Gurugram University Gurugram

Curriculum for UG Degree Course in

Computer Science and Engineering

Gurugram University, Gurugram

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S. No.	Category	Breakup of Credits (Total 160)
1	Humanities and Social Sciences, including Management courses	11
2	Basic Science courses	19
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	30.5
4	Professional core courses	64
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	14
8	Mandatory Courses [Environmental Sciences, Induction training, Constitution of India, Essence of Indian Traditional Knowledge]	Non-credit
	Total	**162.5**

SEMESTER-WISE SUMMARY OF THE PROGRAM

S. No.	Semester	No. of Contact Hours	Credits	Marks
1.	I	25	19.5	900
2.	II	25	22	900
3.	III	28	22	1000
4.	IV	26	22	1000
5.	V	27	21	900
6.	VI	26	22	900
7.	VII	26	20	800
8.	VIII	22	14	500
	Total		**162.5**	6900

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences, including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
TRAINING	Training
PROJECT	Project

CREDIT DISTRIBUTION IN THE FIRST YEAR OF THE UNDERGRADUATE ENGINEERING PROGRAM

Bachelor of Technology (SCHEME A1) Semester-1

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit
			L	T	P		
1.	HSE-101	Communication Skills in English	2	0	0	2	2
2.	BSM-101	Mathematics-I	3	1	0	4	4
3.	BSP-101 OR EEE-101	Physics OR Basic of Electrical and Electronics Engineering	3 3	1 0	0 0	4 OR 3	4 OR 3
4.	CSE-101	Programing for problem solving using C	3	0	0	3	3
5.	ENV-101	Basics of Environmental Science	2	0	0	2	2
6.	HSE-101P	Communication Skills in English (P).	0	0	2	2	1
7.	BSP-101P OR EEE-101P	Physics (P) OR Basic of Electrical and Electronics Engineering (P)	0	0	2	2	1
8.	CSE-101P	Programing for problem solving using C (P)	0	0	2	2	1
9.	CSE-103P OR MEE-102P	Engineering Graphics (Web Design) OR Workshop Practices (P)	1 1	0 0	2 3	3 OR 4	2 OR 2.5
10.	AUS-101	Sports (Audit Course) Compulsory	0	0	2	2*	0
						24+2*	**20/19.5**

Bachelor of Technology (SCHEME A1) Semester-2

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit
			L	T	P		
1.	BSM-102	Mathematics-II	3	1	0	4	4
2.	HSV-102	Human Value & Soft Skills	2	0	2	4	3
3.	EEE-101 OR BSP-101	Basic of Electrical and Electronics Engineering OR Physics	3 3	0 1	0 0	3 OR 4	3 OR 4
4.	CSE-102	Data Structure Using C	3	0	0	3	3
5.	CSE-104	Object Oriented Concepts and Python Programming	3	0	0	3	3
6.	EEE-101P OR BSP-101P	Basic of Electrical and Electronics Engineering (P) OR Physics (P).	0	0	2	2	1
7.	CSE-102P	Data Structure Using C (P)	0	0	2	2	1
8.	CSE-104P	Object Oriented Concepts and Python Programming (P)	0	0	2	2	1
9.	MEE-102P OR CSE-103P	Workshop Practices (P) OR Engineering Graphics (Web Designing)	1 1	0 0	3 2	4 OR 3	2.5 OR 2
Total						**27**	**21.5/22**

HUMANITIES & SOCIAL SCIENCES, INCLUDING MANAGEMENT (HSMC)

S. No.	Code No.	Course Title	Hours Per week			Total Credits	Semester
			L	T	P		
1.		Communication Skills in English	2	0	2	3	I
2.		Basics of Environmental Science	2	0	0	2	I
3.		Human Value & Soft Skills	2	0	2	3	II
4.		Economics for Engineers	3	0	0	0	V
5.		Organizational Behaviour	3	0	0	3	VII
Total Credits						**11**	

BASIC SCIENCE COURSES (BSC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Mathematics-I	3	1	0	4	I
2.		Mathematics-II	3	1	0	4	II
3.		Physics	3	1	2	5	II
4.		Calculus and Ordinary Differential Equations	3	0	0	3	III
5.		Discrete Mathematics	3	0	0	3	IV
Total Credits						**19**	

ENGINEERING SCIENCE COURSE (ESC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Basic of Electrical and Electronics Engineering	3	0	2	4	I
2.		Programming for problem-solving using C	3	0	2	4	I
3.		Workshop Practices(P)	1	0	2	2.5	I
4.		Data Structure Using C	3	0	2	4	II
5.		Object-Oriented Concepts and Python Programming	3	0	2	4	II
6.		Engineering Graphics (Web Design)	1	0	2	2	II
7.		Digital Electronics	3	0	2	4	III
8.		MOOC - I (Essential)	3	-	-	3	VIII
9.		MOOC - II (Essential)	3	-	-	3	VIII
Total Credits						**30.5**	

PROFESSIONAL CORE COURSES (PCC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Advance Data structures	3	0	2	4	III
2.		Database Management Systems with SQL	3	0	2	4	III
3.		Programming with C++	3	0	2	4	III
4.		Introduction to AI and ML	3	0	0	3	III
5.		Operating System	3	0	2	4	IV
6.		Programming in Java	3	0	2	4	IV
7.		Microprocessor and Microcontroller	3	0	2	4	IV
8.		R-programming	3	0	2	4	IV
9.		Computer Organization & Architecture	3	0	0	3	IV
10.		Design & Analysis of Algorithms	3	0	2	4	V
11.		Computer Networks	3	0	2	4	V
12.		Web Technology	3	0	2	4	V
13.		Formal Languages & Automata	3	0	0	3	V
14.		Advance Java Programming	3	0	2	4	VI
15.		Machine Learning and its Applications	3	0	2	4	VI
16.		Compiler Design	3	0	0	3	VI
17.		Neural Networks	3	0	2	4	VII
Total Credits						64	

PROFESSIONAL ELECTIVE COURSES (PEC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Professional Elective Course - I	3	0	0	3	V
2.		Professional Elective Course - II	3	0	0	3	VI
3.		Professional Elective Course - III	3	0	0	3	VI
4.		Professional Elective Course - IV	3	0	0	3	VII
Total Credits						**12**	

OPEN ELECTIVE COURSES (OEC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Open Elective Course – I	3	0	0	3	V
2.		Open Elective Course - II	3	0	0	3	VI
3.		Open Elective Course - III	3	0	0	3	VII
4.		Open Elective Course - IV	3	0	0	3	VII
Total Credits						**12**	

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE

S. No.	Code No.	Course Title	Hours per week			Total Credits	Semester
			L	T	P		
1.		Practical Training - I	-	-	2	1	V
2.		Project - I	0	0	4	2	VI
3.		Practical Training - II	0	0	2	1	VII
4.		Project - II	0	0	8	4	VII
5.		Project - III	0	0	16	8	VIII
Total Credits						**16**	

Semester-wise Structure and Curriculum for

UG Course in

Computer Science and Engineering

Gurugram University
Scheme of Studies and Examination
Bachelor of Technology (SCHEME A1) Semester-1

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit
			L	T	P		
1.	HSE-101	Communication Skills in English	2	0	0	2	2
2.	BSM-101	Mathematics-I	3	1	0	4	4
3.	BSP-101 OR EEE-101	Physics OR Basic of Electrical and Electronics Engineering	3 3	1 0	0 0	4 OR 3	4 OR 3
4.	CSE-101	Programing for problem solving using C	3	0	0	3	3
5.	ENV-101	Basics of Environmental Science	2	0	0	2	2
6.	HSE-101P	Communication Skills in English (P).	0	0	2	2	1
7.	BSP-101P OR EEE-101P	Physics (P) OR Basic of Electrical and Electronics Engineering (P)	0	0	2	2	1
8.	CSE-101P	Programing for problem solving using C (P)	0	0	2	2	1
9.	CSE-103P OR MEE-102P	Engineering Graphics (Web Design) OR Workshop Practices (P)	1 1	0 0	2 3	3 OR 4	2 OR 2.5
10.	AUS-101	Sports (Audit Course) Compulsory	0	0	2	2*	0
						24+2*	**20/19.5**

Gurugram University

Scheme of Studies and Examination

Bachelor of Technology (SCHEME A1) Semester-2

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit
			L	T	P		
1.	BSM-102	Mathematics-II	3	1	0	4	4
2.	HSV-102	Human Value & Soft Skills	2	0	2	4	3
3.	EEE-101 OR BSP-101	Basic of Electrical and Electronics Engineering OR Physics	3 3	0 1	0 0	3 OR 4	3 OR 4
4.	CSE-102	Data Structure Using C	3	0	0	3	3
5.	CSE-104	Object Oriented Concepts and Python Programming	3	0	0	3	3
6.	EEE-101P OR BSP-101P	Basic of Electrical and Electronics Engineering (P) OR Physics (P).	0	0	2	2	1
7.	CSE-102P	Data Structure Using C (P)	0	0	2	2	1
8.	CSE-104P	Object Oriented Concepts and Python Programming (P)	0	0	2	2	1
9.	MEE-102P OR CSE-103P	Workshop Practices (P) OR Engineering Graphics (Web Designing)	1 1	0 0	3 2	4 OR 3	2.5 OR 2
Total						**27**	**21.5/22**

B. Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - III

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**ESC**		Digital Electronics	3	0	0	3	3	30	70		100
2.	**PCC**		Advanced-Data Structure	3		0	3	3	30	70		100
3.	**PCC**		Database Management Systems with SQL	3	0	0	3	3	30	70		100
4.	**PCC**		Programming with C++	3	0	0	3	3	30	70		100
5.	**PCC**		Introduction to AI and ML	3	0	0	3	3	30	70		100
6.	**BSC**		Calculus and Ordinary Differential Equations	3	0	0	3	3	30	70		100
7.	**LC**		Digital Electronics Lab	0	0	2	2	1	50		50	100
8.	**LC**		Advanced-Data Structure Lab	0	0	2	2	1	50		50	100
9.	**LC**		Database Management Systems Lab	0	0	2	2	1	50		50	100
10.	**LC**		Programming with C++ Lab	0	0	2	2	1	50		50	100
11.	**MC**		Constitution of India*	2	0	0	2	0	30	70		100*
			Total	**20**	**0**	**8**	**28**	**22**	**380**	**420**	**200**	**1000**

***** The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

B.Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - IV

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Operating System	3	0	0	3	3	30	70		100
2.	**PCC**		R-Programming	3	0	0	3	3	30	70		100
3.	**PCC**		Programming in Java	3	0	0	3	3	30	70		100
4.	**PCC**		Microprocessor and Micro-controller	3	0	0	3	3	30	70		100
5.	**BSC**		Discrete Mathematics	3	0	0	3	3	30	70		100
6.	**PCC**		Computer Organization & Architecture	3	0	0	3	3	30	70		100
7.	**LC**		Operating System Lab	0	0	2	2	1	50		50	100
8.	**LC**		Programming in Java Lab	0	0	2	2	1	50		50	100
9.	**LC**		Microprocessor and Micro-controller Lab	0	0	2	2	1	50		50	100
10.	**LC**		R-Programming Lab	0	0	2	2	1	50		50	100
			Total	**18**	**0**	**8**	**26**	**22**	**380**	**420**	**200**	**1000**

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry /Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

B. Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester – V

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Design and Analysis of Algorithm	3	0	0	3	3	30	70		100
2.	**PCC**		Formal Languages & Automata	3	0	0	3	3	30	70		100
3.	**PCC**		Web Technology	3	0	0	3	3	30	70		100
4.	**PCC**		Computer Networks	3	0	0	3	3	30	70		100
5.	**PEC**		Professional Elective Course - I	3	0	0	3	3	30	70		100
6.	**OEC**		Open Elective Course - I	3	0	0	3	3	30	70		100
7.			Design and Analysis of Algorithm Lab	0	0	2	2	1	50		50	100
8.	**LC**		Web Technology Lab	0	0	2	2	1	50		50	100
9.	**LC**		Computer Networks Lab	0	0	2	2	1	50		50	100
10.	**HSMC**		Economics for Engineers*	3	0	0	3	3	30	70		100*
11.	**PT**		Practical Training - I	0	0	2	2	1	50		50	100
			Total	**21**	**0**	**6**	**27**	**22**	**330**	**420**	**150**	**1000**

NOTE:

1. **The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.**
2. **The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students.**
3. **Choose any one from Professional Elective Course – I**
4. **Choose any one from Open Elective Course – I**

Professional Elective Course – I

1. Software Engineering
2. Digital Image Processing
3. Distributed System
4. Statistical computing
5. Big data analytics

B.Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VI

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Compiler Design	3	0	0	3	3	30	70		100
2.	**PCC**		Advance JAVA Programming	3	0	0	3	3	30	70		100
3.	**PCC**		Machine Learning and its Applications	3	0	0	3	3	30	70		100
4.	**PEC**		Professional Elective Course - II	3	0	0	3	3	30	70		100
5.	**PEC**		Professional Elective Course - III	3	0	0	3	3	30	70		100
6.	**OEC**		Open Elective Course - II	3	0	0	3	3	30	70		100
7.	**LC**		Advance JAVA Programming Lab	0	0	2	2	1	50		50	100
8.	**LC**		Machine Learning and its Applications Lab	0	0	2	2	1	50		50	100
9.	**PROJECT**		Project - I	0	0	4	4	2	50		50	100
			Total	**18**	**0**	**8**	**26**	**22**	**330**	**420**	**150**	**900**

NOTE:

1. **At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.**
2. **Choose any one from Professional Elective Course – II & III**
3. **Choose any one from Open Elective Course – II**

Professional Elective Course – II

1. Software Testing
2. Computer Graphics
3. Information Retrieval
4. Internet of Things
5. Soft Computing

Professional Elective Course – III

1. Network Security and Cryptography
2. Internet Technologies
3. Mobile applications development
4. Advance Database Management System
5. Cloud Computing

B. Tech. (Computer Science and Engineering)

Scheme of Studies/Examination w.e.f. 2023-24

Semester – VII

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Neural Networks	3	0	0	3	3	30	70		100
2.	**PEC**		Professional Elective Course - IV	3	0	0	3	3	30	70		100
3.	**PEC**		Open Elective Course - III	3	0	0	3	3	30	70		100
4.	**OEC**		Open Elective Course - IV	3	0	0	3	3	30	70		100
5.	**HSMC**		Organizational Behaviour	3	0	0	3	3	30	70		100
6.	**LC**		Neural Networks Lab	0	0	2	2	1	50		50	100
7.	**PROJECT**		Project - II	0	0	8	8	4	100		100	200
8.	**PT**		Practical Training - II	0	0	2	2	1	50		50	100
			Total	**15**	**0**	**11**	**26**	**20**	**300**	**350**	**150**	**900**

NOTE:

1. **The evaluation of Practical Training - II will be based on the seminar, viva voice, and report submitted by the students.**
2. **Choose any one from Professional Elective Course – IV**
3. **Choose any one from Open Elective Course – III & IV**

Professional Elective Course – IV

1. Cyber Security Threats
2. Advanced Computer Architecture
3. Predictive Analytics
4. Information Hiding Techniques
5. Data Science

B.Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VIII

S. No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**ESC**		MOOCs (Essential)	3	-	-	-	3	-	-	-	100
2.	**ESC**		MOOCs (Essential)	3	-	-	-	3	-	-	-	100
3.	**PROJECT**		Project – III/Industrial Training	0	0	16	16	8	150		150	300
			Total	**6**	**0**	**16**	**22**	**14**	**150**	**-**	**150**	**500**

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

3RD SEMESTER

B. Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - III

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**ESC**		Digital Electronics	3	0	0	3	3	30	70		100
2.	**PCC**		Advanced-Data Structure	3		0	3	3	30	70		100
3.	**PCC**		Database Management Systems with SQL	3	0	0	3	3	30	70		100
4.	**PCC**		Programming with C++	3	0	0	3	3	30	70		100
5.	**PCC**		Introduction to AI and ML	3	0	0	3	3	30	70		100
6.	**BSC**		Calculus and Ordinary Differential Equations	3	0	0	3	3	30	70		100
7.	**LC**		Digital Electronics Lab	0	0	2	2	1	50		50	100
8.	**LC**		Advanced-Data Structure Lab	0	0	2	2	1	50		50	100
9.	**LC**		Database Management Systems Lab	0	0	2	2	1	50		50	100
10.	**LC**		Programming with C++ Lab	0	0	2	2	1	50		50	100
11.	**MC**		Constitution of India*	2	0	0	2	0	30	70		100*
			Total	**20**	**0**	**8**	**28**	**22**	**380**	**420**	**200**	**1000**

***** The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

DIGITAL ELECTRONICS

Semester	III				
Course code					
Category	Engineering Science courses				
Course title	Digital Electronics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
2. To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits**.**
3. To express real-life problems in logic design terminology.
4. To understand the logic of adders, subtractors and converters.

UNIT - I

FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems - binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

UNIT - II

COMBINATIONAL DIGITAL CIRCUITS

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer, Decoders, Adders, Subtractors, BCD arithmetic, carry look-ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT - III

SEQUENTIAL CIRCUITS AND SYSTEMS

A 1-bit memory, the circuit properties of the Bistable latch, the clocked SR flip-flop, J-K flip-flop, T flip-flop and D flip-flop, applications of flip-flops, shift registers, applications of shift registers,

serial-to-parallel converter, parallel-to-serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip-flops, special counter IC's, asynchronous sequential counters, applications of counters**.**

UNIT - IV

A/D AND D/A CONVERTERS

Digital to analog converters: weighted resistor/converter, R-2-R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, Analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Outline the general concepts and terminology related to logic gates, logic families, combinational and sequential circuits.

CO2: Discuss the basic analog/digital components and their interconnections in logic families and circuits.

CO3: Apply different methods/techniques to design various digital circuits.

CO4: Analyse day to day problems and industrial problems for their solutions using digital circuits.

CO5: Contrast different types of digital circuits and their designing methods.

CO6: Design digital circuit for various practical problems.

TEXT AND REFERENCE BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer Design", Pearson Education India,2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Nasib Singh Gill and J B Dixit, "Digital Design and Computer Organization", University Science Press, New Delhi

ADVANCE DATA STRUCTURE

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Advance Data Structure				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand and apply linear data structures-List, Stack and Queue.
2. To understand the tree algorithms and their applications.
3. To learn different algorithms and analysis techniques.
4. To apply sorting algorithms in real-time applications

UNIT - I

Review of Linear Data Structures

Linked List: Traverse, Insertion, Deletion; Circular List: Traverse, Insertion, Deletion, Doubly List and Circular List: Insertion and deletions; Stacks and Queue implementation using linked list.

Introduction to Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, and Extendible Hashing.

UNIT - II

Advanced Trees: Trees: Review of binary trees and binary search trees: traversing, insertion, and deletion; **AVL Trees:** Introduction to AVL trees, Rotations in AVL trees: LL, RR, LR & RL,

Introduction, Search, Insert & delete operations: Red-Black Trees, 2-3 Trees, B-Trees, B+ Trees, Splay Trees.

UNIT - III

Sets: Representation on Sets, Operations on Sets, Application on Sets,

Files: File Concepts, File organization, Files and Streams, Working with Files Using I/O Stream, Sequential File Organization, Direct File Organization, Indexed Sequential Organization

UNIT - IV

Graphs: Representation, Basic terminology, traversal, connected components, shortest path, topological sort, Dijkstra's Algorithm, Floyd Warshall's Algorithm, network flow problems.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Design and Analyze programming problem statements.
CO2: Understand the ADT/libraries, and use it to design algorithms for a specific problem.
CO3: Select algorithm design approaches in a problem-specific manner.
CO4: Compare & contrast the complexity analysis of various sorting & searching algorithms.
CO5: To be able to analyse the efficiency of algorithms.
CO6: Implement various data structure concepts on real-world industrial problems.

TEXT AND REFERENCE BOOKS:

1. Seymour Lipschutz: Data Structures with C, Schaum's outline by TMH
2. E Horowitz and S. Sahni: Fundamentals of Data Structures in C, Second Edition, Universities Press, Hyderabad.
3. R.B. Patel: Expert Data Structures in C, Khanna Publishers,2001.
4. R.L. Kruse: Data Structures & Program Design in C, PHI.
5. D.F. Knuth: The art of Computer Programming Vol 1, Narosa Publications,1985.
6. Byron S. Gottfried & J K Chhabra: Theory and Problems of Programming with C Language, Schaum's Series, TMH,2005.

DATABASE MANAGEMENT SYSTEMS WITH SQL

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Database Management Systems With SQL				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

UNIT - I

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

UNIT - II

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

UNIT - III

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Storage strategies: Indices, B-trees, hashing,

UNIT - IV

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced topics: Object-oriented and object-relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: For a given query, write relational algebra expressions for that query and optimize the developed expressions
- CO2: For a given requirement specification, design the databases using E R method and normalization.
- CO3: For a given specification, construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.
- CO4: For a given query, optimize its execution using Query optimization algorithms
- CO5: For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
- CO6: Implement the isolation property, including locking, and time stamping based on concurrency control and Serializability of scheduling.

TEXT AND REFERENCE BOOKS:

1. Database System Concepts, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill
2. Principles of Database and Knowledge–Base Systems, Vol 1 by J. D. Ullman, Computer Science Press.
3. Fundamentals of Database Systems, 5th Edition by R. Elmasri and S. Navathe, Pearson Education
4. Foundations of Databases, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

PROGRAMMING WITH C++

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Programming with C++				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand how the C++ is superset of C by incorporating the Object-oriented features in C language.
2. To learn how to efficiently use the memory using Pointers and Dynamic Memory Management
3. To learn how to implement different types of constructors and the use of destructor.
4. To learn how to implement the concept of data abstraction, encapsulation and how to perform different types of overloading i.e. operators and functions.
5. To learn how inheritance helps to reuse the code.
6. To learn how we can implement dynamic binding with polymorphism.
7. To learn the use of exception handling in C++ programs.

UNIT - I

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

UNIT - II

Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritances, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, the pointer to an object, this pointer, pointer

related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

UNIT - III

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract clasess, virtual destructors.

UNIT - IV

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the concept of Object-Oriented Programming through C++.

CO2: Identify importance of object-oriented programming and difference between Procedural programming and object oriented programming features.

CO3: be able to make use of objects and classes for developing programs.

CO4: be able to use various object-oriented concepts to solve different problems.

CO5: be able to develop the programs /Projects using some advanced features of C++ Programming.

TEXT AND REFERENCE BOOKS:

1. BjraneStroustrup, “C++ Programming language”,3rd edition, Pearson education Asia(1997)
2. LaforeR.”Object oriented Programming in C++”,4th Ed. Techmedia,New Delhi(2002).
3. Yashwant Kenetkar,”Let us C++”,1stEd.,Oxford University Press(2006)
4. B.A. Forouzan and R.F. Gilberg,CompilerScience,”A structured approach using C++” Cengage Learning, New Delhi.

CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

Semester	III				
Course code					
Category	Basic Science Courses				
Course title	Calculus and Ordinary Differential Equations				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the basic concepts of Limits & Continuity.
2. Understand partial and total derivative and apply it to real time applications.
3. Understand the ordinary Differential Equations of First, Second and Higher Order.

UNIT - I

Multivariable Differential Calculus: Limit, Continuity and Partial derivatives, Homogeneous functions, Euler's Theorem, Total derivative, Maxima, Minima and Saddle points, Lagrange's method of undetermined multipliers.

UNIT - II

Multivariable Integral Calculus: Double integral, change of order of integration, Change of variables, Applications of double integral to find area enclosed by plane curves, Triple integral.

UNIT - III

Ordinary Differential Equations of first order: Linear and Bernoulli's equations, Exact differential equations, Equations reducible to exact differential equations, Applications of differential equations of first order and first degree to simple electric circuits, Newton's law of cooling, Heat flow and Orthogonal trajectories.

UNIT - IV

Ordinary Differential equations of second and higher order: Linear differential equations of second and higher order, Complete solution, Complementary function and Particular integral, Method of variation of parameters to find particular integral, Cauchy's and Legendre's linear equations, Simultaneous linear differential equations with constant coefficients, Applications of linear differential equations to oscillatory electric circuits.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Deal with functions of several variables and evaluate partial derivative.

CO2: Evaluate multiple integrals and their usage.

CO3: Solve ordinary differential equations that model physical processes.

CO4: Formulate and solve problems involving moment of inertia, volume and centre of gravity.

CO5: Solve engineering problems related to oscillatory electric circuits.

CO6: Solve field problems in engineering involving Ordinary Differential Equations like R-L-C circuits and to find heat loss

TEXT AND REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
4. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems,Wiley India.
7. S. L. Ross, Differential Equations, Wiley India.
8. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India.
9. E. L. Ince, Ordinary Differential Equations, Dover Publications

INTRODUCTION TO AI and ML

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Introduction to AI and ML				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the very basics and Uses of Artificial Intelligence (AI)
2. Understand the basics and uses of Machine Learning (ML)
3. To provide the most fundamental knowledge to the students so that they become familiar with basic principles of AI towards problem solving, inference, knowledge representation and learning
4. Understand the logic-building methods and inferences for the knowledge representation.
5. Explore application of AI techniques in Expert systems, Neural Networks.

UNIT - I

Introduction to AI: What is AI, Turing test, History of AI, Artificial Intelligence Techniques, advantages, and limitations of AI, Impact and Examples of AI

Applications of AI by domain: Transportation, home/service robots, healthcare, education, low-resource communities, public safety and security, employment and workplace, entertainment, finance, banking and insurance.

Introduction to Machine Learning: What is Machine Learning, History of Machine Learning, Machine Learning and Statistics, Types of Machine Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning,

UNIT - II

Intelligent agent: Nature of Agents, Rationality and Rational agent with performance measures Flexibility and Intelligent agents, Task environment and its properties, Types of agents, other aspects of agents;

Multi-Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

UNIT - III

Knowledge Representation schemes and reasoning: Approaches and issues, procedural vs declarative knowledge, Matching, conflict resolution.

Logic: Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm.

Uncertain Knowledge and reasoning: Methods, Bayesian probability and belief network, Probabilistic reasoning, Forward and backward reasoning, Other uncertain techniques-Data mining, Fuzzy logic, Dempster -Shafer theory.

UNIT - IV

Planning: The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Formulate a problem and build intelligent agents.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.

CO3: Analyze the problem and infer new knowledge using suitable knowledge representation schemes.

CO4: Develop planning and apply learning algorithms on real world problems.

CO5: Design an expert system and implement advance techniques in Artificial Intelligence.

CO6: Create a real life and industrial problems related mini project.

TEXT AND REFERENCE BOOKS:

1. Artificial Intelligence 3e: A Modern Approach Paperback – By Stuart J Russell & Peter Norvig; Publisher – Pearson
2. Artificial Intelligence Third Edition by Kevin Knight, Elaine Rich, B. Nair – Mc Graw Hill
3. Artificial Intelligence Third Edition by Patrick Henry Winston – Addison-Wesley Publishing Company
4. Machine Learning using Pythons, U Dinesh Kumar, Manaranjan Pradhan, John Wiley & Sons.
5. A Classical Approach to Artificial Intelligence, M. C. Trivedi, Khanna Publishing House.
6. Machine Learning, V. K. Jain, Khanna Publishing House.
7. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning, Sayan Mukhopadhyay, Apress.
8. Introduction to Machine Learning, Jeeva Jose, Khanna Publishing House.

CONSTITUTION OF INDIA

Semester	III				
Course code					
Category	Mandatory courses				
Course title	Constitution of India				
Scheme and Credits	L	T	P	Credits	
	2	0	0	-	
Classwork	30				
Exam	70				
Total	100				
Duration of Exam	3 hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
4. To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

UNIT - I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT - II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT - III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor,

Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT - IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Rights to equality, right to freedom, right against exploitation, Right to

freedom of religion, Cultural and Education rights and Fundamental duties.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to a revolution in India.

CO3: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.

CO4: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO5: Discuss the passage of the Hindu Code Bill of 1956.

CO6: Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail.

TEXT AND REFERENCE BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

NOTE: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

DIGITAL ELECTRONICS LAB

Semester	III				
Course code					
Category	Laboratory course				
Course title	Digital Electronics Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

Implementation of all experiments with the help of Bread-Board.

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates.
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations.
12. DAC Operation: Study of 8-bit DAC, obtain staircase waveform.
13. ADC Operations: Study of 8-bit ADC

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Define different types of logic gates, identify their ICs and also verify their truth table.

CO2: Derive basic logic gates, adder, and subtractor using universal gates.

CO3: Illustrate realization of Boolean expression in SOP and POS form and design it using logic gates.

CO4: Design and test combinational circuits.

CO5: Design and develop sequential circuits.

CO6: Demonstrate team- based laboratory activities with fellow students to interact effectively on a social and interpersonal level.

DATABASE MANAGEMENT SYSTEM LAB

Semester	III				
Course code					
Category	Laboratory course				
Course title	Database Management System Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE.
4. Write the queries to implement the joins.
5. Write the query for implementing the following functions: MAX (), MIN (), AVG () and COUNT ().
6. Write the query to implement the concept of Integrity constrains.
7. Write the query to create the views.
8. Perform the queries for triggers.
9. Study of PL/SQL block.
10. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
11. Write the query for creating the users and their role. Mini project (Application Development using Oracle/ MySQL)
    a. Inventory Control System
    b. Material Requirement Processing.
    c. Hospital Management System.
    d. Railway Reservation System.
    e. Personal Information System.
    f. Web-Based User Identification System.
    g. Time Table Management System.
    h. Hotel Management

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify the fundamental elements of relational database management systems.

CO2: Design and explain the basic concepts of relational data model, entity-relationship model, and relational database design.

CO3: Apply the relational database theory to formulate basic and advanced SQL queries and relational algebra expressions for the queries.

CO4: Identify the use of normalization and functional dependency in database design.

CO5: Understand the concept of transactions and serializability in database management system.

CO6: Classify the implementation details of Concurrency control protocols and discuss various database recovery methods.

ADVANCED DATA STRUCTURE LAB

Semester	III				
Course code					
Category	Laboratory course				
Course title	Advance Data Structure Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Write a program to implement all operations on 1-D array.
2. Write a program to implement all operations on Simple Linked List.
3. Write a program to implement all operations on a circular Linked List.
4. Write a program to implement all operations on a doubly Linked List.
5. Write a program to implement all operations on a doubly circular Linked List.
6. Write a program to implement all operations on Stack using Array.
7. Write a program to implement all operations on Stack using Linked List.
8. Write a program to implement all operations on Queue using Array.
9. Write a program to implement all operations on Queue using Linked List.
10. Write a Program to implement dictionary techniques.
11. Write a program to implement hashing techniques.
12. Write a Program to implement Red-Black Trees.
13. Write a Program to implement Binary Search Trees.
14. Write a Program to design a menu to implement: Quick, Merge, and Bubble sorting.
15. Write a Program to develop a recursive Program to implement Breadth First Search and Depth First Search.
16. Write a Program to develop a non-recursive Program to implement Breadth First Search and Depth First Search

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify the appropriate data structure for a given problem.

CO2: Implement Dictionary by using hashing techniques.

CO3: Analyse various basic operations of trees to improve the efficiency.

CO4: Build a Binary Heap using Priority queues.

CO5: Apply the concepts of data structures in various real-world applications.

CO6: Identify, model, solve and develop algorithms for real-life problems like shortest path and MST using graph theory.

PROGRAMMING WITH C++ LAB

Semester	III				
Course code					
Category	Laboratory course				
Course title	Programming with C++ Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Write a program that uses a class where the member functions are defined inside a class.
2. Write a program that uses a class where the member functions are defined outside a class.
3. Write a program to demonstrate the use of static data members.
4. Write a program to demonstrate the use of const data members.
5. Write a program to demonstrate the use of zero argument and parameterized constructors.
6. Write a program to demonstrate the use of dynamic constructor.
7. Write a program to demonstrate the use of explicit constructor.
8. Write a program to demonstrate the use of initializer list.
9. Write a program to demonstrate the overloading of increment and decrement operators.
10. Write a program to demonstrate the overloading of binary arithmetic operators.
11. Write a program to demonstrate the overloading of memory management operators.
12. Write a program to demonstrate the multilevel inheritance.
13. Write a program to demonstrate the multiple inheritance.
14. Write a program to demonstrate the virtual derivation of a class.
15. Write a program to demonstrate the runtime polymorphism.
16. Write a program to demonstrate the exception handling.
17. Write a program to demonstrate the use of function template.
18. Write a program to demonstrate the use of class template.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand dynamic memory management techniques using pointers, constructors, destructors, etc.

CO2: Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.

CO3: Classify inheritance with the understanding of early and late binding

CO4: Usage of exception handling and generic programming.

CO5: Develop the programs /Projects using some advanced features of C++ Programming.

CO6: Percept the utility and applicability of OOP.

4TH SEMESTER

B.Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - IV

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Operating System	3	0	0	3	3	30	70		100
2.	**PCC**		R-Programming	3	0	0	3	3	30	70		100
3.	**PCC**		Programming in Java	3	0	0	3	3	30	70		100
4.	**PCC**		Microprocessor and Micro-controller	3	0	0	3	3	30	70		100
5.	**BSC**		Discrete Mathematics	3	0	0	3	3	30	70		100
6.	**PCC**		Computer Organization & Architecture	3	0	0	3	3	30	70		100
7.	**LC**		Operating System Lab	0	0	2	2	1	50		50	100
8.	**LC**		Programming in Java Lab	0	0	2	2	1	50		50	100
9.	**LC**		Microprocessor and Micro-controller Lab	0	0	2	2	1	50		50	100
10.	**LC**		R-Programming lab	0	0	2	2	1	50		50	100
			Total	**18**	**0**	**8**	**26**	**22**	**380**	**420**	**200**	**1000**

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry /Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

OPERATING SYSTEM

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Operating System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand the mechanisms of OS to handle processes and threads and their communication.
2. To understand the process management mechanisms and scheduling algorithms.
3. To understand the mechanisms involved in memory management in OS and virtual memory concepts.
4. To understand the file management and deadlocks handling techniques in OS.

UNIT - I

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading.

Process Scheduling: Foundation and Scheduling OBJECTIVESs, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling.

UNIT - II

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT - III

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation

and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU).

UNIT - IV

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. Case study on UNIX and WINDOWS Operating System.

Case Studies: Comparative study of WINDOW, UNIX & LINUX system.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain the basic concepts of operating system.
CO2: Describe mechanisms of OS to handle processes, threads, and their communication.
CO3: Analyze the memory management and its allocation policies.
CO4: Illustrate different conditions for deadlock and their possible solutions.
CO5: Discuss the storage management policies with respect to different storage management technologies.
CO6: Evaluate the concept of the operating system with respect to UNIX, Linux, Time, and mobile OS.

TEXT AND REFERENCE BOOKS:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

R - PROGRAMMING

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	R - Programming				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Learn Fundamentals of R.
2. Covers how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions.
3. Cover the Basics of statistical data analysis with examples.
4. The whole syllabus will give an idea to collect, compile and visualize data using statistical functions.

UNIT - I

Introduction to R: What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments.

Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), package.Description(), help(), find.package(), library() - Input and Output – Entering Data from keyboard.

R - Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame.

R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables

UNIT - II

R - Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators.

R - Decision Making: if statement, if – else statement, if – else if statement, switch statement.

R - Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.

R - Function: function definition,Built-inn functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values.

UNIT - III

R – Strings: Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower().

R – Vectors: Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting.

R – List: Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector.

R – Matrices: Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division.

R - Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements.

R – Factors: creating factors, generating factor levels gl().

R - Data Frames: Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, **Expand Data Frame:** Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast().

UNIT - IV

Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File – R -Excel File – Reading the Excel file.

Data Visualization through various plots and charts: bar charts, histogram, frequency polygon, density plots, scatter plots, box & whisker plots, heat and contour plots, plotting the above graphs in R, plotting with package ggplot2.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: outline concepts related to R programming and data analysis.
CO2: explain the basic concepts and tools that are used to solve problems in data analytics.
CO3: apply R programming for reading, cleaning, visualizing and analysing data.
CO4: analyse the trends in data through exploratory data analysis.
CO5: Understands the loading, retrieval techniques of data.
CO6: Minimize and maximize functions simulation and visualization and statistical analysis using R.

TEXT AND REFERENCE BOOKS:

1. W. N. Venables, D. M. Smith and the R core Team, An introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics, version 3.3.2, 2016.
2. Saroj Dahiya Ratnoo and Himmat Singh Ratnoo, Essentials of R for Data Analytics, Wiley, 2021.
3. Hadley Wickham and Garrett Grolemund, R for Data Science Import, Tidy, Transform and model Data, O'Reilly, 2017.
4. Paul Teeter, R Cookbook, O'Reilly, 2011.
5. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2013.
6. Han, J., Kamber, M, Pei, J., Data Mining Concepts and Techniques, Third edition, Morgan Kaufmann, 2012.

PROGRAMMING IN JAVA

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Programming in Java				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methos etc.
2. Be able to use the Java SDK environment to create, debug and run simple Java programs.
3. To analyze the object-oriented paradigm using java programming language.
4. To implement small/medium scale java programs to resolve small business problems.

UNIT - I

Introduction to Java: Evolution of Java, Object Oriented Programming Structure, Overview and characteristics of Java, Java program Compilation and Execution Process, Organization of the Java Virtual Machine, Client side Programming, Platform Independency & Portability, Security, Relation b/w JVM, JRE and JDK, Introduction to JAR format, Naming Conventions, Data types & Type casting, operators, Security Promises of the JVM, Security Architecture and Security Policy, security aspects, sandbox model.

UNIT - II

OOPS Implementation: Classes, Objects, attributes, methods, data encapsulation, reference variables, Constructors, Anonymous block, Method Overloading, Static Data members, Block & methods; Memory Structure: Stack, Heap, Class & Method area

Class loading & Execution flow: Static vs Dynamic Class loading, implicit vs explicit class loading, class loading operations;

Argument Passing Mechanism: Passing primitive arguments, passing objects, Wrapper Classes;

This keyword: Referencing instance members, Intra class constructor chaining, Method chaining;

Inheritance & code reusability: Extending classes for code reusability, Usage of super keyword, Method Overriding, Object class

Inheritance & Runtime Polymorphism: Static & Dynamic binding, Inheritance and Is-A relation, Runtime Polymorphism and Generalization, Abstract classes & methods, Final Keyword;

Interfaces and Role based Inheritance: Feature & Role based Inheritance, Static & Dynamic

classing Environment, classes & interfaces, interface applications in real scenarios; Has-A relation: Aggregation & Composition, Nested classes, Inner classes, Anonymous Inner classes, String Buffer Class, tokenizer, applets, Life cycle of applet and Security concern

UNIT - III

Threads: Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

Swing & AWT:

Swing class hierarchy, containers, user interface components, graphics context, AWT Components, Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

Package & Scopes: Need of Packages, associating classes to Packages, Class path environment variable, Import Keyword and Feature of static import, Public, protected, private & default scope, Private Inheritance;

Exception Handling: exception and error, Exception Handling & Robustness, Common Exceptions and Errors, Try and catch block, Exception handlers, throw keyword, Checked and Unchecked Exceptions, Role of finally, User defined Exceptions.

UNIT - IV

Collection Framework: Role and Importance of Collection Framework, List & Set based collection, Iterator & List Iterator, Maps, Searching elements in List, Hash and Tree based collections, Role of equals and hashCode() methods, Comparable and Comparator Interfaces, Thread Safety and Vector, Difference b/w Enumeration and Iterator, Type safety and Generics, Common algorithms and Collections class, Using Properties class for managing properties files;

Database Connectivity Using JDBC: Overview of native and ODBC Drives, Introduction to JDBC, Type of JDBC drivers, Usage of drivers, defining properties-based Connection Factory; Basic database operations: Insert, Delete, Update, and Select;

Prepared Statement: Statement, Prepared Statement, Setting Query parameters, Executing Queries;

Callable Statement: Creating PL/SQL Stored procedures and functions, Creating Callable statements, executing procedures & functions, Batch Updation, Transacting Queries, Programmatic initialization of database, ResultSetMetaData, DatabaseMetaData; Input/Output Stream, Stream Filters, Buffered Streams, Data input and Output Stream, Print Stream Random Access File,

Reflection: reflection API, newInstance()method, javap tool, creating javap tool, creating applet viewer, call private method, java 9 features.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Identify classes, objects, members of a class and relationships among them for a specific problem.
- CO2: Understand and demonstrate the concepts of garbage collection, polymorphism, inheritance etc.
- CO3: Do numeric (algebraic) and string-based computation.
- CO4: Understand and implement modularity as well as basic error-handling techniques.
- CO5: Develop, design and implement small multithreaded programs using Java language.

CO6: Apply appropriate problem-solving strategies for the implementation of small/medium scale Java applications.

TEXT AND REFERENCE BOOKS:

1. E. Balaguruswamy, “Programming with Java”, TMH
2. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
3. Decker &Hirshfield, “Programming.Java”, Vikas Publication.
4. Patrick Naughton and HerbertzSchidt, “Java-2 the complete Reference”, TMH
5. Sierra & bates, “Head First Java”, O’Reilly.

MICROPROCESSOR AND MICRO-CONTROLLER

Semester	IV				
Course code					
Category	Basic Science courses				
Course title	Microprocessor and Micro-controller				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To provide solid foundation on the fundamentals of microprocessors and applications, interfacing the external devices to the processor according to the user requirements thus, enabling to create novel products and solutions for real time problems.
2. Describe the architecture of 8086 microprocessors.
3. Develop programs for microprocessor and microcontrollers.
4. Compare microprocessors and microcontrollers.
5. Understand 8051, PIC and ARM microcontroller concepts, architecture and programming**.**

UNIT - I

THE 8086 MICRO-PROCESSOR

Introduction to 8086, Micro-processor architecture, Addressing modes, Instruction set and assembler directives, Assembly language programming, Modular Programming, Linking and Relocation, Stacks, Procedures, Macros, Interrupts and interrupt service routines, Byte and String Manipulation.

UNIT - II

8086 SYSTEM BUS STRUCTURE

8086 signals, Basic configurations, System bus timing, System design using 8086, I/O programming, Introduction to Multiprogramming, System Bus Structure, Multiprocessor configurations, Coprocessor, Closely coupled and loosely Coupled configurations, Introduction to advanced processors.

UNIT - III

I/O INTERFACING

Memory Interfacing and I/O interfacing, Parallel communication interface, Serial communication interface, D/A and A/D Interface, Timer, Keyboard /display controller, Interrupt controller, DMA controller, Programming and applications Case studies: Traffic Light control, LED display, LCD

display, Keyboard display interface and Alarm Controller.

UNIT - IV

MICROCONTROLLER

Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

INTERFACING MICROCONTROLLER

Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the operation and architecture of Intel 8085 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.

CO2: Learn the operation of circuits for user interaction through switches, keyboard and display devices.

CO3: Understand the operation and architecture of Intel 8086 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.

CO4: Understand the motivation and need for peripheral operations circuits for digital data exchange, timer, serial communication, merits of direct memory access, interrupt controller and other circuits.

CO5: Identify & diagnose common issues & errors that may arise during microprocessor & microcontroller programming.

CO6: Apply problem solving techniques to resolve hardware and software related problems.

TEXT AND REFERENCE BOOKS:

1. Microprocessors and interfacing: D V Hall; TMH
2. The 8088 & 8086 Microprocessors, Programming, interfacing, Hardware & Applications: Triebel & Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming &Design: Yu,Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

COMPUTER ORGANIZATION & ARCHITECTURE

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Computer Organization & Architecture				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. How Computer Systems work & the basic principles.
2. Instruction Level Architecture and Instruction Execution.
3. The current state of art in memory system design.
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism.
6. To impart the knowledge on microprogramming.
7. Concepts of advanced pipelining techniques.

UNIT - I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

UNIT - II

Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

UNIT - III

Pipelining: Parallel Processing, Amdahl's law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Pipeline Hazards, RISC Pipeline.

Parallel Processors: Introduction to Parallel Processors, Concurrent access to memory andCache

Coherency.

Vector Processing: Vector Operations, Memory Interleaving, Supercomputers, Array Processors: Attached Array Processor, SIMD Array Processor.

UNIT - IV

Input-output Organization: I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: outline the general concepts of digital electronics and computer organization and architecture.
CO2: discuss the basic components and their interfacing.
CO3: discuss the basic components and their interfacing.
CO4: analyse the effect of addressing modes on the execution time of a program.
CO5: analyse the effect of addressing modes on the execution time of a program.
CO6: Design of simple computer with different instruction sets.

TEXT AND REFERENCE BOOKS:

1. "Computer System Architecture", 3rd Edition by M.Morris Mano, Pearson.
2. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
3. "Computer Organization and Embedded Systems", 6th Edition by CarlHamacher, McGraw Hill Higher Education.
4. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
5. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
6. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring andHarry F. Jordan, Pearson Education.

OPERATING SYSTEM LAB

Semester	IV				
Course code					
Category	Laboratory course				
Course title	Operating System Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Introduction to UNIX File System.
2. File and Directory Related Commands in UNIX.
3. Essential UNIX Commands for working in UNIX environment.
4. I/O Redirection and Piping
5. Introduction to VI Editors.
6. Introduction of Processes in UNIX
7. Communication in UNIX and AWK.
8. Introduction of the concept of Shell Scripting.
9. Decision and Iterative Statements in Shell Scripting.
10. Writing the Shall Scripts for unknown problems.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: apply commands related to vi and Emacs editors, general utilities and file systems.

CO2: write basic shell scripts and use sed commands as well as awk programming.

CO3: analyse the results of memory management and disk management commands.

CO4: evaluate solutions for different operating system problems such as scheduling, memory management and file management.

CO5: create lab record for assignments that includes problem definitions, design of solutions and conclusions.

CO6: demonstrate use of ethical practices, self-learning and team spirit.

PROGRAMMING IN JAVA LAB

Semester	IV				
Course code					
Category	Laboratory course				
Course title	Programming in Java Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Create a java program to implement stack and queue concept.
2. Write a java package to show dynamic polymorphism and interfaces.
3. Write a java program to show multithreaded producer and consumer application.
4. Create a customized exception and also make use of all the5 exception keywords.
5. Convert the content of a given file into the upper-case content of the same file.
6. Develop an analog clock using applet.
7. Develop a scientific calculator using swings.
8. Create an editor like MS-word using swings.
9. Create a servlet that uses Cookies to store the number of times a user has visited your servlet.
10. Create a simple java bean having bound and constrained properties.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: implement Java programs using object-oriented concepts for problem solving.

CO2: detect syntax and logical errors in java programs.

CO3: apply exception handling for making robust JAVA code.

CO4: design java applications using File I/O and GUI.

CO5: create lab record for assignments that includes problem definitions, design of solutions and conclusions.

CO6: Able to build dynamic user interfaces using applets and Event handling in java.

MICROPROCESSOR AND MICRO-CONTROLLER LAB

Semester	IV				
Course code					
Category	Laboratory course				
Course title	Microprocessor and Micro-controller Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Write a program using 8085 and verify for:
    a. Addition of two 8,bit numbers.
    b. Addition of two 8,bit numbers (with carry).
2. Write a program using 8085 and verify for:
    a. 8,bit subtraction (display borrow)
    b. 16,bit subtraction (display borrow)
3. Write a program using 8085 for multiplication of two 8, bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
4. Write a program using 8085 for multiplication of two 8, bit numbers by bit rotation method and verify.
5. Write a program using 8086 for finding the square root of a given number and verify.
6. Write a program using 8086 for copying 12 bytes of data from source to destination and verify.
7. Write a program using 8086 and verify for:
    a. Finding the largest number from an array.
    b. Finding the smallest number from an array.
8. Write a program using 8086 for arranging an array of numbers in descending order and verify.
9. Write a program using 8086 for arranging an array of numbers in ascending order and verify.
10. Write a program to interface a two,digit number using seven,segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.
11. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.
12. To study implementation & interfacing of Display devices Like LCD, LED Bar graph & seven segment display with Microcontroller 8051/AT89C51
13. To study implementation & interfacing of Different motors like stepper motor, DC motor & servo Motors.
14. Write an ALP for temperature & pressure measurement
15. Write a program to interface a graphical LCD with 89C51

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Ability to analyze and understand the architecture, instruction set, and functioning of microprocessors and microcontrollers.

CO2: Proficiency in programming microprocessors and microcontrollers using assembly language and high level languages.

CO3: Skill in designing and implementing simple embedded systems by interfacing peripherals and devices with microprocessors and microcontrollers.

CO4: Competence in troubleshooting and debugging microprocessor and microcontroller based systems.

CO5: Understanding of the memory organization, input/output operations, and interrupt handling mechanisms in microprocessors and microcontrollers.

CO6: Familiarity with real-time operating systems and their applications in microcontroller, based systems.

R – PROGRAMMING LAB

Semester	IV				
Course code					
Category	Laboratory course				
Course title	R - Programming Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

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. Implement R-Loops with different examples.
4. Learn the basics of functions in R and implement with examples.
5. Implement data frames in R. 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**.**
9. Create pie charts and bar charts using R.
10. Create a data set and do statistical analysis on the data using R.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Show the installation of R Programming Environment.

CO2: Utilize and R Data types for developing programs.

CO3: Make use of different R Data Structures.

CO4: Develop programming logic using R Packages.

CO5: Analyze the datasets using R programming capabilities.

CO6: Apply R programming for reading, cleaning, visualizing and analyzing data.

5TH SEMESTER

B. Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester – V

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
12.	**PCC**		Design and Analysis of Algorithm	3	0	0	3	3	30	70		100
13.	**PCC**		Formal Languages & Automata	3	0	0	3	3	30	70		100
14.	**PCC**		Web Technology	3	0	0	3	3	30	70		100
15.	**PCC**		Computer Networks	3	0	0	3	3	30	70		100
16.	**PEC**		Professional Elective Course - I	3	0	0	3	3	30	70		100
17.	**OEC**		Open Elective Course - I	3	0	0	3	3	30	70		100
18.			Design and Analysis of Algorithm Lab	0	0	2	2	1	50		50	100
19.	**LC**		Web Technology Lab	0	0	2	2	1	50		50	100
20.	**LC**		Computer Networks Lab	0	0	2	2	1	50		50	100
21.	**HSMC**		Economics for Engineers*	3	0	0	3	3	30	70		100*
22.	**PT**		Practical Training - I	0	0	2	2	1	50		50	100
			Total	**21**	**0**	**6**	**27**	**22**	**330**	**420**	**150**	**1000**

NOTE:

1. **The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.**
2. **The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students.**
3. **Choose any one from Professional Elective Course – I**
4. **Choose any one from Open Elective Course – I**

Professional Elective Course – I

1. Software Engineering
2. Digital Image Processing
3. Distributed System
4. Statistical computing
5. Big data analytics

DESIGN & ANALYSIS OF ALGORITHMS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Design & Analysis of Algorithms				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

UNIT - I

Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big O, Omega and Theta)-best, average and worst-case behaviour. Elementary Data Structures (Basic terminology of Stacks and Queues, Tree, Graph), Sets and Disjoint Set Union.

Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms and analysis of these problems.

UNIT - II

Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.

Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Traveling Salesperson problem.

UNIT - III

Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles.

Branch and Bound: The method, 0/1 knapsack problem, Traveling Salesperson problem, Efficiency considerations.

UNIT - IV

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: state terminology and concepts algorithmic techniques.
CO2: discuss various algorithmic techniques.
CO3: apply appropriate algorithmic techniques to solve computational problems.
CO4: analysing algorithms for their efficiency by determining their complexity.
CO5: compare the pros and cons of applying the different algorithmic techniques to solve problems.
CO6: formulate efficient and effective algorithmic solutions for different real- world problems.

TEXT AND REFERENCE BOOKS:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publication
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald L Rivest: 1990, TMH
3. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
4. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
5. Writing Efficient Programs, Bentley, J.L., PHI
6. Introduction to Design and Analysis of Algorithm, Goodman, S.E. &Hedetnieni, 1997, MGH.
7. Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, 2002, T.M.H.
8. Fundamentals of Algorithms: The Art of Computer Programming Vol Knuth, D.E.: 1985, Naresh Publication.

FORMAL LANGUAGES & AUTOMATA THEORY

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Formal Languages & Automata Theory				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand basic concepts of formal languages and automata theory.
2. To study the types of Automata i.e., NFA, DFA, NFA with ϵ-transition and their interconversion methods and importance.
3. To Study formal languages of different kinds, such as regular and context-free languages. Understand the concept of grammar and its types. Removal of ambiguity and reduced form and Normal forms of grammar.
4. To develop the concepts and design of higher-level automata to accept the language not accepted by finite automata such as PDA &Turing machine.
5. To study the various properties of Turing machines and their design.

UNIT - I

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Non-Deterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA, minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.

Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

UNIT - II

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of the regular expression, Regular expression conversion to Finite Automata, and vice versa.

Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

UNIT - III

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions, Normal Form:

Chomsky Normal form (CNF) and Greibach Normal Form (GNF),

Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

UNIT - IV

Turing machines: The basic model for Turing machines I, Deterministic and Non- Deterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by a designed Turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: define terminology related to the theory of computation.
CO2: explain the basic concepts and applications of Theory of Computation.
CO3: apply the principles of Theory of Computation to solve computational problems.
CO4: compare and contrast the hierarchy of grammars.
CO5: design various types of automata for given problems.
CO6: To solve various problems of applying normal form techniques, push-down automata, and Turing Machines.

TEXT AND REFERENCE BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
3. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.
4. Raymond Greenlaw, H. James Hoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
5. John C. Martin: Introduction to Languages and Automata Theory, 3rd edition, Tata McGraw-Hill, 2007

WEB TECHNOLOGY

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Web Technology				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

5. To familiarize the students with the basic concepts of internet, its history, ways to connect to internet and basics of world wide web and search engines.
6. To familiarize the student with the fundamental language of internet i.e., HTML.
7. To teach the student aware of the concepts of cascading style sheets.
8. To teach the student the students the basics of client side and Server-side scripting.

UNIT - I

HYPERTEXT MARKUP LANGUAGE: The anatomy of an HTML document: Marking up for structure and style: basic page markup, absolute and relative links, ordered and unordered lists, embedding images and controlling appearance, table creation and use, frames, nesting and targeting.

STYLE SHEETS: Separating style from structure with style sheets, Internal style specifications within HTML, External linked style specification using CSS, page and site design considerations.

UNIT - II

Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc., Handling File Uploads, Connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies. File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

UNIT - III

CLIENT SIDE PROGRAMMING: Introduction to Client side programming, Java Script syntax, the Document object model, Event handling, Output in JavaScript, Forms handling, cookies, Introduction to VBScript, Form Handling.

UNIT - IV

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Analyze given assignment to select sustainable web development and design methodology.

CO2: Identify the difference between the HTML PHP and XML documents.

CO3: Identify the engineering structural design of XML and parse tree

CO4: Analyze the difference between and PHP and XML.

CO5: Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management.

CO6: Develop web based application using suitable client side and server side web technologie.

TEXT AND REFERENCE BOOKS:

1. "Fundamentals of the Internet and the World Wide Web", Raymond Greenlaw and Ellen Hepp, TMH , latest edition.
2. "Internet & World Wide Programming", Deitel,Deitel & Nieto, Pearson Education
3. "Complete idiots guide to java script". Aron Weiss, QUE.
4. "Network firewalls", Kironjeet syan - New Rider Pub.

COMPUTER NETWORKS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Computer Networks				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To develop an understanding of modern network architectures from a design and Performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs), and Wireless LANs (WLANs).
3. To provide an opportunity to do Network programming.
4. To provide WLAN measurement ideas.

UNIT - I

Introduction: Data communication, Components, Data Representation, Simplex, Half Duplex, and Full Duplex Transmission, Modulation, Multiplexing, Computer networks, distributed processing, Internet, Topologies, Packet and circuit switching, connectionless and connection-oriented services.

Network Models: OSI model and TCP/IP Model

Physical Layer – LAN: Ethernet.

UNIT - II

Data Link Layer and Medium Access Sub Layer: MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Medium Access Control: Random access, Controlled Access, and channelization protocols.

Network Layer: Logical addressing, classful and classless addressing, subnetting, Ipv4, ICMPv4, ARP, RARP and BOOTP, Ipv6, Ipv6 addressing.

UNIT - III

Network Devices: Repeater, hub, switch, router, and gateway.

Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State, and Distance Vector Routing

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.

UNIT - IV

Congestion Control, Quality of Service, QoS Improving techniques.

Application Layer: Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Network Security: Firewalls, security goals, types of attack, symmetric and asymmetric key ciphers.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain the functions of the different layers of the OSI Protocol.

CO2: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs), and Wireless LANs (WLANs) and describe the function of each.

CO3: Identify and connect various connecting components of a computer network.

CO4: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, and Firewalls using open-source available software and tools.

CO5: outline various models, topologies and devices of Computer Networks.

CO6: Design engineering solutions to complex problems utilizing a systems approach.

TEXT AND REFERENCE BOOKS:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. Computer Networks, latest Edition, Andrew S. Tanenbaum, Pearson New International Edition.
4. Internetworking with TCP/IP, Volume 1, latest Edition Douglas Comer, Prentice Hall of India.
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

ECONOMICS FOR ENGINEERS

Semester	V				
Course code					
Category	Humanities & Social Sciences, Including Management				
Course title	Economics for Engineers				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand how economic analysis can be applied to engineering decision-making processes.
2. Understand the implications of economic factors on engineering design, production, and operation decisions.
3. Apply economic principles to analyze and interpret the behavior of markets and industries.
4. Gain awareness of the relationship between economics and sustainable development in engineering practices.

UNIT - I

Definition of Economics- Various definitions, types of economics- Micro and Macro-Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning, factors effecting it, its practical application and importance.

UNIT - II

Production- Meaning of Production and factors of production, Law of variable proportions, and returns to scale, Internal external economies and diseconomies of scale. Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Realcost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT - III

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT - IV

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions,Difference between Commercial & Central Bank.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: outline the principles of economics in general and economics in Indian context.

CO2: discuss concepts related to economics in general and particularly relevant to Indian scenario.

CO3: apply the principles of economics for solving problems related to Engineering sector.

CO4: carry out cost/benefit/, life cycle and breakeven analyses on one or more economic alternatives.

CO5: judge the issues and challenges of sustainable development.

CO6: Undertake problem identification, formulation and solution.

TEXT AND REFERENCE BOOKS:

1. Alfred William Stonier, D. C. Hague, A text book of Economic Theory, 5th edition, Longman Higher Education, 1980.
2. K. K. Dewett, M. H. Navalur, Modem Econornic Theory, S. Chand, 2006.
3. H. L. Ahuja, Modern Microeconomic: Theory and Applications, S. Chand, 2017.
4. N. Gregory Mankiw, Principles of Economics, 7th edition, South-Western College Publishing, 2013.
5. Ruddar Dutt & K. P. M. Sundhram, Indian Economy, S. Chand, 2004.
6. V. Mote, S. Paul, G. Gupta, Managerial, Economics, McGraw Hill Education, 2017.
7. Saroj Pareek, Text book of Business Economics, Neha Publishers and Distributors, 2013.
8. William McDonough and Michael Braungart, Cradle to Cradle Remaking the Way We Make Things, North Point Press, New York, 2002.
9. Sustainable Development Challenges, World Economic and Social Survey, United Nations Publication, 2013.

DESIGN & ANALYSIS OF ALGORITHMS LAB

Semester	V				
Course code					
Category	Laboratory course				
Course title	Design & Analysis of Algorithms Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Write a Program for iterative and recursive Binary Search.
2. Write a Program to sort a given set of elements using the Quick Sort/Merge Sort/Selection Sort method and determine the time required to sort the elements.
3. Write a Program for the implementation of the Fractional Knapsack problem using Greedy Method and 0/1 Knapsack problem using Dynamic Programming.
4. Write a Program to find the shortest path from a given vertex to other vertices in a weighted connected graph using Dijkstra's algorithm.
5. Write a Program to find the minimum cost spanning tree (MST) of a given undirected graph using Kruskal's algorithm/Prim's Algorithms.
6. Write a Program to implement the N-Queens problem using backtracking.
7. Write a Program to check whether a given graph is connected or not using the DFS method.
8. Write a program to implement the Travelling Salesman Problem (TSP).

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Develop and code program for the algorithms and analyze it to determine its computational complexity.

CO2: Identify and analyze worst-case running times of algorithms.

CO3: Model given engineering problem using graph and trees and write the corresponding algorithm to solve the problems.

CO4: Identify and apply the suitable algorithm for the given real-world problem.

CO5: Undertake problem identification, formulation and solution.

CO6: Design engineering solutions to complex problems utilising a systems approach.

WEB TECHNOLOGY LAB

Semester	V				
Course code					
Category	Laboratory course				
Course title	Web Technology Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital
2. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 99 and shows it in words. It should not accept three and above digits, alphabets and special characters.
3. Develop and demonstrate the usage of inline, internal and external style sheet using CSS
4. Design the following static web pages required for an online book store web site.
   a) HOME PAGE: The static home page must contain three frames.
   b) LOGIN PAGE
   c) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table.
   d) REGISTRATION PAGE
5. Write JavaScript to validate the following fields of the Registration page.
   a) First Name
   b) Last Name
   c) Password
   d) E,mail id
   e) Mobile Number
   f) Address
6. Write a program for implementing XML document for CUSTOMER DETAILS
7. Develop and demonstrate PHP Script for the following problems: a) Write a PHP Script to find out the Sum of the Individual Digits. b) Write a PHP Script to check whether the given number is Palindrome or not
8. Write a program to design a simple calculator using (a) JavaScript (b) PHP
9. Develop and demonstrate JavaScript with POP,UP boxes and functions for the following problems:

a) Input: Click on Display Date button using onclick( ) function
Output: Display date in the textbox
b) Input: A number n obtained using prompt
Output: Factorial of n number using alert
c) Input: A number n obtained using prompt
Output: A multiplication table of numbers from 1 to 10 of n using alert
d) Input: A number n obtained using prompt and add another number using confirm
Output: Sum of the entire n numbers using alert

10. (Mini Project) Create your own website using all constructs studied in theory paper

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Design and implement dynamic websites with good aesthetic sense of designing and latest technical know, how's
CO2: Create web pages using HTML and Cascading Styles sheets
CO3: Analyze a web page and identify its elements and attributes
CO4: Create dynamic web pages using JavaScript
CO5: Build web applications using PHP •
CO6: Create XML documents and XML Schema

COMPUTERS NETWORK LAB

Semester	V				
Course code					
Category	Laboratory course				
Course title	Computer Network Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Study of Socket Programming and Client – Server model
2. Write a code simulating ARP /RARP protocols.
3. Write a code simulating PING and TRACEROUTE commands
4. Create a socket for HTTP for web page upload and download.
5. Write a program to implement RPC (Remote Procedure Call)
6. Implementation of Subnetting .
7. Applications using TCP Sockets like a. Echo client and echo server b. Chat c. File Transfer
8. Applications using TCP and UDP Sockets like. DNS e. SNMP f. File Transfer
9. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. i. Link State routing ii. Flooding iii. Distance vector
11. To learn handling and configuration of networking hardware like RJ,45 connector, CAT,6 cable, crimping tool, etc.
12. Configuration of router, hub, switch etc. (using real devices or simulators)
13. Running and using services/commands like ping, traceroute, nslookup, arp, telnet, ftp, etc.
14. Network packet analysis using tools like Wireshark, tcpdump, etc.
15. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
16. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative &concurrent servers).

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Develop Client, Server architectures and prototypes by the means of correct standards and technology

CO2: Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols.

CO3: Analyse & Implement various framing methods of Data Link Layer.
CO4: Demonstrate basic configuration of switches and routers.
CO5: Analyse & Implement various Error and flow control techniques.
CO6: Implement network routing and addressing techniques

PRACTICAL TRAINING - I

Semester	V				
Course code					
Category	PT				
Course title	Practical Training - I				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students.

Professional Elective Course - I

SOFTWARE ENGINEERING

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Software Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Be successful professionals in the field with solid fundamental knowledge of software engineering.
2. To enable students to apply a systematic application of scientific knowledge in creating and building cost-effective software solutions to business and other types of problems.
3. To make students understand different phases to make a software & study them in detail.
4. To make students understand different testing techniques for different projects, making the students understand to develop quality software, its maintenance & software reliability.
5. To make students aware about the design models & its principles (data design, component design, interface design & architectural design).

UNIT - I

Introduction:- Evolving role of software, Software Characteristics, Software crisis, Software myths, Software process, Software development Models: Waterfall Model, Prototype Model, Spiral, Model, RAD Model, Iterative Model, Incremental Model, Aspect-oriented Model, **Agile Methodology:** Pair and mob programming, high performance teams with core protocols, test driven development, behaviour driven development, continuous delivery, clean code, refactoring, extreme programming, Scrum.

UNIT - II

Requirements, Analysis & Specification:- Software Requirements engineering, Requirement Engineering Process, Requirement Engineering Tasks, Types of requirements, SRS.

System Modeling:- Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling, The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the data dictionary.

UNIT - III

System Design:- Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion,

Coupling; Design Heuristics for effective modularity, Data Design, Architecture Design, Interface Design.

Software Testing And Maintenance:- Testing terminology: error, bug/defect/fault, failure, Verification and validation, Test case design, Static testing, Dynamic testing, Black box testing, Boundary value analysis, White box testing, basis path testing, Unit testing, Integration testing, Acceptance Testing, debugging, debugging process debugging approaches. Software maintenance categories, Models.

UNIT - IV

Software Quality Models And Standards:- Quality concepts, Software Quality Assurance, SQA activities, Formal approaches to SQA; Statistical software quality assurance; CMM, The ISO 9126 Standard, Configuration Management, Software reengineering, reverse engineering, restructuring, forward engineering,

Software Project Management:- Project management concepts, Planning the software project, Software Estimations, empirical estimation COCOMO, staffing, team structures, staffing, risk analysis and management.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand basic concepts of software engineering, implement Software life cycle models and have knowledge of different estimation models.
CO2: Understand requirements and modelling concepts in software development.
CO3: Understand the different design principles of a software project and prepare soft testing strategies.
CO4: Understand and incorporate the Software Quality standards and build a robust software.
CO5: Undertake problem identification, formulation and solution.
CO6: Design engineering solutions to complex problems utilising a systems approach.

TEXT AND REFERENCE BOOKS:

1. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering, Rajib Mall, PHI
3. Software Engineering by Ian sommerville, Pearson Edu., 5th edition, 1999,AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson1995, JW&S
6. An Integrated Approach to Software Engineering by Pankaj jalote, 1991, Narosa.

DIGITAL IMAGE PROCESSING

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To become familiar with digital image fundamentals.
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
3. To learn concepts of degradation function and restoration techniques.
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition method.

UNIT - I

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

UNIT - II

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.

UNIT - III

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering.

UNIT - IV

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.

CO2: Operate on images using the techniques of smoothing, sharpening and enhancement.
CO3: Understand the restoration concepts and filtering techniques.
CO4: Learn the basics of segmentation, features extraction, compression and recognition methods for colour models.
CO5: Undertake problem identification, formulation and solution.
CO6: Design engineering solutions to complex problems utilizing a systems approach.

TEXT AND REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition,2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.
3. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

STATISTICAL COMPUTING

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Statistical Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the basics of data, exploratory data analysis, statistics.
2. Demonstrate the concept of hypothesis testing in problem-solving.
3. Illustrate multivariate data analysis methods to solve the problems.
4. Understand the concepts of classification methods to analysis and representation of multivariate data in real world.

UNIT - I

Review of Descriptive Statistics and Probability Theory: Scale of measurement and data types, Descriptive statistics, Frequency Tables and graphs, Relative frequency tables and graphs, grouping data, histograms and ogive, mean, median, mode, variance and standard deviation of sample data, Sample spaces and events, Axioms, Conditional Probability, Independent event, Bayes Theorem, Binomial Theorem.

UNIT - II

Random Variable and Distributions: Random variables, type of random variables, Mean (Expectation) and variance of a discrete random variables, Discrete uniform distribution, Bernoulli's distribution, Binomial distribution, Geometric distribution, Poisson's distribution, Mean and variance of a continuous random variable, Continuous uniform distribution: normal distribution, exponential distribution, Central Limit Theorem.

UNIT - III

Hypothesis testing: determining levels of significance, Types of hypothesis testing errors, Hypothesis testing for population mean for large and small samples; Comparing two population means for large and small independent samples; Comparing two population means for paired samples; Comparing two population proportions, Chi-Square, t-test and F-test, Analysis of variance (ANOVA).

UNIT - IV

Multivariate Analysis: Multivariate distributions: multivariate normal distribution and its properties, distributions of linear and quadratic forms, Wishart distribution (definition, properties), union-intersection and likelihood ratio principles, inference on mean vector, Hotelling's T2. MANOVA- Inference on covariance matrices.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: define basic tools of data analysis**.**
CO2: explain the concepts given in descriptive and inferential statistics**.**
CO3: apply statistical concepts to solve real-world statistical computing problems.
CO4: analyse the trends in data using descriptive statistics.
CO5: interpret and evaluate statistical models**.**
CO6: conclude the findings of statistical analysis.

TEXT AND REFERENCE BOOKS:

1. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 4th edition, Academic Press, 2009.
2. Douglas S. Shafer and Zhang Zhiyi, Beginning Statistics, 2012. [Available freely online under Creative Commons by-nc-sa 3.0 license]
3. Brain S. Everitt, A Handbook of Statistical Analysis Using R, Second Edition, LLC 2014
4. Roger D. Peng, R Programming for Data Science, Lean Publishing, 2015.
5. Michael J. Crawley, Statistics, An introduction using R, Second edition, John Wiley, 2015
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer, 2nd edition, 2009

DISTRIBUTED SYSTEM

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Distributed System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols.
2. Analyze the issues in distributed operating systems and to address these distributed systems issues in a broader sense. Emphasis will be placed on communication, process, naming, synchronization and fault tolerance.

UNIT - I

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

UNIT - II

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems

Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues

UNIT - III

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing

UNIT - IV

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management

Distributed Web-based Systems: Architecture, Processes, Communication, Naming, Synchronization

Case Studies: JAVA RMI, Sun Network File System, Google Case Study

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: List the principles of distributed systems and describe the problems and challenges associated with these principles.

CO2: Understand Distributed Computing techniques, Synchronous and Processes.

CO3: Apply Shared Data access and Files concepts.

CO4: Design distributed system that fulfills requirements with regards to key distributed systems properties.

CO5: Understand Distributed File Systems and Distributed Shared Memory.

CO6: Apply Distributed web-based system and understand the importance of security in distributed system

TEXT AND REFERENCE BOOKS:

1. Distributed Operating Systems by Andrew S Tannebaum, Pearson
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, TimKindberg, Pearson
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI 6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India

BIG DATA ANALYTICS

Semester	V				
Course code					
Category	Professional Elective Courses				
Course title	Big Data Analytics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To describe the basic concepts of Big Data characteristics and Analytics.
2. To examine the Hadoop and MapReduce framework for processing large volume of data sets and various data analysis methods.
3. To store and retrieve the data effectively using MongoDB and report generation.
4. To analyze the big data for useful business applications and familiar with the Visualization.

UNIT - I

Introduction to Big Data: Types of Digital Data-Characteristics of Data, Evolution of Big Data, Definition of Big Data, Characteristics, Applications & Challenges with Big Data, 3Vs of Big Data, Non-Definitional traits of Big Data, Big Data workflow Management, Business Intelligence vs. Big Data, Distributed file systems.

UNIT - II

Big Data Analytics: Classification of analytics, Data Science, Terminologies in Big Data, CAP Theorem.

Introduction to Hadoop: Features, Advantages, Overview of Hadoop Eco systems, Hadoop distributions, SQL vs. Hadoop, Hadoop Components, Architecture, HDFS.

UNIT - III

Map Reduce: Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

NoSQL: Types of Databases, Advantages, SQL vs. NoSQL, NewSQL

Mongo DB: Introduction, Features, Data types, Mongo DB Query language, CRUD operations, Arrays. Functions: Count, Sort, t – Limit, Skip, Aggregate, Map Reduce. Cursors: Indexes, Mongo Import, Mongo Export.

UNIT - IV

Cassandra: Introduction, Features, CQLData types, CQLSH, Key spaces, CRUD operations, Collections, Counter, TTL, alter commands, Import and Export, Querying System tables.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify the characteristics and challenges of big data analytics.

CO2: Implement the Hadoop and MapReduce framework for processing massive volume of data.

CO3: Analyze data by utilizing various statistical and data mining approaches.

CO4: Implement CRUD operations effectively using MongoDB and Report generation using Jaspersoft studio.

CO5: Explore the usage of Hadoop and its integration tools to manage Big Data and use Visualization Techniques.

CO6: Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

TEXT AND REFERENCE BOOKS:

1. T. Erl , W.Khattak and P. Buhler., *Big Data Fundamentals, Concepts, Drivers & Techniques* (1e), The Prentice Hall Service Technology Series, 2016.
2. S. Acharya, *Big Data and Analytics*, Wiley India Pvt. Ltd., 2015
3. V. Prajapati, *Big Data Analytics with R and Hadoop*, Packt Publishing Ltd., 2013.
4. A. Holmes, *Hadoop in Practice*, (2e), Manning Publications, 2015
5. S. Ryza, *Advanced Analytics with Spark: Patterns for Learning from Data at Scale*, (2e), O'Reilly, 2017

6TH SEMESTER

B.Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VI

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Compiler Design	3	0	0	3	3	30	70		100
2.	**PCC**		Advance JAVA Programming	3	0	0	3	3	30	70		100
3.	**PCC**		Machine Learning and its Applications	3	0	0	3	3	30	70		100
4.	**PEC**		Professional Elective Course - II	3	0	0	3	3	30	70		100
5.	**PEC**		Professional Elective Course - III	3	0	0	3	3	30	70		100
6.	**OEC**		Open Elective Course - II	3	0	0	3	3	30	70		100
7.	**LC**		Advance JAVA Programming Lab	0	0	2	2	1	50		50	100
8.	**LC**		Machine Learning and its Applications Lab	0	0	2	2	1	50		50	100
9.	**PROJECT**		Project - I	0	0	4	4	2	50		50	100
			Total	**18**	**0**	**8**	**26**	**22**	**330**	**420**	**150**	**900**

NOTE:

1. **At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.**
2. **Choose any one from Professional Elective Course – II & III**
3. **Choose any one from Open Elective Course – II**

Professional Elective Course – II

1. Software Testing
2. Computer Graphics
3. Information Retrieval
4. Internet of Things
5. Soft Computing

Professional Elective Course – III

1. Network Security and Cryptography
2. Internet Technologies
3. Mobile applications development
4. Advance Database Management System
5. Cloud Computing

COMPILER DESIGN

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Compiler Design				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis.
3. Design top-down and bottom-up parsers.
4. Identify synthesized and inherited attributes.
5. Develop syntax-directed translation schemes.

UNIT - I

Introduction to Compilers: Language Processors, The Structure of compiler: its different phases, Compiler Construction Tools, Applications of Compiler Technology.

Lexical Analysis: Role of lexical analyzer, Input Buffering, Specification, and recognition of tokens, design of lexical analyzer, regular expressions, A language specifying lexical analyzer, Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing the number of states of DFA, Implementation of lexical analyzer.

UNIT - II

Syntax Analysis: Role of parsers, context-free grammars.

Parsing Technique: Shift-reduce parsing, Operator precedence parsing, Top-down parsing, Predictive parsing.

UNIT - III

LR parsers, SLR, LALR, and Canonical LR parser.

Syntax Directed Translations: Syntax-directed definitions, construction of syntax trees, syntax-directed translation scheme, implementation of syntax-directed translation, Intermediate-Code Generation: three address code, quadruples and triples.

UNIT - IV

Symbol Table & Error Detection, and Recovery: Symbol tables: its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase

error, and Semantic error. **Code Optimization & Code Generation:** Code generation, forms of objects code, machine-dependent code, optimization, register allocation for temporary and user defined variables.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: state principles of compiler design.
CO2: illustrate the essential phases for automatically converting source code into object code.
CO3: apply lexical analysis, syntax analysis and code optimization techniques for solving problems.
CO4: analyse a parse tree and a given BNF grammar.
CO5: compare and contrast syntax-oriented translation schemes.
CO6: design a lexical analyser from the specification of a language's lexical rules.

TEXT AND REFERENCE BOOKS:

1. Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.
2. System software by Dhamdhere, 1986, MGH.
3. Principles of compiler Design, Narosa Publication
4. Elements compiler Design, Dr. M. Joseph, University Science Press
5. Compilers Principle, Techniques & Tools – Alfred V. AHO, Ravi Sethi & J.D. Ullman; 1998 Addison Wesley.

ADVANCE JAVA PROGRAMMING

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Advance Java Programming				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

UNIT - I

Servlet: Servlet introduction, web terminology, servlet API, servlet Interface, generic servlet, Http servlet, servlet lifecycle, servlet with IDE (eclipse, My eclipse, Net beans), servlet request, servlet collaboration, servlet configuration, context, attribute in servlet, session technique in servlet, event and listener, servlet filter, CRUD, pagination, input output stream, annotation, single thread model, SSI;

JSP: Lifecycle of JSP, JSPAPI, scripting elements, 9Implicit Objects, directive elements, Exceptions, action elements, expression language, MVC in JSP, JSTL, custom tags, pagination, CRUD, JSTL function, formatting, XML, SQL tags.

UNIT - II

Struts: Introduction, features, models, components, struts2 architecture, action, configuration, interceptors, validation method, aware Interfaces, stuts2withI18N, zero configuration, struts2withtiles, hibernate with struts2, spring with struts2, UI tags;

Mail API: java mail introduction, methods of sending email, sending mail by Gmail, receiving email, sending attachment, receiving attachment, sending html, forwarding, deleting email.

UNIT - III

Hibernate(HB): Introduction, architecture, HB with IDE, HB Log4j, inheritance mapping, HB mapping, transaction management, HB query language, HB criteria query language, named query, HB caching, integration, HB lifecycle;

Spring: Introduction, modules, spring with IDE, dependency injection methods, spring AOP, spring Jdbc template, spring ORM, SPEL, MVC tag library, applications, spring remoting, spring OXM, spring web, security models, spring boot, spring with angular.

UNIT - IV

Android: Introduction, history & versions, architecture, building blocks, emulator, android widgets, activity and intents, android fragments, android menu, android service, SQLite, XML & JSON, android speech, multimedia, telephony, maps;

Design Pattern: java design pattern, creational, structural, behavioral, J2EE patterns, presentation layers.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Knowledge of the structure and model of the Java programming language, (knowledge).
CO2: Use the Java programming language for various programming technologies (understanding).
CO3: Develop software in the Java programming language.
CO4: Demonstrate a sound technical knowledge of their selected project topic.
CO5: Undertake problem identification, formulation and solution.
CO6: Conduct an engineering project.

TEXT AND REFERENCE BOOKS:

1. Patrick Naught on and Herbertz Schidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.
3. E. Balaguruswamy, “Programming with Java”,TMH
4. Horstmann, “Computing Conceptswith Java2 Essentials”, John Wiley.
5. Decker & Hirsh field, “Programming.Java”, Vikas Publication.

MACHINE LEARNING AND ITS APPLICATIONS

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Machine Learning and its Applications				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the machine learning techniques.
2. Gain knowledge of linear regression models, Random Forests
3. KNN classifier Gain knowledge on the basics of probabilistic approaches like Naïve Bayes, Bayes Theorem
4. Acquire knowledge of Support Vector machines, K-means clustering techniques
5. Introduce the working principle of Artificial Neural networks

UNIT - I

Machine Learning: Definition, History, Need, Features, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning, Parametric vs. non-parametric models. Learning theory-bias/variance tradeoff, Underfitting, Overfitting, Major differences between statistical modelling and machine learning, Steps in machine learning model development, Machine learning losses, when to stop tuning machine learning models, Train, validation, and test data Cross-validation, Grid Search.

UNIT - II

Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction.

UNIT - III

Supervised Learning: Definition, how it works. Types of Supervised learning algorithms k - Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines.

UNIT - IV

Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests.

Dimensionality reduction techniques: PCA, LDA, ICA, SVD

Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Acquire the knowledge of machine learning model evaluation methods/measurements.

CO2: Understand different types of machine learning techniques and their applications in the real world.

CO3: Apply various mathematical models for supervised machine learning models.

CO4: Apply and evaluate the unsupervised machine learning models through various clustering algorithms.

CO5: Evaluate various machine learning algorithms through statistical learning techniques.

CO6: Apply reinforcement learning algorithms to solve real-time complex problems with an understanding of the trade-offs involved.

CO7: Design the recommendation system using natural language processing and evaluate the machine learning models through ANN.

TEXT AND REFERENCE BOOKS:

1. E. Alpaydin, Introduction to Machine Learning, (3e), PHI Learning 2015.
2. S Marsland, Chapman and Hall, Machine Learning: An Algorithmic Perspective, (2e), CRC,2014.
3. M. Bishop, Pattern Recognition and Machine Learning, (2e), Springer, 2013.
4. T. Mitchell, Machine Learning, (1e), McGraw Hill Education, 2017.
5. L.E. Sucar, Probabilistic Graphical Models: Principles and Applications (Advances in Computer Vision and Pattern Recognition), (1e), Springer, 2016

ADVANCE JAVA PROGRAMMING LAB

Semester	VI				
Course code					
Category	Laboratory course				
Course title	Advance Java Programming Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Servlet Program: User Registration Form
   a. Create a servlet to handle user registration form submission.
   b. Store the user data in a database using JDBC.
   c. Perform validation on the form inputs and display appropriate error messages.
   d. Redirect the user to a success page upon successful registration.
2. JSP Program: Employee Management System
   a. Create a JSP page to display a list of employees retrieved from a database.
   b. Implement CRUD operations (Create, Read, Update, Delete) for managing employee records.
   c. Use JSTL (JavaServer Pages Standard Tag Library) for iteration and conditional rendering.
   d. Apply formatting using JSTL functions and display data in a tabular format.
3. Struts Program: Employee Management with Struts
   a. Create an Employee Management web application using Struts framework.
   b. Implement actions, forms, and validation using Struts annotations.
   c. Apply interceptors for authentication and authorization.
   d. Integrate with Hibernate for database operations.
4. Mail API Program: Email Client Application
   a. Develop an email client application using Java Mail API.
   b. Implement features such as sending and receiving emails.
   c. Support attachments, HTML content, forwarding, and deleting emails.
   d. Use Gmail SMTP and IMAP servers for email communication.
5. Hibernate Program: Product Catalog Management
   a. Build a product catalog management system using Hibernate framework.
   b. Define Hibernate mapping for product and category entities.
   c. Perform CRUD operations on the database using Hibernate APIs.
   d. Utilize Hibernate query language and criteria queries for advanced querying.
6. Spring Program: Library Management System

a. Develop a library management system using Spring framework.
b. Utilize Spring's dependency injection for managing application components.
c. Implement Spring AOP for logging and transaction management.
d. Integrate with Spring JDBC Template for database operations.

7. Android Program: Weather Forecast App
   a. Create a weather forecast application for Android devices.
   b. Fetch weather data from a web API using HTTP requests.
   c. Display the weather information using Android widgets and RecyclerView.
   d. Implement features like location-based weather, caching, and multi-day forecasts.
8. Design Pattern Program: Factory Method Pattern
   a. Implement the Factory Method design pattern in Java.
   b. Create a factory interface and concrete factories for creating different types of products.
   c. Define a common product interface and concrete product classes.
   d. Demonstrate the flexibility of the pattern by creating and using products through the factory.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explore the usage of JSP scripting elements, implicit objects, and directive elements.
CO2: Familiarize yourself with the Java Mail API, its methods, and practical implementation for sending and receiving emails.
CO3: Understand Hibernate caching mechanisms and its integration with other technologies.
CO4: Understand the importance and implementation of design patterns in Java, including creational, structural, and behavioral patterns.
CO5: Explore J2EE patterns and presentation layers to develop scalable and maintainable enterprise-level applications.
CO6: Explore various Android components like widgets, activities, intents, fragments, menus, and services.

MACHINE LEARNING LAB

Semester	VI				
Course code					
Category	Laboratory course				
Course title	Machine Learning Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Implement program to perform automatic word analysis.
2. Two assignments related to classification algorithms and interpreting the results of these algorithms**.**
3. Two assignments related to clustering algorithms and interpreting the results of these algorithms.
4. Three assignments on designing neural networks for solving learning problems.
5. Two assignments on ranking or selecting relevant features.
6. Two assignments on linear regression and logistic regression.
7. One assignment to be done in groups.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: implement machine learning algorithms using modern machine learning tools.

CO2: analyse the trends in datasets using descriptive statistics.

CO3: apply descriptive and predictive modelling.

CO4: compare and contrast machine learning algorithms for a given problem. (Describe datasets using descriptive statistics.

CO5: create lab records of assignment by incorporating problem definitions, design of solutions, results and interpretations.

CO6: demonstrate use of ethical practices, self-learning and team spirit.

PROJECT - I

Semester	VI				
Course code					
Category	Project				
Course title	Project - I				
Scheme and Credits	L	T	P	Credits	
	0	0	4	2	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVES

1. To allow students to demonstrate skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
2. To encourage research through the integration learned in a number of courses.
3. To allow students to develop problem solving skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation and prepare a technical report.

Students will be assigned projects (Applications/Research based) individually or in a group of not more than 3 students depending on the efforts required for completion of the project.

The project will have 4 stages: (*Marks for internal evaluation are given in brackets)

1. Synopsis submission (5 marks),
2. 1st mid-term progress evaluation (Literature Survey in case of research project) (5 marks)
3. 2nd mid-term progress evaluation (Paper Publishing/acceptance in a reputed Journal or Conference acceptance/ Presenting) (5 marks)
4. Final submission evaluation

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Demonstrate a sound technical knowledge of their selected project topic.
CO2: Undertake problem identification and formulation.
CO3: Design engineering formula to complex problems utilising a systems approach.
CO4: Research and engineering project.
CO5: Communicate with engineers and the community at large in written and oral form.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

Professional Elective Course - II

SOFTWARE TESTING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Software Testing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To study fundamental concepts of software testing including software testing OBJECTIVESs, process, criteria, strategies, and methods.
2. To learn how to plan a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
3. To gain an insight into techniques and skills on how to use modern software testing tools to support software testing projects.

UNIT - I

Introduction: Overview of Software Development Life Cycle (SDLC), Significance of Software Testing in SDLC, OBJECTIVESs and Limitations of software testing. Difference between an Error, Fault and Failure (Software Bug), Software Testing Life Cycle (STLC) and Seven Principles of Software Testing, Role of Software Testing in Software Quality

UNIT - II

Test Case Design: Test Cases and Test Suite, Test Case Planning and Designing, Characteristics of Good Test Case Design, Format of test case.

Testing Activities: Levels of Testing- Unit, Integration Testing and System Testing. V Model for Software Testing.

UNIT - III

Types of Software Testing: Black box testing, White Box and Gray Box Testing.

Reporting and Analyzing bugs: Problem reports, Content and Characteristics of Problem Report, analysis

and Tactics for analyzing a reproducible bug. Making a bug reproducible, Problem/Bug Reporting tools.

UNIT - IV

Types of Software Testing: Black box testing, White Box and Gray Box Testing.

Reporting and Analyzing bugs: Problem reports, Content and Characteristics of Problem Report, analysis

and Tactics for analyzing a reproducible bug. Making a bug reproducible, Problem/Bug Reporting tools.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand software testing and quality as a fundamental component of software development life cycle.

CO2: Understand and design the test cases for a given problem

CO3: Understand the process of Reporting of software failures(bugs) using tools like Bugzilla

CO4: Develop the knowledge of selection of appropriate test cases for execution during regression testing.

CO5: Compare and contrast the various activities of Quality Assurance, Quality planning and Quality Control.

CO6: Conduct formal inspections, record and evaluate results of inspections.

TEXT AND REFERENCE BOOKS:

1. "Software Testing: Principles and Practices", by Naresh Chauhan. Oxford University Press
2. "William Perry, Effective Methods for Software Testing, John Wiley & Sons, New York, 1995.
3. Boris Beizer, Software Testing Techniques, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, Software Testing, Pearson Education Asia, 2002
5. Roger S. Pressman, Software Engineering – A Practitioner's Approach, Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
6. Boris Beizer, Black-Box Testing – Techniques for Functional Testing of Software and Systems, John Wiley & Sons Inc., New York, 1995.
7. K.K. Aggarwal & Yogesh Singh, Software Engineering, New Age International Publishers, New Delhi, 2003.

COMPUTER GRAPHICS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Computer Graphics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To have basic understanding of the core concepts of Computer Graphics.
2. Understand scan conversion, 2D, 3D – transformation and viewing.
3. To be able to create interactive computer Graphics with understanding of shading, image processing and illumination model.

UNIT - I

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software; Two dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm.

UNIT - II

Two dimensional transformations: Geometric, Coordinate and, composite transformation.
Two Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping

UNIT - III

Three-dimensional transformations: Three dimensional graphics concept, Geometric and Coordinate transformations, Viewing in 3D: Projection, Taxonomy of projection,
Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

UNIT - IV

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, BSpline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: ***Understand and apply*** basics about computer graphics along with graphics standards.

CO2: Understanding of the software, hardware and applications of Computer Graphics.

CO3: Understanding of Scan conversion, 2D, 3D – transformation and viewing.

CO4: ***Understand*** various colour models in computer graphics system and develop animated motions through OpenGL.

CO5: To be able to implement picture on screen using projection, shading, image processing and illumination model.

TEXT AND REFERENCE BOOKS:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.
4. Procedural Elements for Computer Graphics – David F. Rogers, T.M.H latest Edition
5. Fundamentals of 3-Dimensional Computer Graphics by Alan Watt, Addision Wesley.
6. Computer Graphics: Secrets and Solutions by Corrign John, BPB
7. Graphics, GUI, Games & Multimedia Projects in C by Pilania&Mahendra, Standard Publ.
8. Computer Graphics Secrets and solutions by Corrign John, BPV
9. Introduction to Computer Graphics by N. Krishanmurthy T.M.H latest edition

INFORMATION RETRIEVAL

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course Title	Information Retrieval				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To build an understanding of the fundamental concepts of Information Retrieval
2. To understand the elements of Web Search Engines and Crawlers
3. To familiarize students with the basic taxonomy and terminology of Indices and to understand Heap's Law for estimation and Zipf's law for modeling distribution of terms
4. To understand dictionary compression and posting list compression and to introduce the scoring , tf-idf weighting and vector space model for scoring

UNIT - I

Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

UNIT - II

Search Engines: Basic Building Blocks and Architecture, Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking, Evaluation. **CRAWL AND FEEDS:** Crawling the Web, Retrieving Web Pages, The Web Crawler, Freshness, Focused Crawling, Deep Web, Crawling Documents and Email, Storing the Documents, Detecting Duplicates

UNIT - III

INDEX CONSTRUCTION AND COMPRESSION: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing **Index compression:** Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression

UNIT - IV

SCORING, TERM WEIGHTING AND THE VECTOR SPACE MODEL: Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight, Term frequency and

weighting, Inverse document frequency, Tf-idf weighting, The vector space model for scoring , Computing scores in a complete search system.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand basic Information Retrieval Systems and learn how Boolean queries are processed.

CO2: Realize the data structures like Inverted Indices used in Information retrieval systems.

CO3: understand the basic concept of Search Engines their architecture and its various functional components and understand the basic concept of Web crawlers and their architecture

CO4: identify the different types of indices: inverted index, positional index, biword index and be able make estimations and model distribution of terms and compressions

CO5: enumerate various types of indices and also understand the concept of efficient storage of indices and learn tf-idf scoring and vector space model scoring for ranking.

TEXT AND REFERENCE BOOKS:

1. C.D.Manning, P. Raghavan and H.Schutze “Introduction to Information Retrieval”, Cambridge University Press, Latest Edition
2. B.Croft, D.Metzler, T.Strohman, “Search Engines : Information Retrieval in Practice”, AddisionWesley, Latest Edition

SOFT COMPUTING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Soft Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students an hand-on experience on MATLAB to implement various strategies.

UNIT - I

INTRODUCTION TO SOFT COMPUTING: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT - II

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT - III

NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT - IV

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify and describe soft computing techniques and their roles in building intelligent Machines.
CO2: Develop intelligent systems leveraging the paradigm of soft computing techniques.
CO3: Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
CO4: Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO5: Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms.
CO6: Evaluate and compare solutions by various soft computing approaches for a given problem.

TEXT AND REFERENCE BOOKS:

1. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI
2. Satish Kumar, "Neural Networks: A classroom approach" Tata McGraw Hill.
3. Haykin S., "Neural Networks-A Comprehensive Foundations", PHI
4. Anderson J.A., "An Introduction to Neural Networks", PHI
5. M.Ganesh, "Introduction to Fuzzy sets and Fuzzy Logic" PHI.
6. N P Padhy and S P Simon, " Soft Computing with MATLAB Programming", Oxford University Press

INTERNET OF THINGS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course Title	Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Student will be able to learn the basics of IOT.
2. Student will be able to analyse basic protocols of wireless and MAC.
3. Students will get familiar with web of things.
4. Students will get basic knowledge of resource management.

UNIT - I

INTRODUCTION TO IOT: Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT(Design ,Development, Security)

UNIT - II

NETWORK AND COMMUNICATION ASPECTS: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

UNIT - III

WEB OF THINGS: Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

UNIT - IV

RESOURCE MANAGEMENT IN IOT: Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: **Understand** the basics of application areas of IOT.
CO2: Analyze basic protocols network.
CO3: Explain and realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO4: Discuss the architecture, operation, and business benefits of an IoT solution
CO5: Examine the potential business opportunities that IoT can uncover
CO6: Explore the relationship between IoT, cloud computing, and big data and Identify how IoT differs from traditional data collection system

TEXT AND REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Professional Elective Course - III

NETWORK SECURITY AND CRYPTOGRAPHY

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Network Security And Cryptography				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand cryptography theories; algorithms & systems.
2. To understand the symmetric and asymmetric key algorithms.
3. To understand necessary approaches & techniques to build protection mechanisms in order to secure Computer Networks.
4. Acquire fundamental knowledge on the concepts of different security layers.

UNIT - I

Introduction: Plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

UNIT - II

Symmetric Key Algorithms: Introduction, algorithms types and modes, DES, AES.

Asymmetric Key Algorithms: Introduction, history of asymmetric key cryptography, RSA symmetric and asymmetric key cryptography together, Digital signature.

UNIT - III

Internet Security Protocols: Basic concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer protocol (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), S SL versus SET, Electronic Money, Email Security.

UNIT - IV

User Authentication And Kerberos: - Introduction, Authentication basics, Passwords, authentication tokens, certificate-based authentication, biometric-based authentication, Kerberos, key distribution center(KDC), Security handshake pitfalls, single Sign on(SSO) approach.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify services that enhance the security and its mechanism.

CO2: Classify security attacks on information over network. Describe and apply classical encryption techniques.

CO3: Explain and apply modern block cipher with modes

CO4: Compare conventional encryption algorithms & public key cryptography, and design Encryption algorithm to provide the Integration and confidentiality of a message.

CO5: Understand the concept of hash function with application and message authentication code in security system

CO6: Classify key management schemes and discuss web security and transport level security protocols.

TEXT AND REFERENCE BOOKS:

1. Cryptography and Network Security, 2nd Edition by Atul Kahate, TMH
2. Network Management Principles & Practices by Subramanian, Mani (AWL)
3. SNMP, Stalling, Willian (AWL)
4. SNMP: A Guide to Network Management (MGH)
5. Telecom Network Management by H.H. Wang (MGH)
6. Network Management by U. Dlack (MGH)

INTERNET TECHNOLOGIES

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Internet Technologies				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

UNIT - I

WEB SERVERS: Web Protocols- Working of web browser - Browser & Server Communication - Web Server Functions - Web Security - Fire Wall - Proxy Servers - Virtual Directories - MIME - HTTP Headers - Deployment using web servers.

WEB PROGRAMMING: HTML5 Structural Elements-Images - HTML5 Form Elements and Attributes - DHTML - CSS3-Selectors-Box model-Positioning elements-Colors-Shadows-Gradients-Transitions and Transformations.

UNIT - II

JAVASCRIPT: Java Script - Core JavaScript - lexical structure- types-values and variables-expression and operators-statements-objects arrays-functions- classes and modules- pattern matching with regular expressions- java script in web browser-the window objects scripting documents-handling events.

UNIT - III

ANGULARJS: An Overview of the AngularJS Life Cycle-Integrating AngularJS with Existing JavaScript and jQuery-Adding AngularJS to the Node.js Environment-Bootstrapping AngularJS in an HTML Document- Creating a Basic AngularJS Application-Using AngularJS Templates to Create Views- Implementing Directives in AngularJS Views- Implementing AngularJS Services in Web Applications.

NODE.JS: Using Events, Listeners, Timers, and Callbacks in Node.js-5 Handling Data I/O in Node.js- Accessing the File System from Node.js- Implementing HTTP Services in Node.js-implementing Socket Services in Node.js- Scaling Applications Using Multiple Processors in Node.js- Implementing Express in Node.js

UNIT - IV

MONGODB: Understanding NoSQL and MongoDB- Manipulating MongoDB Documents from Node.js- Accessing MongoDB Documents from Node.js- Advanced MongoDB Concepts

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understanding of the concept of the web servers and its working.
CO2: Analyze a web page and identify its elements and attributes.
CO3: Build dynamic web pages using JavaScript (Client side programming).
CO4: Acquire in depth knowledge in web services using the latest server-side technologies.
CO5: Ability to design and develop web server applications using Node JS and Angular JS.
CO6: Demonstrate the connectivity of web pages and database like NoSQL and MongoDB.

TEXT AND REFERENCE BOOKS:

1. Deitel & Deitel, "Internet & World Wide Web How to Program", Pearson Education India, fifth Edition, 2011.
2. David Flanagan "JavaScript: The Definitive Guide, O'Reilly Media, Inc. May 2011.
3. Brad Dayley "Node.js, MongoDB, and AngularJS Web Development", Addison-Wesley Professional. 2014
4. Brad Green, Shyam Seshadri "AngularJS", O'Reilly; 1st Edition Apr 2013.
5. Negrino and Smith, "Javascript for the World Wide Web", 5th Edition, Peach pit Press,2003

MOBILE APPLICATIONS DEVELOPMENT

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Mobile applications development				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Introduce the students with the various "Next Generation Technologies" in the area of mobile computing
2. Assist students understand the various Mobile operating Systems
3. Explore the findings using Android Technologies

UNIT - I

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

UNIT - II

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

UNIT - III

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

UNIT - IV

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain the principles and theories of mobile computing technologies.

CO2: Describe infrastructures and technologies of mobile computing technologies.

CO3: List applications in different domains that mobile computing offers to the public, employees, and businesses.

CO4: Describe the possible future of mobile computing technologies and applications.

CO5: Effectively communicate course work through written and oral presentations

TEXT AND REFERENCE BOOKS:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition:
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
5. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
6. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, latest edition.
7. Jochen Schiller,"Mobile Communications", Addison-Wesley, latest edition
8. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.

ADVANCE DATABASE MANAGEMENT SYSTEM

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Advance Database Management System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand DBMS Components, Advantages and Disadvantages.
2. Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

UNIT - I

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra, SQL, Normal forms.

Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

UNIT - II

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery.

Concurrency: Introduction, Serializability, Concurrency control, locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multi-version techniques, Deadlocks.

UNIT - III

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment.

Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

UNIT - IV

Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics,

Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Students will get understanding of DBMS Components, Its advantages and disadvantages.

CO2: Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.

CO3: Explain the concept of distributed database architecture & design and web technology using databases.

CO4: Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.

CO5: Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

TEXT AND REFERENCE BOOKS:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4th Edition, Pearson Education,2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998
4. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007 2
5. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
6. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
7. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision Wesley

CLOUD COMPUTING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Cloud Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. 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.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

UNIT - I

INTRODUCTION TO CLOUD COMPUTING: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

UNIT - II

CLOUD COMPUTING ARCHITECTURE: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise .

UNIT - III

SECURITY ISSUES IN CLOUD COMPUTING: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

SECURITY MANAGEMENT IN THE CLOUD: Security Management Standards, Security

Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT - IV

AUDIT AND COMPLIANCE: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a Cloud.

DATA INTENSIVE COMPUTING: Map-Reduce Programming Characterizing Data-Intensive Computations, Technologies for Data- Intensive Computing, Storage Systems, Programming Platforms, MapReduce Programming, MapReduce Programming Model, Example Application

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Recall and summarize the basic concepts of cloud computing
CO2: Discuss the architectural design of cloud and illustrate various programming models.
CO3: Outline the virtualization technology and determine their uses.
CO4: Explain the basic threats and security mechanism in cloud
CO5: Summarize the cloud available platforms for business and industry perspective

TEXT AND REFERENCE BOOKS:

1. "Cloud Computing Explained: Implementation Handbook for Enterprises", John Rhoton, Publication Date: November 2, 2009
2. "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)", Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

7TH SEMESTER

B. Tech. (Computer Science and Engineering)

Scheme of Studies/Examination w.e.f. 2023-24

Semester – VII

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
9.	**PCC**		Neural Networks	3	0	0	3	3	30	70		100
10.	**PEC**		Professional Elective Course - IV	3	0	0	3	3	30	70		100
11.	**PEC**		Open Elective Course - III	3	0	0	3	3	30	70		100
12.	**OEC**		Open Elective Course - IV	3	0	0	3	3	30	70		100
13.	**HSMC**		Organizational Behaviour	3	0	0	3	3	30	70		100
14.	**LC**		Neural Networks Lab	0	0	2	2	1	50		50	100
15.	**PROJECT**		Project - II	0	0	8	8	4	100		100	200
16.	**PT**		Practical Training - II	0	0	2	2	1	50		50	100
			Total	**15**	**0**	**11**	**26**	**20**	**300**	**350**	**150**	**900**

NOTE:

1. **The evaluation of Practical Training - II will be based on the seminar, viva voice, and report submitted by the students.**
2. **Choose any one from Professional Elective Course – IV**
3. **Choose any one from Open Elective Course – III & IV**

Professional Elective Course – IV

1. Cyber Security Threats
2. Advanced Computer Architecture
3. Predictive Analytics
4. Information Hiding Techniques
5. Data Science

NEURAL NETWORKS

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Neural Networks				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand the different issues involved in the design and implementation of neural networks
2. To study the basics of neural Networks and its activation functions.
3. To understand concept of perceptron and its application in real world.
4. To introduce techniques used for training artificial neural networks.
5. To implement design of an artificial neural network and build a NN model to solve a problem.

UNIT I

Introduction to ANN: Need of Artificial Neural Network, Biological Neurons and Memory, Structure & Function of a single Neuron, Biological neuron equivalencies to artificial neuron model, Evolution of neural network, Application of Artificial Neural Network
Models of Artificial Neuron & activation functions

UNIT II

McCulloch and Pits Neural Network (MCP Model): Architecture, Solution of AND, OR, XOR function using MCP model,
Hebb Model: Architecture, training and testing, Hebb network for AND, OR function.
Supervised Learning Network: Architecture of Perceptron Network, training and Testing algorithm for single output and multi-output model. Adaptive Linear Neuron (Adaline): Architecture, training and Testing algorithm

UNIT III

Learning Rules: Introduction to learning and type of learning, Hebbian Learning Rule, Perceptron Learning Rule, Correlation Learning Rule, Delta Learning Rule, Competitive Learning Rule
Back propagation Network: Back Propagation networks, Architecture of Back-propagation(BP) Networks, Back-propagation Learning

UNIT IV

Associative Memory Networks: Auto associative and Hetro associative memory and their architecture, training (insertion) and testing (Retrieval) algorithm using Hebb rule and Outer Product rule. Storage capacity, testing of associative memory for missing and mistaken data, Bidirectional Associative memory

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the difference between biological neuron and artificial neuron.
CO2: Familiar with different Neural network Models
CO3: Understand the concept of learning in Neural Network.
CO4: Understanding of CNN and RNN to model for real-world applications.
CO5: Analyse the given conceptual problem and able to visualize in Neural Network
CO6: Understand the associative memory and its architecture.

TEXT AND REFERENCE BOOKS:

1. Introduction to artificial Neural systems by Jacek M. Zurada, 1994, Jaico Publ. House.
2. Principles of Soft Computing by S.N. Deepa, S.N. Sivanandam., Weley publication.
3. "Neural Networks: A Comprehensive formulation", Simon Haykin, 1998
4. "Neural Networks", Kosko, 1992, PHI.
5. "Neural Network Fundamentals" – N.K. Bose , P. Liang, 2002, T.M.H
6. Neural Network To design and build a simple NN model to solve a problem, T.N.Shankar, University Science Press

1. Neuro Fuzzy Systems, Lamba, V.K., University Science Press

ORGANIZATIONAL BEHAVIOR

Semester	VII				
Course code					
Category	HSMC				
Course title	Organizational Behavior				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

The OBJECTIVES of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

UNIT - II

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT - II

Introduction of organization: - Meaning and process of Organization, Management v/s Organization;

Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.

Individual Processes and Behavior-**Personality**- Concept, determinants and applications; **Perception-** Concept, process and applications,

Learning- Concept (Brief Introduction);

Motivation- Concept, techniques and importance.

UNIT - III

Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict;

Leadership: Concept, function, styles & qualities of leadership.

Communication – Meaning, process, channels of communication, importance and barriers of communication.

UNIT - IV

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior;

Organizational culture - Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Students will be able to apply the managerial concepts in practical life.

CO2: The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.

CO3: Students will be able to understand the behavioral dynamics in organizations.

CO4: Students will be able to understand the organizational culture and change.

CO5: To develop creative and innovative ideas that could positively shape the organizations.

CO6: To accept and embrace in working with different people from different cultural and diverse background in the workplace.

TEXT AND REFERENCE BOOKS:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, OrganisationalBehaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding OrganisationalBehaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., OrganisationalBehaviour, Prentice Hall of India, New Delhi.
7. GhumanKarminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi

Neural Networks LAB

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Neural Networks Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

1. Introduction to Matlab in context with NN.
2. Plotting of Activation Functions: Threshold functions, Signum function, Sigmoid function, Tan-hyperbolic function, Ramp function, Identity function using matlab.
3. Implementation of some basic model like MCP with suitable example.
4. Implementation of Hebb model with suitable example.
5. How the weights and bias values affect the output of a neuron.
6. How the choice of activation function (or transfer function) affects the output of a neuron.
7. Implementation of linearly separable concept for a problem.
8. To study some basic neuron models and learning algorithms by using Matlab neural network toolbox.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: For a given conceptual problem student will be able to analyze the problem and able to visualize using NN.

CO2: Students will be familiar with different NN models and its implementation.

CO3: Students will be able to understand the concept of learning in NN and its implementation.

CO4: Apply Artificial Neural Networks models to handle uncertainty and solve engineering problems.

CO5: Identify and describe Artificial Neural Network techniques in building intelligent machines.

PRACTICAL TRAINING - II

Semester	VII				
Course code					
Category	PT				
Course title	Practical Training - II				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50				
Exam	50				
Total	100				
Duration of Exam	02 Hours				

The evaluation of Practical Training – II will be based on the seminar, viva voice, and report submitted by the students.

PROJECT - II

Semester	VII				
Course code					
Category	Laboratory course				
Course title	Project - II				
Scheme and Credits	L	T	P	Credits	
	0	0	8	4	
Classwork	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES

1. To allow students to demonstrate a wide range of the skills by working on PROJECT-I that has passed through the design, analysis, testing and evaluation.
2. To encourage problem solving skills.
3. To allow students to develop problem solving, synthesis and evaluation skills.
4. To encourage teamwork and leadership.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation.

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

1. Synopsis submission (10 marks)
2. 1st mid-term progress evaluation (10 marks)
3. 2nd mid-term progress evaluation (10 marks)
4. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Demonstrate a sound technical knowledge of their selected project solution.
CO2: Undertake problem solution.
CO3: Design engineering solutions to complex problems utilising a systems approach.
CO4: Conduct the remaining engineering project.
CO5: Communicate with team members at large in written an oral form.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

Professional Elective Course - IV

CYBER SECURITY THREATS

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Cyber Security Threats				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

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 cybercrimes, 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 be able to incorporate approaches for risk management and best practices.
6. The learner will gain an understanding of cryptography, how it has evolved, and some key encryption techniques used today.

UNIT - II

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: Risk Assessment - Forensic Analysis - Security threat correlation –Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools –Threat identification - Threat Analysis - Threat Modelling - Model for Information Security Planning.

UNIT - III

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

UNIT - IV

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.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.

CO2: Design, develop, test and evaluate secure software.

CO3: Develop policies and procedures to manage enterprise security risks.

CO4: Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.

CO5: Interpret and forensically investigate security incidents.

TEXT AND 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.

ADVANCED COMPUTER ARCHITECTURE

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Advanced Computer Architecture				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To make students know about the Parallelism concepts in Programming.
2. To give the students an elaborate idea about the different memory systems and buses.
3. To introduce the advanced processor architectures to the students.
4. To make the students know about the importance of multiprocessor and multicomputer.
5. To study about data flow computer architectures.

UNIT - II

Architecture And Machines: Some definition and terms, interpretation and microprogramming. The instruction set, Basic data types, Instructions, Addressing and Memory. Virtual to real mapping. Basic Instruction Timing.

UNIT - II

Cache Memory Notion: Basic Notion, Cache Organization, Cache Data, adjusting the data for cache organization, write policies, strategies for line replacement at miss time, Cache Environment, other types of Cache. Split I and D-Caches, on chip caches, Two level Caches, write assembly Cache, Cache references per instruction, technology dependent Cache considerations, virtual to real translation, overlapping the Tcycle in V-R Translation, studies. Design summary.

UNIT - III

Memory System Design: The physical memory, models of simple processor memory interaction, processor memory modeling using queuing theory, open, closed and mixedqueue models, waiting time, performance, and buffer size, review and selection of queuing models, processors with cache.

UNIT - IV

Concurrent Processors: Vector Processors, Vector Memory, Multiple Issue Machines, Comparing vector and Multiple Issue processors.

Shared Memory Multiprocessors: Basic issues, partitioning, synchronization and coherency, Type of shared Memory multiprocessors, Memory Coherence in shared Memory Multiprocessors.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the Concept of Parallel Processing and its applications.
CO2: Implement the Hardware for Arithmetic Operations.
CO3: Analyze the performance of different scalar Computers.
CO4: Develop the Pipelining Concept for a given set of Instructions.
CO5: Distinguish the performance of pipelining and non-pipelining environment in a processor.

TEXT AND REFERENCE BOOKS:

1. Advance computer architecture by Hwang & Briggs, 1993, TMH.
2. Pipelined and Parallel processor design by Michael J. Fiynn – 1995, Narosa

PREDICTIVE ANALYTICS

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Predictive Analytics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To provide the knowledge of various quantitative and classification predictive models based on various regression and decision tree methods.
2. To provide the knowledge to select the appropriate method for predictive analysis
3. To provide the understanding of how to search, identify, gather and pre-process data for the analysis.
4. To provide the understanding of how to formulate predictive analytics questions.

UNIT - II

Introduction: The Analytics Life Cycle, Introduction to Predictive Analytics, Matrix Notation, Basic Foundations, Model, Method and Feature Selection

Regression: Covariance, Correlation and ANOVA review; Simple Linear Regression, OLS Model Diagnostics, Dummy Variables, Multivariate Regression, OLS Assumptions ,Weighted Least Squares (WLS), Generalized Linear Models (GLM).

UNIT - II

Classification Models: Introduction, Binomial Logistic Regression, Multinomial Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis.

Decision Trees: Introduction Regression Trees, Regression Tree Issues, Classification Trees, Pruning Trees, Bootstrap Aggregation (Bagging), Random Forest Models.

UNIT - III

Data Pre-Processing: Overview, Variable Types, Introduction to Data Transformations, Data Transformations: Categorical to Dummy Variables, Polynomials, Box-Cox Transformation, Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization, Rank Transformations, Lagging Data (Causal Models), Data Reduction.

UNIT - IV

Variable Selection: Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step

Methods.

Dimensionality: Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO, Dimension Reduction Models, Principal Components Regression (PCR), Partial Least Squares (PLS).

Machine Learning: Machine Learning Overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Ability to develop and use various quantitative and classification predictive models based on various regression and decision tree methods.

CO2: Analyse the working mechanism of data pre-processing for the model building.

CO3: Ability to select the appropriate method for predictive analysis

CO4: Ability to search, identify, gather and pre-process data for the analysis.

CO5: Ability to formulate predictive analytics questions.

TEXT AND REFERENCE BOOKS:

1. "An Introduction to Statistical Learning: with Applications in R" by James, Witten, Hastie and Tibshirani, Springer, 1st. Edition, 2013.
2. "The Elements of Statistical Learning-Data Mining, Inference, and Prediction "by Trevor Hastie, Robert Tibshirani, Jerome Friedman , Second Edition , Springer Verlag, 2009.
3. Predictive & Advanced Analytics (IBM ICE Publication)

INFORMATION HIDING TECHNIQUES

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Information Hiding Techniques				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To learn about data hiding applications and their techniques.
2. To learn about hacking.
3. To learn security-based protocols, attacks and intrusions.
4. To work with advance data hiding techniques.

UNIT - II

Introduction to Information Hiding: Types of Information Hiding, Applications, Importance & Significances. Differences between cryptography and steganography, Wisdom from Cryptography, types of steganography their application and significances. Past present and future of steganography

UNIT - II

Framework for Secret Communication, Security of Steganography System, Information Hiding in Noisy Data, Adaptive versus non-Adaptive Algorithms, Active and Malicious Attackers, Information hiding in Written Text, Steganographic system, Study of Different methods of insertion and retrieval of message using image steganography, Study of histrogram analysis using MATLAB of original image and stegno image

UNIT - III

Basics of watermarking, Watermarking process, Watermarking applications, Requirements and Algorithmic Design Issues, Evaluation and Benchmarking of Watermarking, Bit plane of an Image, study of noises in stego images and their comparisons, Robustness of watermarking schemes on different attacks like blurring, cropping , compression of theimage. PSNR calculation of the images.

UNIT - IV

Use of image steganography in biometric sciences, Study of security enhancement of biometric template using steganographic Frame proof codes:-Definition, Introduction of frame proof codes,

Methods to obtain 2- frame proof codes using mutually orthogonal latin squares. Use of frame proof codes in ownership and software piracy.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain information security.

CO2: Give an overview of access control of relational databases.

CO3: State the basic concept in information systems security, including security technology and principles, software security and trusted systems and IT security management.

CO4: Learn advance data hiding techniques.

CO5: Understand how to apply these data hiding techniques in real-life projects.

TEXT AND REFERENCE BOOKS:

1. Recent Advancesin Information Hiding and Applications, Pan, J.-S., Huang, H.-C., Jain, L.C., Zhao, Y., Springer (2013).
2. Information Hiding Techniques for Steganography and Digital Watermarking, Stefan Katzenbeisser, Fabien A. P. Petitcolas, Artech House, 2000.

DATA SCIENCE

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Data Science with R programming				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. . Able to apply fundamental algorithmic ideas to process data.
2. Understand the Data Analytics lifecycle.
3. Able to construct predictive models to classify new data set.
4. Learn to apply hypotheses and data into actionable predictions.
5. Document and communicate the results effectively to different stakeholders.
6. Effectively communicate the findings using visualization techniques

UNIT - I

Introduction to Data Science: Concept of Data Science, Traits of Big data, statistical modelling and algorithm modelling, AI and data science, Myths of Data science

UNIT - II

Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, working with data: Reading Files, Scraping the Web,

UNIT - III

Data Science Methodology: Business Understanding, Analytic Approach, Data Requirements, Data Collection, Data Understanding, data Preparation, Modeling, Evaluation, Deployment, feedback

UNIT - IV

Data Science Application: Prediction and elections, Recommendations and business analytics, clustering and text analytics.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the value of data science and the process behind using it.
CO2: Use Python to gather, store, clean, analyse, and visualise data-sets.
CO3: Apply toolkits to formulate and test data hypotheses and uncover relationships within data-sets
CO4: Understand the data science methodology in the data science pipeline
CO5: Understand real-world challenges with several case studies

TEXT AND REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics" , EMC Education Services,2015
2. Nina Zumel, John Mount,"Practical Data Science with R",Manning Publications,2014
3. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman,"Mining of Massive Datasets", Cambridge University Press,2014
4. Mark Gardener,"Beginning R- The Statistical Programming Language", John Wiley & Sons, Inc,2012
5. W.N.Venables, D.M.Smithandthe R Core Team,"An Introduction to R", 2013
6. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd.,2014

8TH SEMESTER

B.Tech. (Computer Science and Engineering)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VIII

S. No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
4.	**ESC**		MOOC - I (Essential)	3	-	-	-	3	-	-	-	100
5.	**ESC**		MOOC - II (Essential)	3	-	-	-	3	-	-	-	100
6.	**PROJECT**		Project – III/Industrial Training	0	0	16	16	8	150		150	300
			Total	**6**	**0**	**16**	**22**	**14**	**150**	**-**	**150**	**500**

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

PROJECT – III

Semester	VIII				
Course code					
Category	Professional Core Courses				
Course title	Project - III				
Scheme and Credits	L	T	P	Credits	
	0	0	16	8	
Classwork	150 Marks				
Practical	150 Marks				
Total	300 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
   To encourage multidisciplinary research through the integration learned in a number of courses.
2. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
3. To encourage teamwork.
4. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

5. Synopsis submission (10 marks)
6. 1st mid-term progress evaluation (10 marks)
7. 2nd mid-term progress evaluation (10 marks)
8. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Demonstrate a sound technical knowledge of their selected project topic.
CO2: Undertake problem identification, formulation and solution.
CO3: Design engineering solutions to complex problems utilising a systems approach.
CO4: Conduct an engineering project.
CO5: Communicate with engineers and the community at large in written an oral form.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

MOOC - I

Semester	VIII				
Course code					
Category	Engineering Science Course				
Course title	MOOC - I				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	-				
Practical	-				
Total	100 Marks				
Duration of Exam	-				

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

MOOC - II

Semester	VIII				
Course code					
Category	Engineering Science Course				
Course title	MOOC - II				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	-				
Practical	-				
Total	100 Marks				
Duration of Exam	-				

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.