.

COURSE CONTENT:

UNIT I INTRODUCTION **9 Hours**

Overview of Graphics System - Bresenham technique – Line Drawing and Circle Drawing Algorithms - DDA - Line Clipping - Text Clipping.

UNIT II 2D TRANSFORMATIONS **9 Hours**

Two dimensional transformations – Scaling and Rotations - Interactive Input methods - Polygons - Splines – Bezier Curves - Window view port mapping transformation.

UNIT III 3D TRANSFORMATIONS **9 Hours**

3D Concepts - Projections – Parallel Projection - Perspective Projection – Visible Surface Detection Methods - Visualization and polygon rendering – Color models – XYZ-RGB-YIQ-CMY-HSV Models - animation – Key Frame systems - General animation functions - morphing.

UNIT IV Application – I **9 Hours**

Multimedia hardware & software - Components of multimedia – Text, Image – Graphics – Audio – Video – Animation – Authoring.

UNIT V Application – II **9 Hours**

Multimedia communication systems – Data base systems – Synchronization Issues – Presentation requirements – Applications – Video conferencing – Virtual reality – Interactive video – video on demand.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK:

1. Hearn D and Baker M.P, "Computer graphics – C Version", 2nd Edition, Pearson Education, 2004(unit 1, 2 & 3)
2. Ralf Steinmetz, Klara steinmetz, "Multimedia Computing, Communications and Applications", Pearson education, 2004 (Unit 4 & 5)

REFERENCES:

1. Siamon J. Gibbs and Dionysios C. Tsichritzis, "Multimedia programming", Addison Wesley, 1995.
2. John Villamil, Casanova and Leony Fernanadez, Eliar, "Multimedia Graphics", PHI, 1998.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2350	**Design and Analysis of Algorithms**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	Data Structure				
Co-requisites					

OBJECTIVES:

1. To understand and apply the algorithm analysis techniques.
2. To critically analyze the efficiency of alternative algorithmic solutions for the same problem
3. To understand different algorithm design techniques.
4. To understand the limitations of Algorithmic power.

OUTCOMES:

At the end of the course, the students should be able to:

1. Design algorithms for various computing problems.
2. Analyze the time and space complexity of algorithms.
3. Critically analyze the different algorithm design techniques for a given problem.
4. Modify existing algorithms to improve efficiency.
5. Understand about the NP concept.
6. Understanding the latest advances and its applications in algorithm.

COURSE CONTENT:

UNIT I INTRODUCTION 9 Hrs

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Mathematical analysis for Recursive and Non-recursive algorithms.

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER 9 Hrs

Brute Force – Computing an – String Matching – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort – Multiplication of Large Integers.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9 Hrs

Dynamic programming – Principle of optimality – Computing a Binomial Coefficient – Floyd‘s algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Prim‘s algorithm and Kruskal’s Algorithm – 0/1 Knapsack problem, Optimal Merge pattern – Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT 8 Hrs

The Simplex Method – The Maximum- Flow Problem – Maximum - Stable marriage Problem.

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 10 Hrs

Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem – Subset Sum Problem. – LIFO Search and FIFO search – Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms‖, Pearson Education, Reprint 2006.
3. Harsh Bhasin, Algorithms Design and Analysis‖, Oxford university press, 2016.
4. S. Sridhar, Design and Analysis of Algorithms‖, Oxford university press, 2014.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2321	**DATABASE MANAGEMENT SYSTEMS LAB**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	DBMS				
Co-requisites					

OBJECTIVES:

The student should be made to:

1. Learn to create and use a database.
2. Be familiarized with a query language.
3. Have hands on experience on DDL Commands.
4. Have a good understanding of DML Commands and DCL commands.
5. Familiarize advanced SQL queries.
6. Be exposed to different applications.

OUTCOMES:

At the end of the course, the student should be able to:

1. Design and implement a database schema for a given problem-domain.
2. Populate and query a database
3. Create and maintain tables using PL/SQL.
4. Prepare reports.

LIST OF EXPERIMENTS:

1. Creation of a database and writing SQL queries to retrieve information from the database.

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.

3. Creation of Views, Synonyms, Sequence, Indexes, Save point.

4. Creating an Employee database to set various constraints.

5. Creating relationship between the databases.

6. Study of PL/SQL block.

7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.

8. Write a PL/SQL block that handles all types of exceptions.

9. Creation of Procedures.

10. Creation of database triggers and functions

11. Mini project (Application Development using Oracle/ Mysql) (any one)
a) Student Management System.
b) Hospital Management System.
d) Railway Reservation System.
e) Personal Information System.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2331	**Java Programming Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	Java				
Co-requisites					

COURSE OBJECTIVES

1. To be knowledgeable enough about basic Java language syntax and semantics to be able to successfully read and write Java computer programs.
2. To have obtained experience designing, implementing, testing, and debugging graphical user interfaces that respond to user events using Java;

COURSE OUTCOME

Upon successful completion of this course, students will be able to

1. Understand programming language concepts, particularly Java and object-oriented concepts.
2. Write, debug, and document well-structured Java applications.
3. Implement Java classes from specifications and effectively create and use objects from predefined class libraries.
4. Understand the behavior of primitive data types, object references, and arrays.
5. Apply decision and iteration control structures to implement algorithms.
6. Write simple recursive algorithms.
7. Implement interfaces, inheritance, and polymorphism as programming techniques and apply exceptions handling.

S.No.	Program List
1.	Write a Java Program to perform the arithmetic operations using switch case.
2.	Write a program to check the input character for uppercase, lowercase, no. of digits and other characters.
3.	Write a java program to find the greatest among three numbers.

4.	Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root.
5.	Write a java program to implement binary search mechanism in use of following concepts (Operations, Expressions, Control-flow, Strings)
6.	Write a Java program that reads a line of integers and then displays each integer, and the sum of all the integers(Use String Tokenizer class of java.util)
7.	Write a Java Program for sorting a given list of names in ascending order.
8.	write a JAVA program to implement class mechanism. - Create a class, methods and invoke them inside main method.
9.	Write a java program to call a windows run time comments.
10.	Write a java program to calculate the area of square, rectangle and circle using method overloading.
11.	Write a java program to calculate the area of circle and cylinder using method overriding.
12.	Write a java program to calculate the area of rectangle, triangle and circle method abstract class.
13.	Write a java program that implements the concept of package creation.
14.	Write a java program that implements Interface concept using basic mathematical function.
15.	Write a java program to implements exception handling techniques and its concepts.
16.	Write a Java program that implements a multithreaded program has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd the third thread will print the value of cube of the number.
17.	Write a java program to implement Inter Process (Inter Thread) Communication between classes and there by using the mutual exclusion among them to display and produce the output.
18	Create an application for color class by using Applet.
19	Create an applet application using the Key Event class and KeyListener interface.
20	create an applet application for dialog box creation using Frames
21	Create an applet application (Mouse Events) for MouseListener and MouseMotionListener interface.
22	Create an application to display the calendar of a month based on users choice of month and year.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2341	**COMPUTER GRAPHICS LAB**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	Graphics				
Co-requisites					

OBJECTIVES:

The student should be made to:

1. Understand graphics programming.
2. Be exposed to creation of 3D graphical scenes using open graphics library suits.\
3. Be familiar with image manipulation, enhancement.
4. Learn to create animations
5. To create a multimedia presentation/Game/Project.

OUTCOMES:

At the end of the course, the student should be able to

1. Create 3D graphical scenes using open graphics library suits
2. Implement image manipulation and enhancement
3. Create 2D animations using tools

SOFTWARE: C / C++ / Java / OpenGL

LIST OF EXPERIMENTS:

1. Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes Circle (Midpoint)
2. 2D Geometric transformations –
   Translation
   Rotation Scaling
   Reflection Shear
   Window-Viewport
3. Composite 2D Transformations
4. Line Clipping
5. 3D Transformations - Translation, Rotation, Scaling.
6. 3D Projections – Parallel, Perspective.
7. Creating 3D Scenes.
8. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
9. 2D Animation – To create Interactive animation using any authoring tool.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2351	**Design and Analysis of Algorithms Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	0	0	2	1
Prerequisite/Exposure	C, C++, Java or Python Languages				
Co-requisites					

COURSE OBJECTIVE

This course is designed to introduce the students to design and analyse algorithms in terms of efficiency and correctness. The course focuses on highlighting difference between various problem solving techniques for efficient algorithm design.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

1. Given an algorithm, identify the problem it solves.
2. Write algorithms choosing the best one or a combination of two or more of the algorithm design techniques: Iterative, divide-n-conquer, Greedy, Dynamic Programming using appropriate data structures.
3. Write proofs for correctness of algorithms.
4. Re-write a given algorithm replacing the (algorithm design) technique used with a more appropriate/efficient (algorithm design) technique.

SL. NO.	**EXPERIMENT NAME**
1	Implementation of Sorting Algorithms i) QUICK SORT
2	Implementation of Sorting Algorithms ii) MERGE SORT
3	Implementation of Sorting Algorithms iii) HEAP SORT
4	Implementation of Binary Search Tree Algorithm
5	Implementation of Minimum Spanning Tree
6	Implementation of Knapsack Problem
7	Implementation of 8 Queen's Problem
8	Implementation of All Pair Shortest Path Algorithm
9	Implementation of Travelling Salesman Problem
10	Implementation of Graph Colouring
11	Implementation of Multistage Graphs
12	Selection Sort Using Brute Force Method

Continuous Assessment Pattern

Internal Assessment (IA)	**End Term Test (ETE)**	**Total Marks**
70	30	100

Course Code: BSCS2460	Artificial Intelligence and Machine Learning	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Neural Networks				
Co-requisites					

COURSE OBJECTIVES

1. Build the foundation to designing intelligent agents.
2. To know the importance of the complexity of a given algorithm
3. How should and intelligent agent solve problems
4. AI search techniques, Game Playing, Planning, Knowledge Representation, Reasoning under Uncertainty and Machine Learning.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real world Knowledge representation.
5. Demonstrate profciency in applying scientifc method to models of machine learning.
6. Understanding the latest advances and its applications AI & ML.

COURSE CONTENT

Unit 1: Fundamentals of Artificial Intelligence (9 Hrs)

Introduction, A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, Criteria for Success, Turing Test.

Unit 2: Searching (9 Hrs)

Depth First Search, Breadth First Search, Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means-Ends Analysis. Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence, Applications of Minimax Algorithm.

Unit 3: Knowledge Representation (9Hrs)

Knowledge based agents, Wumpus world, Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. Basics of PROLOG: Representation, Structure, Backtracking, Expert System.

Unit 4: Machine Learning Introduction and Algorithm (9 Hrs)

Introduction to Machine Learning, Machine Learning Algorithm Hidden markov model, Genetic algorithm, SVM, Kernel functions, Linear SVM, Nonlinear SVM, Regression analysis, ensemble classifiers, Validation, evaluation.

Unit 5: Clustering Algorithm and recurrent Networks (9 Hrs)

k-means algorithm, k-nearest neighbor learning, weighted majority algorithm, Hopefield Net, Hamming net, Maxnet, Kohonen self organizing map, Principal component Analysis (PCA), Applications of machine learning.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books:

1. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill Structure and syllabus of S.Y. B.Tech
2. Computer Engineering. Pattern A-14, A.Y. 2015-16.
3. Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.
4. T. Mitchell, " Machine Learning", McGraw-Hill, 1997.
5. Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.
6. Introduction to neural networks, S. N. Shivanandam, Mc-Graw Hill, 2013.

Reference Books:

1. Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley, 1990.
2. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley
3. Patterson: "Introduction to AI and Expert Systems", PHI
4. Nilsson : "Principles of Artificial Intelligence", Morgan Kaufmann. 5. Carl Townsend, "Introduction to turbo Prolog", Paperback, 1987
5. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.
6. Jacek M. Zurada, "Introduction to Artificial neural System", JAICO publishing house,2002.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2470	Cryptographic and Network Security	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Idea about Encryption and Decryption.				
Co-requisites					

COURSE OBJECTIVES

1. The learner will gain knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.
2. The learner will understand key terms and concepts in cyber law, intellectual property and cyber crimes, trademarks and domain theft.
3. The learner will be able to examine secure software development practices.
4. The learner will understand principles of web security.
5. The learner will develop an understanding of security policies (such as confidentiality, integrity, and availability), as well as protocols to implement such policies.

COURSE OUTCOMES

On Completion of the course, the students should be able to:

1. An ability to analyze a problem, and to identify and define the computing requirements appropriate to its solution.
2. An ability to make informed judgements in computing practice based on legal and ethical principles.
3. An ability to apply security principles and practices to the environment, hardware, software, and human aspects of a system.
4. An ability to analyze and evaluate systems with respect to maintaining operations in the presence of risks and threats.
5. Understanding about the IP security.
6. Understanding the latest advances and its applications in Network security.

COURSE CONTENT:

Unit I Introduction and Classical Encryption Technique 9 hours

OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, Model for Network Security. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Unit II Block Ciphers, Data Encryption Standard and Advanced Encryption Standard 9 hours

Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round.

Unit III Public Key Cryptography, Key Management, Message, 7 hours

Principles of Public Key Cryptosystem, RSA algorithm, Key management, Diffie Hellman Key exchange.

Unit IV Authentication and Hash Function 7 hours

Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard.

Unit V IP Security, Web Security and System Security 10 hours

IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management. Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS);Secure Electronic Transaction (SET), Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewall and Firewall Configuration

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books:

1. Cryptography and Network Security - Principles and Practice ,2017 by Stallings William (Author).
2. Firewalls and Network Security Perfect Paperback – 2009 by Whitman
3. Network Security a Practical Approach Paperback – 2005 by Harrington

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2430	**Computer Networks**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Fundamental of Networks				
Co-requisites					

OBJECTIVES:

1. To understand the protocol layering and physical level communication.
2. To analyze the performance of a network.
3. To understand the various components required to build different networks.
4. To learn the functions of network layer and the various routing protocols.
5. To familiarize the functions and protocols of the Transport layer.

OUTCOMES:

On Completion of the course, the students should be able to:

1. Understand the basic layers and its functions in computer networks.
2. Evaluate the performance of a network.
3. Understand the basics of how data flows from one node to another.
4. Analyze and design routing algorithms.
5. Design protocols for various functions in the network.
6. Understanding the latest advances and its applications in computer network.

COURSE CONTENT:

UNIT I INTRODUCTION AND PHYSICAL LAYER 9

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II DATA-LINK LAYER & MEDIA ACCESS 9

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III NETWORK LAYER 9

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV TRANSPORT LAYER 9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V APPLICATION LAYER 9

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

REFERENCES

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2440	Software Engineering	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Fundamental of OS.				
Co-requisites					

OBJECTIVES:

1. To understand the phases in a software project
2. To understand fundamental concepts of requirements engineering and Analysis Modeling.
3. To understand the various software design methodologies
4. To learn various testing and maintenance measures.

OUTCOMES:

On Completion of the course, the students should be able to:

1. Identify the key activities in managing a software project.
2. Compare different process models.
3. Concepts of requirements engineering and Analysis Modeling.
4. Apply systematic procedure for software design and deployment.
5. Compare and contrast the various testing and maintenance.
6. Understanding the latest advances and its applications in SE.

COURSE CONTENT:

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMEN 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing – basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing –

System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOKS:

1. Roger S. Pressman, ―Software Engineering – A Practitioner‟s Approach‖, Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, ―Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

REFERENCES:

1. Rajib Mall, ―Fundamentals of Software Engineering‖, Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, ―Software Engineering, A Precise Approach‖, Wiley India, 2010.
3. Kelkar S.A., ―Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, ―Software Engineering‖, Tata McGraw-Hill Publishing Company Limited, 2007.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2450	Internet and Web Technology	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Java, HTML				
Co-requisites					

OBJECTIVES:

1. To understand different Internet Technologies.
2. To learn java-specific web services architecture.

OUTCOMES:

At the end of the course, the students should be able to:

1. Construct a basic website using HTML and Cascading Style Sheets.
2. Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
3. Develop server side programs using Servlets and JSP.
4. Construct simple web pages in PHP and to represent data in XML format.
5. Use XML and web services to develop interactive web applications.
6. Understanding the latest advances and its applications in IWT.

COURSE CONTENT: **hours**

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT SIDE PROGRAMMING 9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions-Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III SERVER SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling-Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP and XML 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK:

1. Deitel and Deitel and Nieto, Internet and World Wide Web – How to Program‖, Prentice Hall, 5th Edition, 2011.

REFERENCES:

1. Stephen Wynkoop and John Burke- Running a Perfect Website‖, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming-Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson,-Web Technologies A Computer Science Perspective‖, Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., -Web Technology‖, Prentice Hall of India, 2011.
5. UttamK.Roy, -Web Technologies‖, Oxford University Press, 2011.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS2461	**Artificial Intelligence and Machine Learning Using Python Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVE:

This course introduces the basic concepts and techniques of Artificial Intelligence (AI).

The course aims to introduce intelligent agents and reasoning, heuristic search techniques, game playing, knowledge representation, reasoning with uncertain knowledge.

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

1. Identify problems that are amenable to solution by specific AI methods
2. Represent knowledge in Prolog and write code for drawing inferences.
3. Identify appropriate AI technique for the problem at hand.
4. Compare strengths and weaknesses of different artificial Intelligence techniques.
5. Sensitive towards development of responsible Artificial Intelligence.

LIST OF PRACTICAL

1. Implement Non-AI and AI Techniques
2. Implement any one Technique from the following
   a. Best First Search & A* algorithm
   b. AO* algorithm
   c. Hill Climbing
4. Implement Constraint Satisfaction Algorithm
5. Expert System in Prolog
6. Implement any two Player game.
7. Simulate Blocks world problem using goal stack planning
8. Implementation of learning algorithms like Find S algorithm, Version space and the candidate elimination algorithm, list then eliminate algorithm for simple real world problems.
9. Implementation of learning algorithms like Back propagation algorithm, Support Vector Machines for real time problems.
10. Implementation of algorithms like Evaluating hypothesis accuracy, Sampling theory, Central limit theorem, hypothesis testing, for real time problems.
11. Implementation of learning algorithms like Bayesian Learning for real time problems.

12. Implementation of learning algorithms like weighted majority algorithm, Instance Based Learning: k-nearest neighbour learning, locally weighted regression for real time problems.
13. Implementation of learning algorithms like Genetic Algorithms for real time problems.
14. Implementation of learning algorithms like unsupervised or reinforcement learning for real time problems.

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2471	**Cryptographic and Network Security Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	C, C++, JAVA and Python..				
Co-requisites					

LIST OF EXPERIMENTS:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:

    1. Caesar Cipher
    2. Playfair Cipher
    3. Hill Cipher
    4. Vigenere Cipher
    5. Rail fence –row & Column Transformation

2. Implement the following algorithms

    1. DES
    2. RSA Algorithm
    3. Diffie-Hellman
    4. MD5
    5. SHA-1

3. Implement the Signature Scheme -Digital Signature Standard

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2431	**Computer Networks Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVE:

This course covers the concepts of data communication and computer networks.

It comprises of the study of the standard models for the layered protocol architecture to communicate between autonomous computers in a network and also the main features and issues of communication protocols for different layers. Topics covered comprise of introduction to OSI and TCP/IP models also.

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

5. Describe the hardware, software components of a network and their interrelations.
6. Compare OSI and TCP/IP network models.
7. Describe, analyze and compare different data link, network, and transport layer protocols.
8. Design/implement data link and network layer protocols in a simulated networking environment.

LIST OF EXPERIMENTS:

1. Write a socket Program for Echo/Ping/Talk commands.
2. Create a socket (TCP) between two computers and enable file transfer between them.
3. Create a socket (UDP) between two computers and enable file transfer between them.
4. Write a program to implement Remote Command Execution. (Two M/Cs may be used)
5. Write a code simulating ARP /RARP protocols.
6. Create a socket for HTTP for web page upload and download.
7. Write a program for TCP module implementation.(TCP services)
8. Write a program for File Transfer in client-server architecture using following methods. (a) RS232C (b) TCP/IP
9. Write a program to implement RMI (Remote Method Invocation)
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. i. Shortest path routing ii. Flooding iii. Distance vector
11. Implement client in C and server in Java and initiate communication between them.

Continuous Assessment Pattern

Internal Assessment (IA)	**End Term Test (ETE)**	**Total Marks**
70	30	100

Course Code: BSCS2441	**Software Engineering Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVE:

The course introduces the students to different types of operating systems. Operating system modules such as memory management, process management and file management are covered in detail.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to:

1. Implement multiprogramming, multithreading concepts for a small operating system.
2. Create, delete, and synchronize processes for a small operating system.
3. Implement simple memory management techniques.
4. Implement CPU and disk scheduling algorithms.
5. Use services of modern operating system efficiently
6. Implement a basic file system.

COURSE CONTENT:

1. Prepare a SRS document in line with the IEEE recommended standards.
2. Draw the use case diagram and specify the role of each of the actors.
   Also state the precondition, post condition and function of each use case.
3. Draw the activity diagram.
4. Identify the classes. Classify them as weak and strong classes and draw the class diagram.
5. Draw the sequence diagram for any two scenarios.
6. Draw the collaboration diagram.
7. Draw the state chart diagram.
8. Draw the component diagram.
9. Perform forward engineering in java. (Model to code conversion)
10. Perform reverse engineering in java. (Code to Model conversion)
11. Draw the deployment diagram

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS2451	**Internet and Web Technology Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Java Language				
Co-requisites					

COURSE OBJECTIVE:

This course introduces the protocols used in Internet, its architecture, and security aspect of Internet. Student will have an insight that how a search engine works and web crawls.

COURSE OUTCOMES:

On successful completion of the course, students will be able to:

1. Describe Internet, its architecture, services and protocol.
2. Implement a simple search engine.
3. Implement a web crawler.
4. Use JavaScript technologies to make a website highly responsive, more efficient and user friendly.

S. No	List of Experiments
1	Create a web page with the following using HTML i) To embed a map in a web page ii) To fix the hot spots in that map iii) Show all the related information when the hot spots are clicked.
2	Create a web page with the following. i) Cascading style sheets. ii) Embedded style sheets. iii) Inline style sheets. Use our college information for the web pages.
3	Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.
4	Write programs in Java using sockets to implement the following: i) HTTP request ii) FTP
5	Write programs in Java using sockets to implement the following: i) SMTP ii) POP3
6	Write a program in Java for creating simple chat application with datagram sockets and datagram packets.

7	Write programs in Java using Servlets: i) To invoke servlets from HTML forms ii) To invoke servlets from Applets
8	Write programs in Java to create three-tier applications using servlets for conducting on-line examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
9	Write a program to lock servlet itself to a particular server IP address and port number. It requires an init parameter key that is appropriate for its servlet IP address and port before it unlocks itself and handles a request
10	i) Session tracking using hidden form fields and Session tracking for a hit count ii) Convert the static web pages into dynamic web pages using servlets (or JSP) and cookies.
11	Implement a simple program using following frameworksi) JSP Struts Framework ii) Hibernate iii). Spring
12	Explore an application in AJAX

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS3510	**Open Source Technologies**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	OSS				
Co-requisites					

COURSE OBJECTIVES

The objective of this course is to utilize and contribute to open source projects.

To make the students to gain experience using open source tools, languages and frameworks to prepare for careers in software development.

COURSE OUTCOME

Upon successful completion of this course, students will be able to

1. Understand the Open source Principles and Free software
2. Get knowledge about the methodology and Languages used to develop open source products
3. Demonstrate the Infrastructure services
4. Ability to understand the concept of Wordpress – Moodle – Android Application Development
5. Acquire knowledge about open source desktop and different type of vendors
6. Understanding the latest advances and its applications in OST.

COURSE CONTENT: **Hours**

Unit I **9**

Introduction: Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where I can use Linux? Linux Kernel – Linux Distributions

Unit II **9**

Introduction: Linux Essential Commands – Files System Concept – Standard Files – The Linux Security Model – Vi Editor – Patitions creation – Shell Introduction – String Processing – Investigating and Managing Processes – Network Clients – Installing Application

Unit III **9**

Introduction **–** Apache Explained – Starting, Stopping, and Restarting Apache – Modifying the Default Configuration – Securing Apache – Set User and Group – Consider Allowing Access to Local Documentation – Don't Allow public_html Web sites – Apache control with http access.

Unit IV **9**

Introduction to MY SQL **–** The Show Databases and Table – The USE command – Create Database and Tables – Describe Table – Select, Insert, Update, and Delete statement – Some Administrative detail – Table Joins – Loading and Dumping a Database.

Unit V **9**

PHP Introduction**-** General Syntactic Characteristics – PHP Scripting – Commenting your code – Primitives, Operations and Expressions – PHP Variables – Operations and Expressions Control Statement – Array – Functions – Basic Form Processing – File and Folder Access – Cookies – Sessions – Database Access with PHP – MySQL – MySQL Functions – Inserting Records – Selecting Records – Deleting Records – Update Records.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. James Lee and Brent Ware, "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP".

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3520	Advances in Databases	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	DBMS				
Co-requisites					

OBJECTIVES:

1. To learn the modeling and design of databases.
2. To acquire knowledge on parallel and distributed databases and their applications.
3. To study the usage and applications of Object Oriented and Intelligent databases.
4. To understand the usage of advanced data models.
5. To learn emerging databases such as XML, Cloud and Big Data.
6. To acquire inquisitive attitude towards research topics in databases.

OUTCOMES:

Upon Completion of the course, the students will be able,

1. To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
2. To understand and critique on each type of databases.
3. To design faster algorithms in solving practical database problems.
4. To implement intelligent databases and various data models.
5. Understand about the emerging technologies.
6. Understanding the latest advances and its applications in database.

Course Content:

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

UNIT III INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications-Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships-Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

UNIT IV ADVANCED DATA MODELS 9

Mobile Databases: Location and Handoff Management – Effect of Mobility on Data Management – Location Dependent Data Distribution – Mobile Transaction Models -Concurrency Control – Transaction Commit Protocols-Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

UNIT V EMERGING TECHNOLOGIES 9

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems, Sixth Edition , Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, ―Database Systems, A Practical Approach to Design, Implementation and Management, Fourth Edition, Pearson Education, 2008.

REFERENCES:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, ―Database System Concepts, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.

3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, ―Advanced Database Systems, Morgan Kaufmann publishers,2006.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3530	**Data Mining and Data Warehousing**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	DBMS, DISTIRBUTED SYSTEM				
Co-requisites					

COURSE OBJECTIVES:

1. To interpret the contribution of data warehousing and data mining to the decision support level of organizations
2. To evaluate different models used for OLAP and data pre-processing
3. To categorize and carefully differentiate between situations for applying different data mining techniques: mining frequent pattern, association, correlation, classification, prediction, and cluster analysis

COURSE OUTCOMES

Upon successful completion of this course, students will be able to

1. Understand the data extraction and transformation techniques.
2. List the association rule mining techniques and understand association mining to correlation analysis, constraint based association mining.
3. Understand operational database, warehousing and multidimensional need of data base to meet industrial needs.
4. Understand the components of warehousing, classification methods and clustering analysis.
5. Identify and understand the Business analysis, query tools and application, OLAP etc.
6. Understanding the latest advances and its applications in DM & DW.

COURSE CONTENT: **Hours**

UNIT I DATA MINING **9**

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

UNIT II ASSOCIATION RULE MINING **9**

Association Rule - Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining.

UNIT III CLASSIFICATION **9**

Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

UNIT IV CLUSTERING AND TRENDS IN DATA MINING **9**

Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

UNIT V DATA WAREHOUSING AND BUSINESS ANALYSIS 9

Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup and Transformation Tools – Metadata - Online Analytical Processing (OLAP) – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multi relational OLAP.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOKS:

1. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

REFERENCES:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Aja, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
4. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3540	**Object Oriented Analysis and Design**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	Data structure				
Co-requisites					

Course Outcomes

CO1	Overview of OOA and design
CO2	Understand about dynamic modelling concepts
CO3	Understand the use and write program based functional modelling
CO4	Understand about the coding and testing
CO5	Know the software development practices in java programming language
CO6	Understanding the latest advances and its applications in Object oriented Approach.

COURSE CONTENT: **Hours**

UNIT I INTRODUCTION **9** Introduction to OOAD – Unified Process – UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams.

UNIT II DESIGN PATTERNS **9**

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller – Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral – Strategy – observer.

UNIT III CASE STUDY **9**

Case study – the Next Gen POS system, Inception -Use case Modeling – Relating Use cases – include, extend and generalization – Elaboration – Domain Models – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition.

UNIT IV APPLYING DESIGN PATTERNS **9**

System sequence diagrams – Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement – UML class diagrams – UML interaction diagrams – Applying GoF design patterns.

UNIT V CODING AND TESTING **9**

Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.

REFERENCES:

1. Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010.
2. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, 1995.
3. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.
4. Paul C. Jorgensen, "Software Testing:- A Craftsman‟s Approach", Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3550	Microprocessor and Microcontroller	L	T	P	C
Version No. 01	Date of Approval: 01/06/2019	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

OBJECTIVES:

The student should be made to:

1. Study the Architecture of 8086 microprocessor.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.
4. Study the Architecture of 8051 microcontroller.

OUTCOMES:

At the end of the course, the student should be able to:

1. Design and implement programs on 8086 microprocessor.
2. Design I/O circuits.
3. Design Memory Interfacing circuits.
4. Design and implement 8051 microcontroller based systems.
5. Understand about the interface and memory.
6. Understanding the latest advances and its applications in microprocessor.

Course Content:

Unit I: Introduction **8 lecture hours**

History of microprocessors, Introduction of 8086, Functional diagram of 8086, Register Organization, Memory Segmentation, Programming Model, Memory addresses. Physical memory organization, signal descriptions of 8086- common function signals. Minimum and Maximum mode signals, Timing diagrams.

Unit II: Assembly Language Programming (Part-I) **7 lecture hours**

Instruction formats, addressing modes, instruction set, assembler directives, simple programs involving logical, branch and arithmetic expressions

Unit III: Assembly Language Programming (Part-II) **7 lecture hours**

Procedures: Near and Far procedures, Macros, String Manipulations, searching and sorting programs, Advanced features of Assembly language programming.

Unit IV : I/O Interface **9 lecture hours**

8255 PPI, various modes of operation and interfacing to 8086, Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter, 8251 USART architecture and nterfacing, RS- 232.

Unit V: Interfacing with memory & Interrupts **9 lecture hours**

Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Introduction to DOS and BIOS interrupts, Interfacing 8259 Interrupt Controller, DMA Controller 8257.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books:

1. D.V. Hall, Microprocessors & Interfacing, TMH, 3rd edition
2. Barry B Brey, The intel microprocessor: architecture, programming and interfacing, Prentice hall of India, New Delhi, 2003.ISBN-0138027455, 4th Edition

Reference Books:

1. Alan Clements, "Principles of Computer Hardware", Oxford University Press, 3rd Edition, 2003, ISBN-9780198564539

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3560	Linux Administration	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	Unix.				
Co-requisites					

OBJECTIVES

At the end of the course, student will be able to

1. To Learn the basics of Linux system administrative tasks
2. To perform the Linux file systems management and various server management
3. **Course Outcomes**

CO1	Understand functions and services of Operating system and recognize the command based Linux Operating System.
CO2	Understand different type of CPU Scheduling Algorithm and Shell Programming in Linux.
CO3	Analyze the memory mgt. concept of Operating System and basic administration in Linux.
CO4	Understand the X Window System and Widget Libraries or toolkits.
CO5	Understand latest softwares and security features in Linux operating system.
CO6	Understanding the latest advances and its applications in Linux.

COURSE CONTENT: **Hours**

UNIT I MANAGING FILES FROM COMMAND LINE 9

Linux file system hierarchy - Locating files and directories by Name - Linux file system default permissions and access - Managing Linux file system permission - Controlling new file permission and ownership.

UNIT II MONITORING AND MANAGING LINUX PROCESS AND LOGS 9

Linux process - Controlling Jobs - Background Process and Foreground Process - Monitoring Process Activity - Killing Processes - Reviewing syslog files.

UNIT III MANAGING LINUX USERS 9

User creating and management commands - . /etc/password - /etc/shadow and /etc/group - Users and access permissions – Modifying user and group attributed.

UNIT IV BOOTING, FILE SYSTEMS AND CORE SYSTEM SERVICES 9

Boot Loaders and init process - Enabling and Disabling Services, booting and shutting down - Managing file systems - Adding new disk - Syslog Daemon and CRON.

UNIT V SERVERS AND INTERNET SERVICES 9

DNS: Understanding DNS and Configuring DNS - Configuring DNS Client – Virtualization - Setting Up Web Server: Understanding and Installing HTTP - Configuring Apache.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books:

1. 1 . Steve Shah and Wale Soyinka " Linux Administration: A Begineer's Guide", 4th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN: 978- 0072262599.
2. Susan Lauber, Philip Sweany, Rudolf Kastl and George Hacker, "REDHAT System Administration-1 Student Work book", REDHAT Inc. 2014

3. Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3511	**Open Source Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	OSS				
Co-requisites					

COURSE OBJECTIVES:

To expose students to FOSS environment and introduce them to use open source packages in open source platform.

COURSE OUTCOME:

The students will be able to:

1. Identify and apply various Linux commands
2. Develop shell scripts and GUI for specific needs
3. Use tools like GIT
4. Perform basic level application deployment, kernel configuration and installation, packet management and installation etc

List of Exercises/Experiments:

1. Getting started with Linux basic commands for directory operations, displaying directory structure in tree format etc.
2. Linux commands for operations such as redirection, pipes, filters, job control, changing ownership/permissions of files/links/directory.
3. Advanced linux commands curl, wget, ftp, ssh and grep
4. Shell Programming : Write shell script to show various system configuration like
   - Currently logged user and his login name
   - Your current shell
   - Your home directory
   - Your operating system type
   - Your current path setting
   - Your current working directory
   - Number of users currently logged in
5. Write shell script to show various system configurations like
   - your OS and version, release number, kernel version
   - all available shells
   - computer CPU information like processor type, speed etc
     memory information
   - hard disk information like size of hard-disk, cache memory, model etc
   - File system (Mounted)
6. Write a shell script to implement a menu driven calculator with following functions
   1. Addition
   2. Subtraction

3. Multiplication
4. Division
5. Modulus

7. Write a script called addnames that is to be called as follows .
/addnames ulist username
Here ulist is the name of the file that contains list of user names and username is a particular student's username. The script should

- check that the correct number of arguments was received and print a message, in case the
- number of arguments is incorrect check whether the ulist file exists and print an error message if it does no
- check whether the username already exists in the file. If the username exists, print a message stating that the name already exists. Otherwise, add the username to the end of the list.

8. Version Control System setup and usage using GIT. Try the following features.

- Creating a repository
- Checking out a repository
- Adding content to the repository
- Committing the data to a repository
- Updating the local copy
- Comparing different revisions
- Revert
- Conflicts and a conflict Resolution

9. Shell script which starts on system boot up and kills every process which uses more than a specified amount of memory or CPU.

10. Introduction to packet management system : Given a set of RPM or DEB, build and maintain, and serve packages over http or ftp. Configure client systems to access the package repository.

11. Perform simple text processing using Perl, Awk.

12. Running PHP : simple applications like login forms after setting up a LAMP stack

13. Compiling from source : learn about the various build systems used like the auto* family, cmake, ant etc. instead of just running the commands. This could involve the full process like fetching from a cvs and also include autoconf, automake etc.,

14. Kernel configuration, compilation and installation : Download / access the latest kernel source code from kernel.org, compile the kernel and install it in the local system. Try to view the source code of the kernel

15. GUI Programming: Create scientific calculator – using any one of Gambas, GTK, QT

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS3521	**Advances in Databases Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	DBMS				
Co-requisites					

Objectives of the laboratory:

Upon successful completion of this lab the student of this lab will be able to:

1. Familiarize with creation of databases with constraints.
2. Understand the Control structures of PL/SQL Programming.
3. To be able to apply advanced concepts of PL/SQL like cursors, procedures and triggers.

List of experiments:

1. SQL data types, Operators, Literals, Constraints
2. Assignment on Queries: Select / From / Where/ Group By/Having Clause/ Order By Clause/ SQL Operators/ Joins/ Built-in Functions
3. PL/SQL Block Structure
4. Conditional Statements
5. Iterations: Simple Loops, For Loop, While Loop, Nested Loops
6. Exception Handling
7. Database Programming with Record Variables
8. Database Programming with Cursors, Cursor-For Loop
9. Procedures & Functions
10. Triggers
11. Packages

Continuous Assessment Pattern

Internal Assessment (IA)	**End Term Test (ETE)**	**Total Marks**
70	30	100

Course Code: BSCS3541	**Object Oriented Analysis and Design Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure					
Co-requisites					

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

1. Perform OO analysis and design for a given problem specification.
2. Identify and map basic software requirements in UML mapping.
3. Improve the software quality using design patterns and to explain the rationale behind applying specific design patterns
4. Test the compliance of the software with the SRS.

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR MINI-PROJECT

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system

14. Library management system
15. Student information system

HARDWARE REQUIREMENTS

Standard PC

SOFTWARE REQUIREMENTS

1. Windows 7 or higher
2. ArgoUML that supports UML 1.4 and higher
3. Selenium, JUnit or Apache JMeter

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS3551	**Microprocessor and Microcontroller Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Fundamentals of Electronics				
Co-requisites					

COURSE OBJECTIVE

To provide a theoretical & practical introduction to microcomputer and microprocessors, assembly language programming techniques, design of hardware interfacing circuit.

COURSE OUTCOME:

Upon successful completion of this subject, student will be able to

1. Solve basic arithmetic operations using the 8085 assembly language.
2. Write program to find out smallest/largest number stored in memory, program related to conversion from Binary to Gray code, Hexadecimal to decimal using the 8085 assembly language.
3. Understand the Hardware and Interfacing.
4. Write program with 8085.
5. Understand BCD Arithmetic, 16-Bit Data operations and Interrupts.
6. Interface with Data Converters
7. Demonstrate the concept of Programmable Interface Devices.

S.No	Program
1	ADDITION OF 2 8-BIT HEXADECIMAL NUMBERS
2	ADDITION OF 2 16-BIT HEXADECIMAL NUMBERS
3	SUBTRACTION OF 2 8-BIT HEXADECIMAL NUMBERS
4	SUBTRACTION OF 2 16-BIT HEXADECIMAL NUMBERS
5	MULTIPLICATION OF 2 8-BIT HEXADECIMAL NUMBERS
6	MULTIPLICATION OF 2 16-BIT HEXADECIMAL NUMBERS
7	DIVISION OF 2 8-BIT HEXADECIMAL NUMBERS
8	DIVISION OF 2 16-BIT HEXADECIMAL NUMBERS
9	ASCII ADDITION OF 2 DECIMAL NUMBERS
10	ASCII SUBTRACTION OF 2 DECIMAL NUMBERS
11	ASCII MULTIPLICATION OF 2 DECIMAL NUMBERS
12	ASCII DIVISION OF 2 DECIMAL NUMBERS
13	CONVERSION OF PACKED BCD TO UNPACKED BCD NUMBER
14	CONVERSION OF BCD NUMBER TO EQUIVALENT ASCII NUMBER
15	TO SORT ARRAY ELEMENTS IN AN ASCENDING ORDER
16	TRANSFER OF BLOCK OF DATA FROM ONE LOCATION TO ANOTHER
17	TO COMPARE TWO GIVEN STRINGS AND FIND OUT IF THEY ARE EQUAL OR NOT

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS3561	**Linux Administration Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	C Programming, Data Structures, etc.				
Co-requisites					

COURSE OBJECTIVE:

1. To understand and make effective use of Linux utilities and shell scripting language to solve problems.
2. To implement in C some standard Linux utilities like mv,cp,ls etc…
3. To Develop the skills the necessary for systems programming including file system programming, process and signal management and interprocess communication
4. To develop the basic skills required to write network programs using sockets.

COURSE OUTCOME:

1. Students will be able to understand the basic commands of Linux operating system and can write shell scripts
2. Students will be able to create file systems and directories and operate them
3. Students will be able to create processes background and fore ground etc..by fork() system calls
4. Students will be create shared memory segments, pipes ,message queues and can exercise inter process communication.

Sr.No	TOPIC
1.	Introduction to Basic Linux Commands & Editors
2.	Installation of RedHat Linux Operating System.
3.	Introduction to GRUB.CONF
4.	Linux System Administration
5.	Setting up Linux as a Proxy server
6.	Setting up Samba Server
7.	Setting up Local area Network LAN Topology &Networking (TCP/IP) through manual (Statically) by using setup command or through Wizard.
8.	Assigning Dynamically IP Addresses by configuring DHCP Server
9.	Setting up NFS File Server
10	Creation of Any Domain Name System
11	The Apache web Server
12	Setting up FTP Server
13	Firewall & Security Configuration
14	Using gcc Compiler (Programming in C++) & Using JAVA Compiler (Execution of Simple Java Programs.& Demonstration of Implementing Socket Prog.)
15	Setting up Hardware Devices i.e. Sound card & printer

16	Working with X-Windows A]Switching TO A Graphical Login B]Setup video card, monitor and mouse for the X-server C]Change my default desktop to KDED] Accessing X-window remotely. E]Installing True Type fonts from my MS Windows partition? F]How do I Display and Control a Remote Desktop using VNC
17	Configuring Mail Services Using Send mail

Continuous Assessment Pattern

Internal Assessment (IA)	End Term Test (ETE)	Total Marks
70	30	100

Course Code: BSCS3001	Human Computer Interaction	L	T	P	C
Version No. 01	Date of Approval: 01/06/2019	3	0	0	3
Prerequisite/Exposure	Fundamentals of Computers and Interfaces.				
Co-requisites					

OBJECTIVES:

The student should be made to:

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Learn the guidelines for user interface
4. Be aware of mobile HCI

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Develop meaningful user interface.
2. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
3. Assess the importance of user feedback.
4. Design effective HCI for individuals and persons with disabilities.
5. Design effective dialog for HCI.
6. Understanding the latest advances and its applications in HCI.

COURSE CONTENT: **Hours**

UNIT I FOUNDATIONS OF HCI **9**

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II DESIGN & SOFTWARE PROCESS **9**

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III MODELS AND THEORIES **9**

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI **9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V WEB INTERFACE DESIGN **9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009 (UNIT –IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009. (UNIT-V)

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3002	**Big Data Technology**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	Big Data				
Co-requisites					

COURSE OBJECTIVES:

Understanding Data Science Process and learning techniques, tools, Statistical Methodologies and Machine learning algorithms used in the process.

COURSE OUTCOMES:

Course Outcomes

CO1	**Students should know about design issues of Hadoop Architecture.**
CO2	**Students should learn various techniques for big data analytics.**
CO3	**Students able to identify the real time problems and able to design solution using various big data analytics techniques.**
CO4	**Students use prediction of supervised and unsupervised learning.**
CO5	**Students can use classification of clustering algorithms**
CO6	**Student can understand current research trends in big data**

COURSE CONTENT: **Hours**

UNIT I INTRODUCTION TO BIG DATA: **9**

Introduction – distributed file system – Big Data and its importance, Four V's in bigdata, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

UNIT II INTRODUCTION HADOOP : **9**

Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT- III HADOOP ARCHITECTURE: **9**

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Tasktrackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

UNIT-IV HADOOP ECOSYSTEM AND YARN : **9** Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

UNIT-V HIVE AND HIVEQL, HBASE: 9 Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase concepts- Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”,
2. Wiley, ISBN: 9788126551071, 2015.
3. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
4. Tom White, “HADOOP: The definitive Guide” , O Reilly 2012.
5. Vignesh Prajapati, “Big Data Analytics with R and Haoop”, Packet Publishing 2013.
6. Tom Plunkett, Brian Macdonald et al, “Oracle Big Data Handbook”, Oracle Press, 2014.
7. Jy Liebowitz, “Big Data and Business analytics”,CRC press, 2013.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS3003	**Introduction to Cyber Security**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	Cryptography				
Co-requisites					

COURSE OBJECTIVES

To select appropriate techniques to tackle and solve problems in the discipline of

Cyber security management; To know why security and its management are important for any modern organisation;

COURSE OUTCOMES

Upon successful completion of this course, the students would be able to

1. Gain comprehensive information about security policies, establishing necessary organizational processes /functions for information security and will be able to arrange necessary resources.
2. Explain web security threats and SSL architecture
3. Gain knowledge about Symmetric Encryption Principles and algorithms
4. Know the hash functions and public key cryptography principles
5. Identify the threats to information security and Show how to protect information recourses
6. Understanding the latest advances and its applications in cyber security.

COURSE CONTENT: **Hours**

Unit 1: Introduction to Cyber Security **9**

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

Unit 2: Cyber Security Vulnerabilities **9**

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness.

Unit 3: Cyber Security Safeguards **9**

Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

Unit 4: Securing Web Application, Services and Servers **9**

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

Unit *5*: Cyberspace and the Law **8**

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

References:

1. Cyber security: What You Need to Know About Computer and Cyber Security, Social Engineering, The Internet of Things + An Essential Guide to Ethical Hacking for Beginners Paperback – January 23, 2019
2. Cybersecurity: An Essential Guide to Computer and Cyber Security for Beginners, Including Ethical Hacking, Risk Assessment, Social Engineering, Attack and Defense Strategies, and Cyberwarfare, Paperback – December 11, 2018,by Lester Evans (Author)
3. CYBER SECURITY LAW THOUGHTS ON IoT, AI & BLOCKCHAIN Paperback – January 17, 2019 by PAVAN DUGGAL (Author)
4. Software-Defined Networking and Security: From Theory to Practice (Data-Enabled Engineering) 1st Edition by Dijiang Huang (Author), Ankur Chowdhary (Author), Sandeep Pisharody (Author)
5. Human-Computer Interaction and Cybersecurity Handbook (Human Factors and Ergonomics)1st Edition by Abbas Moallem (Editor)
6. Cyber Security in Organizations Paperback – September 9, 2018 by E. Fritzvold (Author), OmegaTech Series (Author)

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS4001	**Cloud Computing**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	DBMS				
Co-requisites					

COURSE OBJECTIVES

This course introduces a series of current cloud computing technologies, including

Technologies for Infrastructure as a Service, Platform as a Service, Software as a Service and Physical Systems as a Service.

Objective of this course is to learn different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com, etc. solutions as well as theoretical solutions.

COURSE OUTCOMES

Upon successful completion of this course, students will be able to

1. Define cloud computing and related concepts
2. Understand the key dimensions of the challenges of Cloud Computing
3. Understand the assessment of the economics , financial, and technological implications for selecting cloud computing for an organization
4. Describe the benefits of cloud computing and to understand different layers of the cloud technologies, practical solutions
5. Understand the challenges of cloud computing cloud computing.
6. Understanding the latest advances and its applications in

Course Content : **Hours**

Unit 1 **9**

Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service , Broad network access , Location independent resource pooling , Rapid elasticity , Measured service

Unit II **9**

Cloud scenarios-Benefits: scalability , simplicity , vendors ,security. Limitations – Sensitive information - Application development – Security concerns - privacy concern with a third party - security level of third party - security benefits Regularity issues: Government policies

Unit III **9**

Cloud architecture: Cloud delivery model – SPI framework , SPI evolution , SPI vs. traditional IT Model. **Software as a Service** (SaaS): SaaS service providers – Google App Engine, Salesforce.com and google platfrom – Benefits – Operational benefits - Economic benefits – Evaluating SaaS. **Platform as a Service** (PaaS): PaaS service providers – Right Scale – Salesforce.com– Rackspace –Force.com services and benefits.

Unit IV **9**

Infrastructure as a Service (IaaS): IaaS service providers – Amazon EC2 , GoGrid – Microsoft soft implementation and support – Amazon EC service level agreement – Recent developments. Benefits **Cloud deployment model** : Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing

Unit V **9**

Virtualization: Virtualization and cloud computing - Need of virtualization – cost , administration , fast deployment , reduce infrastructure cost – limitations. **Types of hardware virtualization**: Full virtualization - partial virtualization - para virtualization. **Desktop virtualization**: Software virtualization – Memory virtualization - Storage virtualization –Data virtualization – Network virtualization.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter TATA McGraw-Hill , New Delhi - 2010
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
3. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
4. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press
5. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christenvecctiola, S Tammarai selvi, TMH.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS4002	**Distributed Systems**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	Concurrent Computing				
Co-requisites					

COURSE OBJECTIVE:

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

COURSE OUTCOME:

The structure of distributed systems using multiple levels of software is emphasized. Specific topics include:

1. Distributed algorithms
2. Distributed file systems
3. Distributed databases,
4. Security and protection
5. Distributed services such as the world-wide web, and Examples of research and commercial distributed systems.
6. Understanding the latest advances and its applications in distributed system.

COURSE CONTENT: **Hours**

UNIT I **9**

Introduction to Distributed Computing Systems, System Models, and Issues in Designing a Distributed Operating System, Examples of distributed systems.

UNIT II **9**

Features of Message Passing System, Synchronization and Buffering, Introduction to RPC and its models, Transparency of RPC, Implementation Mechanism, Stub Generation and RPC Messages, Server Management, Call Semantics, Communication Protocols and Client Server Binding.

UNIT III **9**

Introduction, Design and implementation of DSM system, Granularity and Consistency Model, Advantages of DSM, Clock Synchronization, Event Ordering, Mutual exclusion, Deadlock, Election Algorithms.

UNIT IV **9**

Task Assignment Approach, Load Balancing Approach, Load Sharing Approach, Process Migration and Threads.

UNIT V **9**

File Models, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication, Atomic Transactions, Cryptography, Authentication, Access control and Digital Signatures.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. Pradeep. K. Sinha: " Distributed Operating Systems: Concepts and Design " , PHI, 2007.
2. George Coulour is, Jean Dollimore, Tim Kindberg: " Distributed Systems" , Concept and Design, 3rd Edition, Pearson Education, 2005.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS4003	**Operational Research for Computer Science**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES:

The aim of this course is to acquaint the students with the fundamental concepts of probability and statistics.

To provide an understanding of the processes by which real life statistical problems are analyzed.

To develop an understanding of the role of statistics in Operational Research.

COURSE OUTCOMES:

Students completing this course will be able to:

1. Quantify uncertainty using probability, learn how to find probability using the concepts of random variables and distribution functions, obtain characteristics of the underlying distributions, and study functional relationships between two random variables.
2. Know various discrete and continuous probability distributions along with their characteristics and identify the situations where they provide realistic models.
3. Learn about sampling and sampling distributions along with their characteristics which will help them analyze the population or phenomenon from which the sample is drawn.
4. Learn inferential methods wherein the distributional form of population or phenomenon from which the sample is drawn is either known (parametric) or unknown (nonparametric).
5. Understand about the queuing model.
6. Understanding the latest advances and its applications in Operation Research.

COURSE CONTENT: **Hours**

UNIT I: Introductory Linear Algebra **9**

System of linear equations, Matrices, Rank and Determinant of a matrix, Linearly dependent and independent vectors, Basis of a matrix.

UNIT II: Linear programming – I **9**

Optimization Problems, Introduction to LP Formulation, Convex sets, Extreme points, Geometry of Linear Programs, Basic feasible solutions (BFS), Neighborhoods, Local and global optima, Profitable Column, Pivoting, Simplex Algorithm with initial BFS, Graphical method.

UNIT III: Linear programming – II **9**

Degeneracy and Bland's Anticycling rule (Definition), Simplex Algorithm without initial BFS, Artificial variable techniques – two phase method, M-Charnes method, special cases in LPP.

UNIT IV: Duality and Transportation Models **9**

Definition of the dual problem, primal-dual relationships, economic interpretation of duality, complementary slackness conditions. Transportation Algorithm, Assignment model, Hungarian Method.

UNIT V: Queuing Models **9**

Introduction to Queuing Models - Elements of Queuing Model, Exponential distribution, Poisson Distributions, Poisson Queuing Models, Single Server model, Multiple Server model Introduction to Markov Chains - Introduction to Markov chains, transition probabilities, classification of states, Steady state probabilities, Absorbing states

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. G. Hadley: Linear Programming. Narosa, 2002 (reprint).
2. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research-Principles and Practice, John Wiley & Sons, 2005.
3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 8th Edition, 2008.
4. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata McGraw Hill. 2010.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS5001	**Disruptive Technology**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES:

Principles of Disruptive Technology: Evaluate your organization in light of the four Principles of Disruptive Technology to identify practices which are both productive for maximizing existing technology and anti-productive in regard to developing new technology.

Qualities of Disruptive Innovation: Apply the potential impact and role of the following variables to an analysis of your organization:

1. Coming in at the bottom of the market;
2. The extendable up-market core;
3. The significance of non-consumption; and changing metrics.

Communities of Disruptive Innovation: Evaluate and participate in at least three online resources and communities supporting Disruptive Innovation for the purpose of gathering knowledge to benefit your current organization.

Recommendations to Capture Future Markets: Develop recommendations using the four Principles of Disruptive Technology to guide your organization in developing new technologies to capture future markets.

COURSE OUTCOMES:

CO1- Students will learn fundamental tools to understand how to manage the dynamic aspects of technology-enabled marketplaces.

CO2- able to understand web services and peer services.

CO3- Student will learn real time computing.

CO4- They will also develop an understanding of the key elements that need to be evaluated when trying to anticipate and manage disruptive technologies in the marketplace.

CO5-To acquire inquisitive attitude towards research topics in Disruptive.

CO-6 Understanding the latest advances and its applications in disruptive technology

They will also develop an understanding of the key elements that need to be evaluated when trying to anticipate and manage disruptive technologies in the marketplace.

COURSE CONTENT:

Unit I: Introduction & Enterprise Innovation **9 lecture hours**

Introduction - Business and IT Trends - Enterprise Software Trends- Key Emerging Technology Vendors - Key Applications- ITIS Innovations - Industry 4.0

Unit II: Web Services & Peer Services **9 lecture hours**

Web services Market (Technology, Business Strategy) - Peer Services Market (Technology, Business Strategy) – Web 2.0- Motion UI and Progressive Web Apps (PWA) - Hybrid Cloud – Containers (Docker, Warden, Garden)

Unit III: Real-Time Computing & Business Process Management **9 lecture hours**

Real-Time Computing (Technology, Business Strategy) - Prescriptive Analytics - Edge Computing - Business Process Management (Technology- Business Strategy) - Cyber Physical Systems.

Unit IV: Mobile Business & Enterprise Security **9 lecture hours**

Wireless Infrastructure Management- Touch commerce and Personalized Shopping - Location-Based Services- Telematics- Electronic Tagging - Enterprise Security Prevention- Detection- Reaction- Estimating Results

Unit V: Future Trends **9 lecture hours**

AR/VR- Digital currencies and Blockchain Technology- Intelligent Computing AI and Autonomous Robots– Data Science and Deep learning- Computer Vision – Industrial IoT.

Unit VI **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference:

1. Carol Moran, 'Business Innovation and Disruptive Technology', Pearson Education, Inc. 2003
2. https://richtopia.com/emerging-technologies/11-disruptive-technology-examples
3. https://www.cognizant.com/whitepapers/the-future-of-it-infrastructure-codex2946.pdf

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS5002	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure	Software Engineering				
Co-requisites					

COURSE OBJECTIVES:

1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.
6. To deliver successful software projects that support organization‘s strategic goals.

COURSE OUTCOMES:

At the end of the course, the students should be able to:

1. Understand Project Management principles while developing software.
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
6. Understanding the latest advances and its applications in SPM.

COURSE CONTENT: **Hours**

UNIT I PROJECT EVALUATION AND PROJECT PLANNING **9**

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION **9**

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of

Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL *9*

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS *9*

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: BSCS5003	**Internet of Things**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**0**	**3**
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVE:

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

COURSE OUTCOMES:

1. Able to understand the application areas of IOT.
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. Able to understand building blocks of Internet of Things and characteristics.
4. Understand about the design of IoT environment.
5. Aware about the Industries applications of IoT.
6. Understanding the latest advances and its applications in IoT.

COURSE CONTENT: **Hours**

UNIT I FUNDAMENTALS OF IoT **9**

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT **9**

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES **9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics

– Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V CASE STUDIES / INDUSTRIAL APPLICATIONS 9

Cisco IoT system – IBM Watson IoT platform – Power Utility Industry – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Unit VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

School of Computing Science and Engineering

Program: M.Sc. (Computer Science)

Scheme: 2020 – 2022

Curriculum

Semester 1									
Sl. No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MSCS1110	Data Structure using C	3	0	0	3	20	50	100
2	MSCS1120	Database Management Systems	3	0	0	3	20	50	100
3	MSCS1130	Software Engineering	3	0	0	3	20	50	100
4	MSCS1140	Operating Systems	3	0	0	3	20	50	100
5	MSCS1150	Mathematical Foundations of Computer Science	3	0	0	3	20	50	100
6	MSCS1111	Data Structure using C Lab	0	0	2	1	70	-	30
7	MSCS1121	Database Management Systems Lab	0	0	2	1	70	-	30
8	MSCS1131	Software Engineering Lab	0	0	2	1	70	-	30
9	MSCS1141	Operating Systems Lab - Unix & Shell Program	0	0	2	1	70	-	30
10	MSCS1161	Python Programming Fundamentals Lab	0	0	4	2	70	-	30
Semester II									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MSCS1210	Computer Architecture	3	0	0	3	20	50	100
2	MSCS1220	OOPs Using Python	3	0	0	3	20	50	100
3	MSCS1230	Design of Analysis and Algorithms	3	0	0	3	20	50	100
4	MSCS1240	JAVA Programming	3	0	0	3	20	50	100
5	MSCS1250	Cloud Infrastructure Services & Virtualization	3	0	0	3	20	50	100
6	MSCS1280	Introduction to Data Science	3	0	0	3	20	50	100
7	MSCS1221	OOPs using Python Lab	0	0	4	2	70	-	30

8	MSCS1241	JAVA Programming Lab	0	0	4	2	70	-	30
9	MSCS1281	Introduction to Data Science Lab using Python	0	0	2	1	70	-	30
10	SLMC5012	English Proficiency and Aptitude Building – 2	0	0	4	2	70	-	30

Semester III

Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MSCS2310	Cyber Security	3	0	0	3	20	50	100
2	MSCS2320	Internet Programming	3	0	0	3	20	50	100
3	MSCS2330	Artificial Intelligence and Machine Learning	3	0	0	3	20	50	100
4	MSCS2340	Computer Networks	3	0	0	3	20	50	100
5		Discipline Specific Elective - I	3	0	0	3	20	50	100
6	MSCS2311	Cyber Security Lab	0	0	2	1	70	-	30
7	MSCS2321	Internet Programming Lab	0	0	2	1	70	-	30
8	MSCS2331	Artificial Intelligence and Machine Learning Lab	0	0	4	2	70	-	30
9	MSCS2351	Quantitative Aptitude II	0	0	2	1	70	-	30
10	MSCS2361	Communication Skills Lab II	0	0	2	1	70	-	30
11	MSCS2371	Comprehension and Technical Seminar	0	0	2	1	70	-	30
12	MSCS2381	Mini Project	0	0	10	5	70	-	30

Semester IV

Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MSCS2410	Major Project	0	0	30	15	70	-	30

List of Electives

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MSCD2310	Opensource Technologies	3	0	0	3	20	50	100
2	MSCD2320	Software Testing	3	0	0	3	20	50	100
3	MSCD2330	Soft Computing	3	0	0	3	20	50	100
4	MSCD2340	Compiler Design	3	0	0	3	20	50	100
5	MSCD2350	Advanced Database Technology	3	0	0	3	20	50	100
6	MSCD2360	Disruptive Technology	3	0	0	3	20	50	100
7	MSCD2370	Internet of Things	3	0	0	3	20	50	100
8	MSCD2380	Big Data Analytics	3	0	0	3	20	50	100
9	MSCD2390	Mobile Application Development	3	0	0	3	20	50	100

Course Code: MSCS1110	**Data Structure Using C++**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Basic Algorithms and Object Oriented Paradigm.				
Co-requisites					

Course Objectives

1. To impart a thorough understanding of linear data structures such as stacks, queues and their applications..
2. To impart a thorough understanding of non-linear data structures such as trees, graphs and their applications.
3. To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.
4. To impart a basic understanding of memory management.

Course Outcomes

At the end of the course, students will be able to:

12. Compare different programming methodologies and define asymptotic notations to analyze performance of algorithms.
13. Use appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.
14. Represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.
15. Illustrate and compare various techniques for searching and sorting.
16. Understand about the dynamic programming and its applications.
17. Understanding the latest advances and its applications in DS.

Course Content

Unit I: Introduction **9 lecture hours**

Definition, Structure and Properties of algorithms – Development of an algorithm – Data Structures and algorithms – Data Structure definition and classification. Analysis of algorithms: Efficiency of algorithms –Apriori analysis – Asymptotic notations – Time complexity of an algorithm using O notation – Polynomial Vs Exponential algorithms – Average, Best and Worst case complexities –Analyzing recursive programs.

Unit II: Stacks **9 lecture hours**

Introduction - Stack Operations – Applications – Recursion - Evaluation of Expressions. Queues: Introduction - Operations on Queues – Circular queues – Application of a linear queue. Linked Lists: Introduction – Singly linked lists - Circularly linked lists - Doubly linked lists - Applications –polynomial addition..

Unit III: Binary Trees **9 lecture hours**

Introduction – Representation of Trees – Binary Tree Traversals. Binary Search Trees: Introduction –Operations.AVL Trees: Definition -Operations. B-Trees: Introduction – m-way search trees - B trees definition and operations. Graphs: Introduction – Definitions – Representation of Graphs – Graph Traversal - Depth-First and Breadth-First Algorithms - Topological Sorting.

Unit IV: Divide and Conquer **9 lecture hours**

General Method – Binary Search – Merge Sort – Quick Sort. Greedy Method: General Method –Knapsack Problem – Minimum Cost Spanning Tree – Single Source Shortest Path.

Unit V: Dynamic Programming **9 lecture hours**

General Method – Multistage Graphs – All Pair Shortest Path – Travelling Salesman

Problem. Backtracking: General Method – 8-Queens Problem – Sum of Subsets – Hamiltonian Cycles. Branch and Bound: The Method –0/1 Knapsack Problem –Travelling Salesperson.

Unit VI Research 9 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course with the latest research.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. GAV Pai, Data Structures and Algorithms Concepts, Techniques and Applications, Tata McGraw Hill.
2. Jean Paul Tremblay, Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill, Second Edition.
3. Sahini, "Data Structures, Algorithms and Applications in C++", McGrawHill, 1998.
4. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2008
5. Robert Sedgewick, PhillipeFlajolet, "An Introduction to the Analysis of Algorithms", Addison- Wesley Publishing Company, 1996.
6. Alfred V. Aho, John E. Hocroft, Jeffrey D.Ullman, "Data Structures and Algorithms"

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS1120	**Database Management System**	L	T	P	C
Version No. 01	**Date of Approval:**	3	0	0	3
Prerequisite/Exposure	Query Languages				
Co-requisites					

COURSE OBJECTIVES

To educate students with fundamental concepts of Data Base Management System, Data Models, Different Data Base Languages.

COURSE OUTCOME

CO1: Understand the database theory, difference between traditional file system and DBMS, application of database system in real life.

CO2: Understand the E-R model and relational model, Concepts of Keys and apply relational algebra expressions and structured query language (SQL) for database definition and database manipulation

CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.

CO4: Examine the basic concept of transaction processing, recovery and concurrency control techniques in database

CO5: Understand the basics characteristics, advantages, disadvantages of Object-Oriented Databases, Object-relational Database, Distributed databases

CO6: Understanding the latest advances and its applications in DBMS.

COURSE CONTENT:

Unit I Introduction

9

Introduction: An overview of database management system- database system vs file system-Database system concept and architecture- data model schema and instances- interfaces-DDL-DML-Overall Database Structure.

Unit II Database Design

9

Data Modeling using the Entity Relationship Model: ER model concepts-notation for ER diagram-mapping constraints- keys- Concepts of Super Key- candidate key-primary key-Generalization- aggregation-reduction of an ER diagrams to tables-extended ER model-Relational Algebra-Introduction to SQL- Basic Queries – Complex SQL Queries – Views

Unit III Database Normalization

9

Functional dependencies-normal Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies

Unit IV Transaction and Concurrency Control

9

Transaction system- ACID property, Testing of serializability - serializability of schedules- conflict & view serializable schedule- recoverability-Recovery from transaction failures- log based recovery-checkpoints-deadlock handling. Concurrency control-Locking Techniques for concurrency control-Time stamping protocols for concurrency control-validation based protocol- multiple granularity

Unit V: Advanced Topics
9

Object-Oriented Databases, Object-relational Database, Distributed databases – characteristics, advantages, disadvantages. Overview of Data mining-Data warehousing

Unit VI: Recent Trends and Research
9

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Book:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Fourth Edition, McGraw-Hill, 2002.

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third Edition, Pearson Education, 2003.
2. Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003.
3. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”- Pearson Education-2000.
4. Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, Thompson Learning Course Technology- Fifth edition, 2003
5. Kao B., Garcia-Molina H. (1994) An Overview of Real-Time Database Systems. In: Halang W.A., Stoyenko A.D. (eds) Real Time Computing. NATO ASI Series (Series F: Computer and Systems Sciences), vol 127. Springer, Berlin, Heidelberg
6. M. Zhang, P. Martin, W. Powley and J. Chen, "Workload Management in Database Management Systems: A Taxonomy," in *IEEE Transactions on Knowledge and Data Engineering*, vol.

30, no. 7, pp. 1386-1402, 1 July 2018, doi: 10.1109/TKDE.2017.2767044.

7. M. Vieira and H. Madeira, "Detection of malicious transactions in DBMS," *11th Pacific Rim International Symposium on Dependable Computing (PRDC'05)*, Hunan, China, 2005, pp. 8 pp.-, doi: 10.1109/PRDC.2005.31.
8. E. Grigoriev, "DBMS for business systems," 2015 10th International Joint Conference on Software Technologies (ICSOFT), Colmar, 2015, pp. 1-6.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Operating Systems			
Course Code	MSCS1140			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	2	4

Course Objectives:

The objective of this course is to:

1. Learn fundamental operating system abstractions such as processes, threads, files, Semaphores, IPC abstractions, shared memory regions, etc.,
2. Learn how the operating system abstractions can be used in the development of application programs, or to build higher level abstractions,
3. Learn how the operating system abstractions can be implemented,
4. Learn the principles of concurrency and synchronization, and apply them to write correct concurrent programs/software,
5. Learn basic resource management techniques (scheduling, time management, space management) and principles and how they can be implemented. These also include issues of performance and fairness objectives, avoiding deadlocks, as well as security and protection.

Course Outcomes

CO1	Understand functions and services of Operating system and identify the use of system calls.
CO2	Understand different type of CPU Scheduling Algorithm.
CO3	Understand process concept and synchronization of concurrent processes.
CO4	Understand classical problems of concurrent processes and their solution.
CO5	Understand concept of deadlock in system and its methods of handling deadlocks
CO6	Understanding the latest advances and its applications in OS.

Unit-1 Fundamentals Concepts of OS 8 hours
Introduction – Types of Operating Systems – I/O structure – Dual–mode operation – Hardware protection – General system architecture.
Unit-2 Process Management 12 hours
Process Management: Process concept – Concurrent process scheduling concepts – CPU scheduling – Scheduling algorithms, Multiple processors Scheduling – Critical section – Synchronization hardware – Semaphores, classical problem of synchronization, lnterprocess communication. Deadlocks: Characterization, Prevention, Avoidance and Detection.
Unit-3 Memory Management 8 hours
Storage management – Swapping, single and multiple partition allocation – paging – segmentation – page segmentation, virtual memory – demand paging – page replacement and algorithms, thrashing. Secondary storage

management – disk structure – free space management – allocation methods – disk scheduling – performance and reliability improvements – storage hierarchy
Unit-4 I/O Control and Information Management 8 hours
Files and protection – file system organisation – file operations – access methods – consistency semantics – directory structure organisation – file protection – implementation issues – security encryption.
Unit-5 Case Study 4 hours
UNIX , Linux and Windows XP operating systems.
Unit-6 Research 5 hours
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Text Book (s)

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2. D M Dhamdhere, “Operating Systems : A Concept based Approach”, 2nd Edition

Reference Book (s)

1. Sibsankar Halder and Alex A Aravind, “Operating Systems”, Pearson Education
2. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education
3. D M Dhamdhere, “Operating Systems : A Concept based Approach”, 2nd Edition

Continuous Assessment Pattern

Course Code: MSCS1150	**Mathematical Foundation for Computer Science**	L	T	P	C
Version No. 01	**Date of Approval:**	3	0	0	3
Prerequisite/Exposure					
Co-requisites					

COURSE OBJECTIVES

- To introduce the concepts of mathematical logic
- To introduce the concepts of sets, relations, and functions.
- To perform the operations associated with sets, functions, and relations.
- To introduce generating functions and recurrence relations.

COURSE OUTCOME

CO1: Ability to apply mathematical logic to solve problems Knowledge.
CO2: Understand permutation, combination, and recurrence relations.
CO3: Able to use algebraic structure to define and reason about fundamental mathematical concepts.
CO4: Able to formulate problems and solve recurrence relations.
CO5: Understand about the lattices and Boolean algebra.
CO6: Understanding the latest advances and its applications in MFCS.

COURSE CONTENT:

UNIT – I LOGIC **9 hours**

Statements – Connectives – Truth Tables – Normal forms – Predicate calculus – Inference – Theory for Statement Calculus and Predicate Calculus – automata theorem proving.

UNIT – II COMBINATORICS **9 hours**

Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion - generating function - Recurrence relations.

UNIT – III ALGEBRAIC STRUCTURES **9 hours**

Semi goup - Monoid - Groups(Definition and Examples only) Cyclic group - Permutation group (Sn and Dn) - Substructures - Homomorphism of semi group, monoid and groups - Cosets and Lagrange Theorem – Normal Subgroups - Rings and Fields (Definition and examples only)

UNIT – IV RECURSIVE FUNCTIONS **9 hours**

Recursive functions - Primitive recursive functions - computable and non - computable functions.

UNIT – V LATTICES **9 hours**

Partial order relation, poset - Lattices, Hasse diagram - Boolean algebra

UNIT- VI RESEARCH

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT BOOK

Gersting J.L., Mathematical Structure for Computer Science, 3rd Edition W.H. Freeman and Co., 1993.

REFERENCES

1. Lidl and pitz., Applied Abstract Algebra, Springer - Verlag, New York, 1984.

2. K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999.
3. http://www.mhhe.com//rosen.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS1130	Software Engineering	L	T	P	C
Version No. 01	Date of Approval: 01/06/2019	3	0	0	3
Prerequisite/Exposure	Fundamentals of Computers				
Co-requisites					

Course Objectives

1. To understand Software Engineering Lifecycle Models.
2. To do project management and cost estimation.
3. To gain knowledge of the System Analysis and Design concepts.
4. To understand software testing approaches.
5. To be familiar with DevOps practices.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the advantages of various Software Development Lifecycle Models
2. Gain knowledge on project management approaches as well as cost and schedule estimation strategies. Perform formal analysis on specifications using UML diagrams for analysis and design.
3. Able to apply architect and design using architectural styles and design patterns.
4. Understand software testing approaches.
5. Understand the advantages of DevOps practices.
6. Understanding the latest advances and its applications in SE.

Course Content

Unit I: Introduction **9 lecture hours**

Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterativewaterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling– Risk management – Software configuration management

Unit II: Software Requirement Specification **9 lecture hours**

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification –Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Classdiagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram.

Unit III: Architecture and Design **9 lecture hours**

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns –Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architecturalstyles – Layered - Clientserver - Tiered - Pipe and filter - User interface design

Unit IV: Testing **9 lecture hours**

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing –Debugging - Program analysis – Symbolic execution – Model Checking

Unit V: Devops **9lecture hours**

DevOps:Motivation-Cloud as a platform – Operations - Deployment Pipeline: Overall Architecture Building and Testing-Deployment- Case study: Migrating to Micro services.

Unit VI: People and Software Engineering

5 lecture hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearso Education, 2004.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010..

Reference Books

1. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
2. Len Bass, Ingo Weber and Liming Zhu, ―DevOps: A Software Architect‘s Perspective‖, Pearson Education, 2016
3. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
4. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Course Code: MSCS1111	**Data Structure using C Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	C Language				
Co-requisites					

LIST OF EXPERIMENTS:

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

Course Code: MSCS1121	**Database Management Systems Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Basic Query Language				
Co-requisites					

LIST OF EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling
8. Database Design using ER modeling, normalization and Implementation for any application
9. Database Connectivity with Front End Tools
10. Case Study using real life database applications

Course Code: MSCS1131	**Software Engineering Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Fundamentals of Computers				
Co-requisites					

SOFTWARE REQUIRED:

Open source Tools: StarUML / UMLGraph / Topcased

Prepare the following documents for each experiment and develop the software using softwareengineering methodology.

1. **Problem Analysis and Project Planning -** Thorough study of the problem –Identify Project scope, Objectives and Infrastructure.
2. **Software Requirement Analysis -** Describe the individual Phases/modules of the projectand Identify deliverables.
3. **Data Modelling -** Use work products – data dictionary, use case diagrams and activitydiagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
4. **Software Development and Debugging** – implement the design by coding
5. **Software Testing** - Prepare test plan, perform validation testing, coverage analysis,memory leaks, develop test case hierarchy, Site check and site monitor.

LIST OF EXPERIMENTS:

Academic domain

1. Course Registration System
2. Student marks analysing system

Railway domain

3. Online ticket reservation system
4. Platform assignment system for the trains in a railway station

Medicine domain

5. Expert system to prescribe the medicines for the given symptoms
6. Remote computer monitoring

Finance domain

7. ATM system
8. Stock maintenance

Human Resource management

9. Quiz System
10. E-mail Client system.

Course Code: MSCS1141	**Operating Systems Lab - Unix & Shell Program**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Unix				
Co-requisites					

LIST OF EXPERIMENTS:

Course Code: MSCS1161	**Python Programming Fundamentals Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Python Language				
Co-requisites					

1. Write shell programs using ‘case’, ‘then’ and ‘if’ & ’else’ statements.
2. Write shell programs using while, do-while and for loop statements.
3. Write a program to create a child process using fork(), exec() system calls and use other system calls.
4. Write a program to convert upper case to lower case letters of a given ASCII file.
5. Write a program to program to search the given pattern in a file.
6. Write a program to implementation of Signals in UNIX.
7. Write a program to simulate UNIX commands like ls, grep, cp.
8. Write a program to demonstrate FCFS and SJF process schedules on the given data.
9. Write a program to demonstrate CPU Priority and Round Robin Scheduling on the given burst time and arrival times.
10. Write a program to simulate Inter Process Communication using pipes.
11. Write a program to implementing Producer and Consumer problem using Semaphores.
12. Write a program tosimulate Bankers Algorithm for Dead Lock Avoidance
13. Write a program tosimulate Bankers Algorithm Dead Lock Prevention.
14. Write a program tosimulate Paging Techniques of memory management.
15. Write a program tosimulate FIFO, LRU, LFU Page replacement algorithms.
16. Write a program tosimulate Sequential, Indexed, and Linked file allocation strategies.

SOFTWARE REQUIRED:

- Recommended to use Open Source Software like Fedora, Ubuntu, CentOS, etc...
- Recommended to write programs using C / C++ on Linux systems.

S.No	**List of Python Program**
1	Python program to add two numbers
2	Python Program for factorial of a number
3	Python Program for simple interest
4	Python Program for compound interest
5	Python Program to check Armstrong Number
6	Python Program for Program to find area of a circle
7	Python program to print all Prime numbers in an Interval
8	Python program to check whether a number is Prime or not
9	Python Program for n-th Fibonacci number
10	Python Program for Fibonacci numbers

11	Python Program for How to check if a given number is Fibonacci number?
12	Python Program for n\'th multiple of a number in Fibonacci Series
13	Program to print ASCII Value of a character
14	Python Program for Sum of squares of first n natural numbers
15	Python Program for cube sum of first n natural numbers
16	Python Ways to find length of list
17	Python Ways to check if element exists in list
18	Python Reversing a List
19	Python Cloning or Copying a list
20	Python Count occurrences of an element in a list
21	Python program to find sum of elements in list
22	Python Multiply all numbers in the list
23	Python program to find smallest number in a list
24	Python program to find largest number in a list
25	Python program to find second largest number in a list
26	Python program to find N largest elements from a list
27	Python program to print even numbers in a list
28	Python program to print odd numbers in a List
29	Python program to print all even numbers in a range
30	Python program to print all odd numbers in a range
31	Python program to count Even and Odd numbers in a List
32	Python program to check if a string is palindrome or not
33	Python program to split and join a string
34	Python Program for Binary Search (Recursive and Iterative)
35	Python Program for Linear Search
36	Python Program for Insertion Sort
37	Python Program for Recursive Insertion Sort
38	Python Program for QuickSort
39	Python Program to Reverse a linked list
40	Python Program for Find largest prime factor of a number
41	Python Program for Efficient program to print all prime factors of a given number
42	Python Program for Product of unique prime factors of a number
43	Python Program for Find sum of odd factors of a number
44	Python Program for Check if count of divisors is even or odd
45	Python Program for Find minimum sum of factors of number
46	Python Program for Difference between sums of odd and even digits
47	Python Program for Find sum of even factors of a number
48	Python Program for Check if all digits of a number divide it
49	Python program to convert float decimal to Octal number
50	Python program to convert floating to binary

Course Code: MSCS1210	**Computer Architecture**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Data Structures				
Co-requisites					

Course Objectives:

1. To explore the fundamentals of computer architecture.
2. To understand the concepts of computer architecture.
3. To identify the core concepts in the real scenario.

Course Outcomes

1. Understand computer abstractions and technology.
2. Understand concepts of arithmetic operations.
3. Understand concept of processor and control unit.
4. Understand concept of parallelism.
5. Identify core concepts of Memory and I/O systems.
6. Understanding the latest advances and its applications in CA.

Course Content:

UNIT I OVERVIEW& INSTRUCTIONS

Eight ideas – Components of a computer system – Tech
Uniprocessors to multiprocessors; Instructions – operations
Logical operations – control operations – Addressing and addressing modes.

UNIT II ARITHMETIC OPERATIONS

ALU – Addition and subtraction – Multiplication – Divisi
parallelism.

UNIT III PROCESSOR AND CONTROL UNIT

Basic MIPS implementation – Building datapath – Contr
Pipelined datapath and control – Handling Data hazards & C

UNIT IV PARALLELISM

Instruction-level-parallelism – Parallel processing challen
multithreading – Multicore processors.

UNIT V MEMORY AND I/O SYSTEMS

Memory hierarchy – Memory technologies – Cache basics – Measuring and improving cache performance – Virtual memory, TLBs – Input/output system, programmed I/O, DMA and interrupts, I/O processors.

Unit VI: **5 hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Book (s)

1. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman / Elsevier, Fifth edition, 2014.
2. V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI th edition, Mc Graw-Hill Inc, 2012.
3. William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.

Reference Book (s)

1. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
2. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998. Performance – Power wall –
4. http://nptel.ac.in/. presenting instructions –

Course Code: MSCS1230	**Design of Analysis and Algorithms**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Data Structures				
Co-requisites					

Course Objectives

1. To know the importance of the complexity of a given algorithm.
2. To study various algorithmic design techniques.
3. To utilize data structures and/or algorithmic design techniques in solving new problems.
4. To know and understand basic computability concepts and the complexity classes P, NP, and NP-Complete.

Course Outcomes

At the end of the course, students will be able to:

1. Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
2. Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
3. Solve the problems through graph algorithms.
4. Justify that a certain problem is NP-Complete
5. Understand and apply linear programming concepts to real time applications.
6. Understanding the latest advances and its applications DAA.

Course Content

Unit I: Introduction 9 hours

Introduction: Algorithms – Analysis of algorithms – Best case and worst case complexities, Analysis of some algorithms using simple data structures, amortized time complexity. Binary search trees: Searching – Insertion and deletion of elements – Analysis.

Unit II: Algorithms for Trees 9 hours

AVL trees: Definition – Height – searching – insertion and deletion of elements, AVL rotations – Analysis. Red black trees: Definition – searching – insertion and deletion of elements – algorithms and their time complexities. Splay trees: Definition – Steps in Splaying – Analysis.

Unit III: Search Trees and Graph Algorithms 9 hours

Multi-way search trees: Indexed Sequential Access – m-way search trees – B-Tree – searching, insertion and deletion - B+ trees - Tries Graphs: Definition – representations, Adjacency matrix, packed adjacency list and linked adjacency list, – network representation – Graph search methods, Breadth first Search and Depth first Search

Unit IV: Divide-and-Conquer and Greedy Algorithms 9 hours

Divide and conquer: The General Method – Examples – Finding the Maximum and Minimum -Merge sort - Quick sort - Binary Search. Greedy method: The General Method – Optimal Storage on Tapes – Knapsack Problem – Job Sequencing with Deadlines – Optimal Merge Patterns - Minimum cost spanning Trees – Single Source Shortest Path

Unit V: Greedy Algorithms, Amortized Analysis and Dynamic Programming 9 hours

Dynamic programming: The General Method – Multistage Graphs - All pairs shortest path problem – Travelling sales Person problem. Back tracking: The General Method – The Eight Queen Problem – Sum of Subset Problem – Graph Coloring – Hamiltonian Cycles.

Unit VI: 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books

1. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran (2008). Fundamentals of Computer Algorithms, 2/e, Universities Press Private Limited, India

Reference Books

1. Ellis Horowitz and SartajSahni (2003). Fundamentals of Data Structures, Gurgaon: Galgotia Publication
2. Robert L Kruse(2008). Data Structures & Program Design, Prentice Hall, New Delhi
3. Tanenbaum A.M.(2008). Data Structures Using C, Prentice Hall of India, New Delhi

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term	End Term	Total Marks

	Test (MTE)	**Test (ETE)**	
20	30	50	100

Course Code: MSCS1240	**Java Programming**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Basic knowledge of C++				
Co-requisites					

Course Objectives

1. To understand the concepts of object-oriented, event driven, and concurrent programming paradigms and develop skills in using these paradigms using Java.
2. To build software development skills using java programming for real-world applications.
3. To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
4. To develop applications using generic programming and event handling.

Course Outcomes

At the end of the course, students will be able to:

1. To understand the concept of Object Oriented Programming.
2. To understand the concept of Exception handling and I/O.
3. To understand the concept of Threading, Generics, Collcetion framework.
4. Apply knowledge for connecting java with data base.
5. To understand the concept of java foundation classes.
6. Understanding the latest advances and its applications in JAVA.

Course Content

UNIT I OBJECT-ORIENTED PROGRAMMING – FUNDAMENTALS AND INHERITANCE 9 hours

Review of OOP - Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method – Arrays – Strings – Packages-Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes – the Object class – Reflection – interfaces – object cloning – inner classes – wrapping classes

UNIT IIEXCEPTION HANDLING AND I/O STREAMS 9 hours

Exceptions – exception hierarchy – throwing and catching exceptions – Stack Trace Elements - assertions –logging Java input and output, Streams, byte streams and character streams, InputStream, OutputStream, Reader, WriterFile, FileInputStream, BufferedInputStream, FileOutputStream, BufferedOutputStream, FileReader, BufferedReader, FileWriter, BufferedWriter,InputStreamReader, OutputStreamWriter, Serialization-Object writing in file and reading

UNIT III CONCURRENT PROGRAMMING - GENERICS AND GENRIC CLASSES 8 hours

Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – thread-safe Collections – Executors – synchronizers –Generics and Genric Classes - Collection framework and collection interfaces List, Queue, Set and Map, List classes, Iterator, ListInterator,For-each method for collection and iterators,The equals method and hashcode method, Comparator and hashCode (), Collections Class.

UNIT IV JDBC Connectivity 9 hours

Introduction to JDBC API, Types of drivers Statement, Prepared Statement and Callable Statement, ResultSet, Performing insert, update and delete operations, Transaction management - commit and rollback

UNIT V EVENT-DRIVEN PROGRAMMING 9 hours

Describe the JFC Swing technology, Identify the Swing packages, Describe the GUI building blocks: containers, components, and layout managers, Examine top-level, general-purpose, and special-purpose properties of container, Examine components, Examine layout managers

UNIT VI
5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books

1. C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.

Reference Books

1. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press, 2008.
2. K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS1250	**Cloud Infrastructure Services & Virtualization**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Basic Knowledge of Database				
Co-requisites	-				

Course Objectives

1. To understand the concept of cloud computing.
2. To appreciate the evolution of cloud from the existing technologies.
3. To have knowledge on the various issues in cloud computing.
4. To be familiar with Infrastructure Services & Virtualization in cloud.
5. To appreciate the emergence of cloud as the next generation computing paradigm.

Course Outcomes

On Completion of the course, the students should be able to:

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Learn the key and enabling technologies that help in the development of cloud.
3. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
4. Explain the core issues of cloud computing such as resource management, Infrastructure Services,Virtualization and security.
5. Understanding the latest advances and its applications in cloud Computing.

Course Content

UNIT I INTRODUCTION

9 hours

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT II CLOUD ENABLING TECHNOLOGIES 9 hours

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices – Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9 hours

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV VIRTUALIZATION 9 hours

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

UNIT V VIRTUALIZATION INFRASTRUCTURE 9 hours

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

UNIT VI 5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Reference Books

1. Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media, 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
5. Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy", O‘Reilly Media, Inc.,2009.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
7. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.
8. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

9. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
10. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS1280	**Introduction to Data Science**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Mathematics, Statistics				
Co-requisites					

Course Objectives

1. To introduce the linear algebra concepts for data science
2. To introduce statistical techniques for data preprocessing in data science
3. To introduce data analytics problem solving framework
4. To introduce R as a programming language for data science
5. To introduce visualization and assessment tools

Course Outcomes

At the end of the course, students will be able to:

7. Represent problems using linear algebra
8. Apply statistical techniques for data pre processing
9. Build predictive model for data science
10. Develop R code for Data science problems
11. Visualize and evaluate model
12. Understanding the latest advances and its applications in Data science.

Course Content

Unit I:LINEAR ALGEBRA FOR DATA SCIENCE **8 lecture hours**

Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse Geometric view - vectors, distance, projections, eigenvalue decomposition

Unit II: STATISTICS **8 lecture hours**

Descriptive statistics, notion of probability, distributions, mean, variance, covariance, and covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates.

Unit III: MODELLING METHODS **8 lecture hours**

Simple linear regression and verifying assumptions used in linear regression, Multivariate linear regression, Classification using logistic regression, Classification using kNN and k-means clustering.

Unit IV :INTRODUCTION TO R **8 lecture hours**

Reading and getting data into R, ordered and unordered factors, arrays and matrices, list and data frames, reading data from files, probability distribution, statistical models in R, manipulating objects, data distribution

Unit V: VISUALIZATION AND ASSESSMENT **8lecture hours**

Introduction to graphical analysis, plot() function, displaying multivariate data, matrix plot, assessing importance of different variables, subset selection, model, model assessment.

Unit VI
5 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

Text Books

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publication, 2014
2. Mark Gardener, "Beginning R- The Statistical Programming Language", John Wiley & Sons, Inc.,2012
3. Gilbert Strang, "Introduction to linear algebra", Wellesley-Cambridge Press, 2016.

Reference Books

1. Hadley Wickham & Garrett Grolemund, "IR for Data Science", O'Reilly
2. Douglas Montgomery, "Applied Statistics and Probability",John Wiley & Sons, Inc.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Course Code: MSCS1221	**OOPs using Python Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**4**	**2**
Prerequisite/Exposure	Python language.				
Co-requisites					

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame
14. Create a calculator program
15. Demonstrate use of advanced regular expressions for data validation.
16. Demonstrate the working of 'id' and 'type' functions
17. To find all prime numbers within a given range.
18. To print 'n terms of Fibonacci series using iteration.
19. To demonstrate use of slicing in string
20. To add 'ing' at the end of a given string (length should be at least). If the given string already ends with 'ing' then add 'ly' instead. If the string length of the given string is less than 3, leave it unchanged. Sample String : 'abc' Expected Result : 'abcing'

    Sample String : 'string' Expected Result : 'stringly'

    a. To get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself.

    b. To compute the frequency of the words from the input. The output should output after sorting the key alphanumerically.

    c. Write a program that accepts a comma separated sequence of words as input and prints the words in a

comma-separated sequence after sorting them alphabetically.

21. Write a program that accepts a sequence of whitespace separated words as input and prints the words after removing all duplicate words and sorting them alphanumerically.
22. To demonstrate use of list & related functions
23. To demonstrate use of Dictionary& related functions
24. To demonstrate use of tuple, set& related functions
25. To implement stack using list
26. To implement queue using list
27. To read and write from a file
28. To copy a file
29. To demonstrate working of classes and objects
30. To demonstrate class method & static method
31. To demonstrate constructors 18. To demonstrate inheritance
32. To demonstrate aggregation/composition
33. To create a small GUI application for insert, update and delete in a table using Oracle as backend and front end for creating form

Course Code: MSCS1241	**JAVA Programming Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**4**	**2**
Prerequisite/Exposure	OOPs.				
Co-requisites					

LIST OF EXPERIMENTS

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:

- First 100 units - Rs. 1 per unit
- 101-200 units - Rs. 2.50 per unit
- 201-500 units – Rs. 4 per unit
- 501and above units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- First 100 units - Rs. 2 per unit
- 101-200 units - Rs. 4.50 per unit
- 201-500 units - Rs. 6 per unit
- 501and above units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.

3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5. Write a program to perform string operations using Array List. Write functions for the following a. Append - add at end b. Insert – add at particular index c. Search d. List all string starts with given letter.

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

7. Write a Java program to implement user defined exception handling.

8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

10. Write a java program to find the maximum value from the given type of elements using a generic function.

11. Design a calculator using event-driven programming paradigm of Java with the following options. a) Decimal manipulations b) Scientific manipulations.

12. Develop a mini project for any application using Java concepts.

Course Code: MCSE2310	Cyber Security
Version No. 01	**Date of Approval: 01/06**
Prerequisite/Exposure	Cryptography and Netwo
Co-requisites	

Course Objectives

1. To learn the fundamentals of Number theory and to and their algorithms.
2. To study and apply Cryptographic techniques.
3. To understand the Cybercrime and methods to provide authentication on cyber.
4. To understand the fundamental concepts of cyber Threats, Attacks and their Prevention.
5. To have an introductory knowledge cyber security policies and practices.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the Number theory and different algorithms used for the same.
2. Implementation of Cryptographic Techniques.
3. Apply the authentication methods and prevent cyber crime
4. Apply the procedures and algorithms to stop cyber Attacks and Threats.
5. Understand the various cyber security policies and how to apply them.
6. Understanding the latest advances and its applications in cyber security.

Course Content

UNIT I Introduction
9 hour

Finite Fields and Number Theory: Modular arithmetic – Euclidian Algorithm – Primality Testing – Fermat's and Euler's theorem –Chinese Reminder theorem – Discrete Logarithms

UNIT II Cryptographic Techniques
9 hours

Symmetric key cryptographic techniques: C Introduction to Stream cipher – Block cipher: DES – AES- IDEA. Asymmetric key cryptographic techniques: principles – RSA – ElGamal - Elliptic Curve cryptography – Key distribution and Key exchange protocols.

UNIT III Authentication and Cybercrime
9 hours

Hash functions – Secure Hash Algorithm (SHA) Message Authentication – Message Authentication Code (MAC) – Digital Signature Algorithm: RSA &ElGamal based Classification of cybercrimes – planning of attacks – social engineering: Human based – Computer based – Cyberstalking – Cybercafe and Cybercrimes

UNIT IV Cyber Threats, Attacks and Prevention
9 hours

Phishing – Password cracking – Keyloggers and Spywares – DoS and DDoS attacks – SQL Injection. Identity Theft (ID) : Types of identity theft – Techniques of ID theft.

UNIT V Cyber Security Policies and Practices
9 hours

What security policies are – determining the policy needs – writing security policies – Internet and email security policies – Compliance and Enforcement of policies- Review.

Unit VI Research
9 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

References:

1. Charles P. P fleeger, Shari Lawerance P fleeger, "Analysing Computer Security", Pearson Education India.
2. V.K.Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House
4. Anshul Kaushik, Cyber Security, Khanna Publishing House

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS2320	**Internet Programming**				
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	C,C++, Java, Python (Any one is sufficient)				
Co-requisites					

Course Objectives

6. TolearnthefundamentalsofBasic network and SGML.
7. To study the socket programming through Java.
8. To understand the Scripting language.
9. To know about the Dynamic HTML.
10. To have an introductory knowledge about server-side programming.

Course Outcomes

At the end of the course, students will be able to:

7. Understand the internet protocol and concept of URL.
8. Understand the Socket programming through Java.
9. Apply the scripting language to form GUI.
10. Implement the concept of dynamic HTML and CSS.
11. Apply the knowledge of Servlets and JDBC.
12. Understanding the latest advances and its applications Internet programming.

Course Content

UNIT I BASIC NETWORK AND WEB CONCEPTS 9 hours

Internet standards – TCP and UDP protocols – URLs – MIME – CGI – Introduction to SGML.

UNIT II JAVA PROGRAMMING 9 hours

Java basics – I/O streaming – files – Looking up Internet Address - Socket programming – client/server programs – E-mail client – SMTP - POP3 programs – web page retrieval – protocol handlers – content handlers - applets – image handling - Remote Method Invocation.

UNIT III SCRIPTING LANGUAGES 9 hours

HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.

UNIT IV DYNAMIC HTML 9 hours

Dynamic HTML – introduction – cascading style sheets – object model and collections – event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data

UNIT V SERVER SIDE PROGRAMMING 9 hours

Servlets – deployment of simple servlets – web server (Java web server / Tomcat / Web logic) – HTTP GET and POST requests – session tracking – cookies – JDBC – simple web applications – multi-tier applications.

Unit VI Research
9 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Deitel, Deitel and Nieto, "Internet and World Wide Web – How to program", Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004.
4. Thomno A. Powell, "The Complete Reference HTML and XHTML", fourth edition, Tata McGraw Hill, 2003.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS2330	Artificial Intelligence and Machine Learning	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	3	0	0	3
Prerequisite/Exposure	Basic knowledge of Intelligence.				
Co-requisites					

Course Objectives

1. To learn the fundamentals of Artificial Intelligence.
2. To study the introduction to Machine learning.
3. To study the linear model and Regression.
4. To learn the Logic and algebraic models.
5. To have a knowledge about Probabilistic models.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the concept of Artificial Intelligence.
2. Learn the machine learning and its Classification.
3. Apply Linear models and understand the Regression.
4. Implement the Logic based and algebraic based models.
5. Apply probabilistic model for problem statement.
6. Understanding the latest advances and its applications AL & ML.

Course Content

Unit I Introduction to Artificial Intelligence
9 hours

What is AI?, Early work in AI, AI and related fields, AI problems and Techniques Defining AI problems as a State Space Search: example, Production Systems, Search and Control Strategies, Problem Characteristics, Issues in Design of Search Programs, Additional Problems Generate-and-test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction, Mean-Ends Analysis.

Unit II Introduction to machine learning and Classification 9 hours

Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection. Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class Probability Estimates, Multiclass Classification.

Unit III Regression and Linear models 9 hours

Regression: Assessing performance of Regression- Error measures, over fitting- Catalysts for over fitting, Case study of Polynomial Regression. Theory of Generalization: Effective number of hypothesis, bounding the Growth function, VC Dimensions, Regularization theory. Linear models - Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perception, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from linear classifiers, Kernel methods for non Linearity

Unit IV Logic based and algebraic models 9 hours

Distance Based Models: Neighbors and Examples, Nearest Neighbors Classification, Rule Based Models: Rule learning for Subgroup discovery, Association rule mining. Tree Based Models: Ranking and Probability estimation Trees, Regression Trees, Clustering Trees.

Unit V Probabilistic models 9 hours

Normal Distribution and Its Geometric Interpretations, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.

Unit VI : 9 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.

The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas.

REFERENCES:

1. Deitel, Deitel and Nieto, “Internet and World Wide Web – How to program”, Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, “Java Network Programming”, O’Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, “Internet and Java Programming”, New Age International Publishers, 2004.
4. Thomno A. Powell, “The Complete Reference HTML and XHTML”, fourth edition, Tata McGraw Hill, 2003.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS2340	**Computer Networks**
Version No. 01	**Date of Approval: 01/06/20**
Prerequisite/Exposure	Fundamentals of Networks
Co-requisites	

Course Objectives

1. To study the physical layer.
2. To learn data link layer and Media Access.
3. To know about network layer working.
4. To learn the transportation of packets.
5. To have a knowledge about working of application layer.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the network and physical layer working.

2. Understand the addressing and connection of devices over network.
3. Learn the formatting and forwarding of packet and switching techniques.
4. Understand the overall working of transport protocol and layer.
5. Understand how web works and their protocols.
6. Understanding the latest advances and its applications in Computer networking.

Course Content

UNIT I INTRODUCTION AND PHYSICAL LAYER 9 hours

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II DATA-LINK LAYER & MEDIA ACCESS 9 hours

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III NETWORK LAYER 9 hours

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV TRANSPORT LAYER 9 hours

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V APPLICATION LAYER 9 hours

WWW and HTTP – FTP – Email –Telnet –SSH – DNS –SNMP

Unit VI Research 9 hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
4. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.

5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

6. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCS2311	**Cyber Security Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Cryptography and Network Security				
Co-requisites					

LIST OF EXPERIMENTS:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
a) Caesar Cipher
b) Playfair Cipher
c) Hill Cipher
d) Vigenere Cipher
e) Rail fence – row & Column Transformation

2. Implement the following algorithms
a) DES
b) RSA Algorithm
c) Diffiee-Hellman
d) MD5
e) SHA-1

3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (NetStumbler)
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

Course Code: MSCS2321	**Internet Programming Lab**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Any computer Procedural or Object Oriented Languages..				
Co-requisites					

LIST OF EXPERIMENTS

1. Write programs in Java to demonstrate the use of following components Text fields, buttons, Scrollbar, Choice, List and Check box
2. Write Java programs to demonstrate the use of various Layouts like Flow Layout, Border Layout, Grid layout, Grid bag layout and card layout
3. Write programs in Java to create applets incorporating the following features:
- Create a color palette with matrix of buttons
- Set background and foreground of the control text area by selecting a color from color palette.
- In order to select Foreground or background use check box control as radio buttons
- To set background images
4. Write programs in Java to do the following.
- Set the URL of another server.
- Download the homepage of the server.
- Display the contents of home page with date,

content type, and Expiration date. Last modified and length of the home page.

5. Write programs in Java using sockets to implement the following:
- HTTP request
- FTP
- SMTP
- POP3

6. Write a program in Java for creating simple chat application with datagram sockets and datagram packets.

7. Write programs in Java using Servlets:
- To invoke servlets from HTML forms
- To invoke servlets from Applets

8. Write programs in Java to create three-tier applications using servlets
- for conducting on-line examination.
- for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

9. Create a web page with the following using HTML

i) To embed a map in a web page
ii) To fix the hot spots in that map
iii) Show all the related information when the hot spots are clicked.

10. Create a web page with the following.

i) Cascading style sheets.
ii) Embedded style sheets.
iii) Inline style sheets.
iv) Use our college information for the web pages.

Course Code: MSCS2331	Artificial Intelligence and Machine Learning Lab using Python	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Python				
Co-requisites					

LIST OF EXPERIMENTS

1. Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithmtooutput a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the

program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct aBayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course Code: MSCS2351	**Quantitative Aptitude II**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Mathematics				
Co-requisites					

GEOMETRY	Quadrilaterals
	Triangle and its various kinds of centers
	Congruence and similarity of triangles
	Regular Polygon
	Right Prism & Hemispheres
	Circle and its chords, tangents
	Angles subtended by chords of a circle
	Common tangents to two or more circles
	Right Circular Cone
	Sphere
	Cylinder
	Right Circular Cylinder
	Regular Right Pyramid with Triangular base or Square base
	Rectangular Parallelepiped
MENSURATION	Two-dimensional (2D) and Three-dimensional (3D) Mensuration
TRIGONOMETRY	Degree and Radian Measures
	Trigonometric Ratios
	Complementary Angles
	Standard Identities
	Height and Distance
DATA INTERPRETATION	Frequency Polygon
	Histogram

	Pie-Chart
	Bar Diagram

Course Code: MSCS1261	**Communication Skills Lab II**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	English – Speaking and Listening				
Co-requisites					

OBJECTIVES:

- To enable learners to develop their communicative competence.
- To facilitate them to hone their soft skills.
- To equip them with employ-ability skills to enhance their prospect of placements.

COURSE OUTCOMES:

CO1: Understand about the International English language.
CO2: Understand about the time and stress management.

UNIT I ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Graduate Record Examination (GRE) – Civil Service (Language related) – Verbal ability.

UNIT II SOFT SKILLS

Motivation – self image – goal setting – managing changes – time management – stress management – leadership traits – team work – career and life planning.

TEACHING METHODS:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

Course Code: MSCS2371	**Comprehension and Technical Seminar**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**0**	**0**	**2**	**1**
Prerequisite/Exposure	Basic English Knowledge				
Co-requisites					

OBJECTIVES:

- To encourage the students to comprehend the knowledge acquired from the first Semester to third Semester of Degree Course through periodic exercise.
- To encourage the students to study advanced topics.
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors,

power point presentation and demonstrative models.

METHOD OF EVALUATION:

- The students will be assessed 100% internally through test with objective type questions on all the subject related topics.

- During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of two periods per week, students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that.

At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

OUTCOMES:

- Ability to understand and comprehend any given problem related to computer Science field.

Course Code: MSCS2381	**Mini Project**	L	T	P	C
Version No. 01	**Date of Approval : 01/06/2019**	**0**	**0**	**10**	**5**
5Prerequisite/Exposure	Must be specialized in Computer Lang, Or design, or Query Lang..				
Co-requisites					

GUIDELINES FOR THE MINI PROJECT:

- Every student is required to carry out Mini Project work under the supervision of a Mentor provided by the MSC Programme Coordinator.

- The mentor shall monitor progress of the student continuously. A candidate is required to present the progress of the Mini Project work during the semester as per the schedule provided by the MSC Programme Coordinator.

OBJECTIVES

- Application of knowledge and techniques learnt in theoretical classes for developing the s/w for real problems.

- Gives an insight into the working of the real organizations/companies.

- Gaining deeper understanding in specific functional areas.

- Helps in exploring career opportunities in their areas of interest.

The course MSC Mini Project is one that involves requirement analysis, feasibility analysis, Database design, coding, testing, implementation and maintenance

Discipline Specific Elective - I

Course Code: MSCD2310	**Open source Technologies**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	Know Basic of OSS.				
Co-requisites					

Course Objectives

1. To learn the fundamentals of PHP.
2. To study the advance PHP and MySQL.
3. To study the connection of PHP with AJAX, SEO.
4. To learn PERL.
5. To have a knowledge about advance PERL.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the concept and logics of PHP.
2. Understand the advance PHP and their connection with Database
3. Understand the connection of PHP with AJAX, SEO and CMS.
4. Implement the Logic of basic PERL.
5. Implement the concept of Advance PERL.
6. Understanding the latest advances and its applications Open source technologies.

Course Content

UNIT I BASIC PHP 9 Hours

Web Server-Apache-PHP-Data Types-User defined Variables-Constants-Operators-Control Structures-User defined Functions-Directory Functions-File system Functions-Arrays-String Functions-Date and Time Functions-Mathematical Functions-Miscellaneous Functions

UNIT II ADVANCED PHP with MySQL 9 Hours

Exceptions handling-Error Handling Functions-Predefined Variables-Cookies-Sessions-COM-DOM-CURL-SOAP-Classes and Objects-Mail Function-URL Functions. PHP with MySQL: PHP MySQL Functions-Database driven application.

UNIT III ADVANCED PHP with AJAX, SEO and CMS 9 Hours

PHP with AJAX: Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Word press Creating an SE-Friendly Blog

UNIT IV BASIC PERL 9 Hours

Introduction-Scalar Data- Lists and Arrays-Subroutines-Input and Output- Hashes-Regular Expressions-Control Structures-Perl Modules-File Tests

UNIT V ADVANCED PERL 9 Hours

Directory Operations-Strings and Sorting-Smart Matching-Process Management- Advanced Perl Techniques.

UNIT VI 9 Hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Mehdi Achour, Friedhelm, Betz Antony Dovgal, Nuno Lopes, Hannes Magnusson, Georg Richter,

Damien Seguy, Jakub VranaAnd several others, (1997-2011), "PHP Manual (Download the manual from PHP official website www.php.net)", The PHP Documentation Group. (For Units I to III)

2. Lee Babin,(2007), "Beginning Ajax with PHP From Novice to Professional", Apres.,

(For Units IV to V)

3. Jaimie Sirovich and Cristian Darie, (2007), "Professional Search Engine Optimization with PHP A Developer's Guide to SEO", Wiley Publishing, Inc., Indianapolis, Indiana.

4. Randal L. Schwartz, Tom Phoenix, brian d foy, "Learning Perl, Fifth Edition.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: SCD2320	**Software Testing**	L	T	P	C
Version No. 01	**Date of Approval : 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	Software Engineering.				
Co-requisites					

Course Objectives

1. To learn the introduction of Software Testing.
2. To study the Test Cases and Design.
3. To study the level of testing.
4. To learn how to manage Test Cases.
5. To have a knowledge about Test Automation.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the concept of Software Testing.
2. Implement the Test case concept.
3. Implement the level of Testing.
4. Understand the Management of Test Case.
5. Implement the Test automation.
6. Understanding the latest advances and its applications Software Testing.

Course Content

UNIT I – INTRODUCTION **9 hours**

Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.

UNIT II – TEST CASE DESIGN **9 hours**

Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – Statebased testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

UNIT III – LEVELS OF TESTING **9 hours**

The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

UNIT IV – TEST MANAGEMENT

9 hours

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT V – TEST AUTOMATION 9 hours

Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

UNIT VI

9 Hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.

The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCD2330	**SOFT COMPUTING**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	Computer Algorithms				
Co-requisites					

COURSE OBJECTIVES

1. To learn the introduction of soft computing.
2. To study the Artificial Neural Network.
3. To understand the Fuzzy Systems.
4. To learn Genetic Algorithms.
5. To Learn the hybrid System.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the Soft computing concept.
2. Understand neural Network and algorithms.
3. Implement the fuzzy algorithm.
4. Understand the genetic algorithm for problem.
5. Implement the algorithms to solve hybrid system problem.
6. Understanding the latest advances and its applications soft computing.

COURSE CONTENT

UNIT I INTRODUCTION TO SOFT COMPUTING 9 hours

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS 9 hours

Back propagation Neural Networks – Kohonen Neural Network -Learning Vector Quantization - Hamming Neural Network – Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks-Support Vector Machines – Spike Neuron Models.

UNIT III FUZZY SYSTEMS

9 hours

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations - Membership Functions -Defuzzification – Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning – Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS

9 hours

Basic Concepts- Working Principles -Encoding-Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion - Mutation Operator – Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS

9 hours

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination – LR-Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP- Inference by Fuzzy BP – Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools – GA in Fuzzy Logic Controller Design – Fuzzy Logic Controller.

UNIT VI

9 Hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.

The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. N.P.Padhy, S.P.Simon, “Soft Computing with MATLAB Programming”, Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications “, PHI Learning Pvt. Ltd., 2017.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, ―Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
5. Kwang H.Lee, ―First course on Fuzzy Theory and Applications, Springer, 2005.
6. George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCD2340	**Compiler Design**	L	T	P	C
Version No. 01	**Date of Approval : 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	Program Structure and Analysis				
Co-requisites					

COURSE OBJECTIVES

1. Introduction of Compilers.
2. To study the Lexical Analysis of compiler.
3. To understand the syntax Analysis.
4. To learn the translation and run time environment.
5. Introduction to Code optimization.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the Compiler design concept.
2. Understand the working of lexical analyzer.
3. Understand the working of syntax analyzer.
4. Learn the syntax directed translation and concepts of run time environment.
5. Learn how to optimize code and generation of code.
6. Understanding the latest advances and its applications in CD.

COURSE CONTENT

UNIT I INTRODUCTION TO COMPILERS 5 hours

Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics.

UNIT II LEXICAL ANALYSIS 9 hours

Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA-Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III SYNTAX ANALYSIS 10 hours

Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies- Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item- Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language .

UNIT IV SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT 12 hours

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions.

RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation-Parameter Passing-Symbol Tables-Dynamic Storage Allocation-Storage Allocation in FORTAN.

UNIT V CODE OPTIMIZATION AND CODE GENERATION 9 hours

Principal Sources of Optimization-DAG-Optimization of Basic Blocks-Global Data Flow Analysis- Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

UNIT VI

9 Hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.

The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles,Techniques and Tools”, 2nd Edition, Pearson Education, 2007.

2. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: ADependence-based Approach”, Morgan Kaufmann Publishers, 2002.

3. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
4.Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
5.Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCD2350	**Advanced Database Technology**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	DBMS				
Co-requisites					

Course Objectives

1. Introduction to parallel databases.
2. To study the intelligent database.
3. Use of XML database.
4. To learn the mobile database.
5. Introduction to multimedia database.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the concept of distributed database.
2. Understand the working of intelligent database.
3. Understand the concept of XML database.
4. Implement the use of mobile database.
5. Learn how to use multimedia with database.
6. Understanding the latest advances and its applications ADT.

Course Content

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9 hours

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

UNIT II INTELLIGENT DATABASES

9 hours

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases-Recursive Queries in SQL- Spatial Databases- Spatial Data Types - Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

UNIT III XML DATABASES

9 hours

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.

UNIT IV MOBILE DATABASES

9 hours

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models -Concurrency Control - Transaction Commit Protocols

UNIT V MULTIMEDIA DATABASES

9 hours

Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.

UNIT VI **9 Hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖ Eighth Edition, Pearson Education, 2006.

2.Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, ―Advanced Database Systems‖, Morgan Kaufmann publishers,2006.

3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, McGraw Hill, 2011.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Objectives

1. Introduction to Enterprise innovation.
2. To study the services.
3. Study about real time computing.
4. To learn the mobile business and security.
5. Future trends.

Course Outcomes

At the end of the course, students will be able to:

1. Understand the concept of Enterprise Innovation.
2. Understand services provided for web and peer.
3. Apply the real time computing and business management.
4. Understand Mobile business and enterprise security.
5. Learn what are the future trends.
6. Understanding the latest advances and its applications DT.

COURSE CONTENT

Unit I: Introduction &Enterprise Innovation **9 lecture hours**

Introduction - Business and IT Trends - Enterprise Software Trends- Key Emerging Technology Vendors - Key Applications- ITIS Innovations - Industry 4.0

Unit II: Web Services & Peer Services **9 lecture hours**

Web services Market (Technology, Business Strategy) - Peer Services Market (Technology, Business Strategy) – Web 2.0- Motion UI and Progressive Web Apps (PWA) - Hybrid Cloud – Containers (Docker,Warden, Garden)

Unit III: Real-Time Computing & Business Process Management 9 lecture hours

Real-Time Computing (Technology, Business Strategy) -Prescriptive Analytics - Edge Computing - Business Process Management (Technology- Business Strategy) - Cyber Physical Systems.

Unit IV: Mobile Business & Enterprise Security **9 lecture hours**

Wireless Infrastructure Management- Touch commerce and Personalized Shopping - Location-Based Services-Telematics- Electronic Tagging - Enterprise Security Prevention- Detection- Reaction- Estimating Results

Unit V: Future Trends **9 lecture hours**

AR/VR- Digital currencies and Blockchain Technology- Intelligent Computing AI and Autonomous Robots– Data Science and Deep learning- Computer Vision – Industrial IoT.

UNIT VI **9 Hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Carol Moran, 'Business Innovation and Disruptive Technology', Pearson Education, Inc. 2003
2. https://richtopia.com/emerging-technologies/11-disruptive-technology-examples
3. https://www.cognizant.com/whitepapers/the-futur e-of-it-infrastructure-codex2946.pdf

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCD2370	**Internet of Things**	L	T	P	C
Version No. 01	**Date of Approval : 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	Basic Application Software.				
Co-requisites					

COURSE OBJECTIVES

1. Introduction to IOT.
2. To study the IOT protocols.
3. Study the things on Web.
4. To learn the integrated techniques.
5. Understand the Applications of IOT.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the concept of IOT.
2. Understand the protocols needed for IOT.
3. Apply the logic and perform things on web.
4. Implement the Integrated techniques over IOT.
5. Learn what are the Application of IOT.
6. Understanding the latest advances and its applications in Internet of Things.

COURSE CONTENT

Unit – I INTRODUCTION **10 hours**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.

Unit – II IOT PROTOCOLS **8 hours**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID

Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security.

Unit – III WEB OF THINGS **10 hours**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing–Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

Unit – IV INTEGRATED **9 hours**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects – Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon.

Unit – V APPLICATIONS **8 hours**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

UNIT VI **9 Hours**

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, ―Architecting the Internet of Things‖, Springer, 2011.
3. David Easley and Jon Kleinberg, ―Networks, Crowds, and Markets: Reasoning About a Highly Connected World‖, Cambridge University Press, 2010.
4. Olivier Hersent, Omar Elloumi and David Boswarthick, ―The Internet of Things: Applications to the Smart Grid and Building Automation‖, Wiley, 2012.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012. Other Reference: 1. http://nptel.ac.in/courses/106105081/

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCD2380	**Big Data Analytics**	L	T	P	C
Version No. 01	**Date of Approval : 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	Big Data.				
Co-requisites					

COURSE OBJECTIVES

1. Introduction to BIG DATA.
2. To study the clustering.
3. Study the recommendation system.
4. To learn the graph theory and stream.
5. Understand the NOSQL data management.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the concept BIG DATA.
2. Apply the clustering methods and classify.
3. Apply the logic to create recommendation system.
4. Understand the graph theory and stream memory concept.
5. Understand the big data Visualization through NOSQL Data.
6. Understand about research and Indexed publication.
7. Understanding the latest advances and its applications in big data.

COURSE CONTENT

UNIT I INTRODUCTION TO BIG DATA 9 hours

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value - Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model.

UNIT II CLUSTERING AND CLASSIFICATION 9 hours Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes‘ Theorem - Naïve Bayes Classifier.

UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM

9 hours Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT IV GRAPH MEMORY AND STREAM MEMORY 9 hours

Using Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Choosing Graph Analytics - Graph Analytics Use Cases - Graph Analytics Algorithms and Solution Approaches - Technical Complexity of Analyzing Graphs- Features of a Graph Analytics Platform - Considerations: Dedicated Appliances for Graph - Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9 hours

NoSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding –- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

UNIT VI

9 Hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.

The latest research conducted in the areas covered in the course.

Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.

Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013. 3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

5. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.

6. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

7. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Course Code: MSCD2390	**Mobile Application Development**	L	T	P	C
Version No. 01	**Date of Approval: 01/06/2019**	**3**	**0**	**2**	**4**
5Prerequisite/Exposure	HTML, XML, Java or Python Language.				
Co-requisites					

COURSE OBJECTIVES

1. Understand the wireless communication.
2. To study mobile short-range networks.
3. Study the mobile IP and transport Layer.
4. To learn the mobile App development.
5. Understand the concept of Android.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the concept of wireless communication and Architecture.
2. Apply the concept to maintain wireless short-range network in mobile.
3. Understand how IP layer and Transport Layer works on Mobile.
4. Implement the Mobile application techniques through android.
5. Implement the Mobile application techniques and storage of data in it.

6. Understanding the latest advances and its applications Mobile application development.

COURSE CONTENT

UNIT I WIRELESS COMMUNICATION FUNDAMENTALS, ARCHITECTURE 9 hours

Frequency Spectrum- Multiplexing- Spread spectrum- GSM vs CDMA - -Comparison of 2G , 3 G, 4G - GSM Architecture-Entities-Call Routing- Address and identifiers- GSM Protocol architecture-Mobility Management-Frequency Allocation- Security –GPRS Architecture (entity and Protocol).

UNIT II MOBILE WIRELESS SHORT RANGE NETWORKS 9 hours

Introduction-WLAN Equipment-WLAN Topologies-WLAN Technologies-IEEE 802.11 Architecture-WLAN MAC-Security of WLAN, Power Management-Standards- WAP Architecture-Bluetooth enabled Devices Network-Layers in Bluetooth Protocol-Security in Bluetooth- IrDA-ZigBee.

UNIT III MOBILE IP NETWORK LAYER, TRANSPORT LAYER
9 hours

IP and Mobile IP Network Layer- Packet delivery and Handover Management-Location Management-Registration- Tunneling and Encapsulation-Route Optimization- Mobile Transport Layer-Conventional TCP/IP Transport Layer Protocol-Indirect, Snooping, Mobile TCP.

UNIT IV MOBILE APPLICATION DEVELOPMENT USING ANDROID
9 hours

Mobile Applications Development - Understanding the Android Software Stack – Android Application Architecture –The Android Application Life Cycle – The Activity Life CycleCreating Android Activity - Views- Layout -Creating User Interfaces with basic views- linking activities with Intents.

UNIT V MOBILE APPLICATION DEVELOPMENT USING ANDROID
9 hours Services-Broadcast Receivers – Adapters – Data Storage, Retrieval and Sharing.-Location based services- Development of simple mobile applications .

UNIT VI
9 Hours

The advances and the latest trends in the course as well as the latest applications of the areas covered in the course.
The latest research conducted in the areas covered in the course.
Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums.
Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

REFERENCES:

1. Asoke K Talukder, Hasan Ahmed,Roopa R Yavagal "Mobile Computing", Tata McGraw Hill Pub ,2nd Edition Aug – 2010.
2. Barry A. Burd ,"Android Application Development For Dummies All in One", Wiley, 2015.
3. Ed Burnette,"Hello, Android: Introducing Google"s Mobile Development Platform" third edition" Pragmatic Programmers,2012.
4. Jochen Schillar "Mobile Communications" Pearson Education second Edition.
5. Jerome(J.F) DiMarzio "Android A programmer"s Guide" Tata McGraw-Hill 2010 Edition.
6. Maritn Sauter, ―From GSM to LTE: An Introduction to Mobile Networks and Mobile Broadband‖, John Wiley and Sons, 2011 .
7. Raj Kamal "Mobile Computing" Oxford Higher Education, Second Edition, 2012.
8. RetoMeier, Professional Android 2 Application Development, Wrox"s Programmer to Programmer series.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100