GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme and Syllabus For

Bachelor of Technology Computer Science and Engineering (CSE)

Common With

Bachelor of Technology Computer Science and Engineering-Artificial Intelligence and Machine Learning (B.Tech CSE-AIML)

Bachelor of Technology Computer Science and Engineering-Data Science (B.Tech CSE-DS)

(Effective from the Session: 2025-26)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	2 Practical (P) per week	1 Credit
4	2 Practical Training per week	1 Credit
5	4 Project per week	2 Credit

2. RANGE OF CREDIT

A credit range of 160-180 is required for a student to be eligible to obtain an undergraduate degree in Computer Science and Engineering.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	71*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	18*
3	Engineering Science Courses	22*
4	Basic Science Courses	21*
5	Humanities and Social Sciences including Management courses	15*
6	Multidisciplinary Open Electives Courses	9*
7	Practical Training	10*
8	Project	4*
9	Mandatory Courses (Non Credit)	-
	Total Credits	170*

**Minor variation is allowed as per need of the respective disciplines.*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	OEC
7	Practical Training	PT
8	Project	PR
9	Mandatory Courses	MC
10	Lab Courses	LC

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Computer Science and Engineering) – 3rd Semester

Common with

B.Tech (CSE- Artificial Intelligence and Machine Learning) – 3rd Semester

B.Tech (CSE – Data Science) – 3rd Semester

w.e.f. 2025-26

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Basic Science Courses	BSC-MCSE-201A	Engineering Mathematics-III	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC-CSE-203A	Data Structures	3	0	0	3	3	40	60		100	3
3	Professional Core Course	PCC-CSE-205A	Operating System	3	0	0	3	3	40	60		100	3
4	Professional Core Course	PCC-CSE-207A	Python Programming	3	0	0	3	3	40	60		100	3
5	Humanities and Social Science including Management Courses	HSMC-01A	Fundamental of Management and Organizational Behaviour	3	0	0	3	3	40	60		100	3
6	Engineering Science Courses	ESC-ECE-206A	Digital Electronics	3	0	0	3	3	40	60		100	3
7	Professional Core Course	LC-CSE-209A	Data Structures Lab Using C	0	0	2	2	1	25		25	50	3
8	Professional Core Course	LC-CSE-211A	Operating System Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Course	LC-CSE-213A	Python Programming Lab	0	0	2	2	1	25		25	50	3
10	Engineering Science Courses	LC-ECE-224A	Digital Electronics Lab	0	0	2	2	1	25		25	50	3
11	Mandatory Courses (Non-Credit)	MC-201A	Environmental Science	2	0	1	3	-		60	40	-	3
Total Credits								**23**				**800**	

Note: MC-201A is a mandatory non–credit course in which the students will be required passing marks in theory.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Computer Science and Engineering) – 4th Semester

Common with

B.Tech (CSE- Artificial Intelligence and Machine Learning) 4th Semester

B.Tech (CSE – Data Science) – 4th Semester

w.e.f. 2025-26

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Course	PCC-CSE-202A	Discrete Mathematics	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC- CSE-204A	Computer Organization and Architecture	3	0	0	3	3	40	60		100	3
3	Professional Core Course	PCC-CSE-206A	Object Oriented Programming	3	0	0	3	3	40	60		100	3
4	Professional Core Course	PCC- CSE-208A	Database Management Systems	3	0	0	3	3	40	60		100	3
5	Professional Core Course	PCC-CSE-210A	Artificial Intelligence	3	1	0	4	4	40	60		100	3
6	Professional Elective Courses	Refer Professional Elective Table-1	Professional Elective-I	3	0	0	3	3	40	60		100	3
7	Professional Core Course	LC-CSE-212A	Object Oriented Programming using C++	0	0	2	2	1	25		25	50	3
8	Professional Core Course	LC-CSE-214A	Database Management Systems Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Course	LC-CSE-216A	Artificial Intelligence Lab	0	0	2	2	1	25		25	50	3
Total Credits								**23**				**750**	

Notes:

I. Choose any one from Professional Elective – I.

II. 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 typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

Table I: Professional Elective - I

Sr. No.	Course Code	Course Title
1	PEC-CSE-218A	Cloud Computing
2	PEC-CSE-220A	Nature Inspired Computing Techniques
3	PEC-CSE-222A	Human Computer Interaction
4	PEC-CSE-224A	Cyber Security

Course Code	**BSC-MCSE-201A**				
Category	Basic Science Courses				
Course Title	**Engineering Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are ● To equip students with advanced mathematical tools—multivariable calculus, vector calculus, partial differential equations, and complex analysis—for modeling, analyzing, and solving problems in computational and engineering domains. ● To emphasise on applications in areas such as image processing, machine learning, signal processing, and system dynamics.				
Course Prerequisite	Mathematics up to 12th Standard and Engineering Mathematics-I				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Describe key terminology of multivariable integrals, vector calculus, partial derivatives and complex analysis.	Level 1: Remember
CO2	Explain the principles and applications of multivariable integrals, vector calculus, partial derivatives and functions of complex variables.	Level 2: Understand
CO3	Solve the problems using techniques of integrals, vector calculus, partial derivatives and complex analysis.	Level 3: Apply
CO4	Analyze complex mathematical problems associated with multi-variable integrals, vector calculus, partial derivatives and complex function.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Multivariable Integral Calculus: Evaluation of definite and improper integrals, double integrals, Evaluation of double integrals (Cartesian and polar coordinates), Change of order of integration, Change of variables between Cartesian, cylindrical and spherical polar coordinates, Applications of double integral to find area enclosed by plane curves, Triple integrals, Applications of triple integrals, Beta and Gamma functions.

Unit-II

Vector Calculus: Differentiation of vectors, scalar and vector point functions, Gradient of a scalar point function, Directional derivative, Curl and divergence, Statement of Green's, Stoke's and Gauss divergence theorems, Verification and evaluation of vector integrals using these theorems.

Unit-III

Partial Derivatives: Definition of Partial Differential Equations, First order linear partial differential equations, Partial Differential Equations of higher order: Second-order linear partial differential equations and their classification, Solution to homogeneous and non-homogeneous linear partial differential equations of second order by complementary function and particular integral method, Initial and boundary conditions, D'Alembert's solution of the wave equation, Separation of variables method to simple problems in Cartesian coordinates, One dimensional diffusion equation and its solution by separation of variables.

Unit-IV

Functions of Complex Variable: Differentiability and Analyticity, Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations, Harmonic functions, Integration of complex functions, Cauchy-integral theorem and formula (without proof), Taylor's series, Laurent's series, Zeros of analytic functions, Singularities, Residues, Cauchy Residue theorem (without proof).

Suggested Readings:

1. Higher Engineering Mathematics by B.V. Ramana, Tata McGraw-Hill Publishing Company Limited.
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.
3. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley& Sons.
4. Advanced Engineering Mathematics by H.K. Dass, S.Chand.
5. A text book of Engineering Mathematics by N.P.Bali and Manish Goyal, Laxmi Publications.
6. Engineering Mathematics for first year by T. Veerarajan, Tata McGraw-Hill Publishing Company Limited.
7. Engineering Mathematics-Calculus, Differential Equations and Linear Algebra by P.Sivarama krishna Das, C. Vijaya kumari, Pearson Education.

Useful Video links

Unit No.	Topics	Links
Unit-I	Multiple Integrals	https://youtu.be/mIeeVrv447s?si=ZxrHvWcK3RQTaOyp
	Change Order Of Integration	https://youtu.be/4rc3w1sGoNU?si=GmMACWg459ppFGyn
	Change Of Variables	https://youtu.be/wtY5fx6VMGQ?si=bSR0rySP3bql6Ngh
Unit-II	Vector Differentiation	https://youtu.be/Qj0KM9Uh7xw?si=9gLE1lLBgoYnyi8v
	Gradient of a scalar field and Directional derivative	https://youtu.be/JTJXHcLrxgM?si=kuqQlxeT4Y0N9Xeo
	Gradient, Divergence and Curl	https://youtu.be/v_sTlDeCUdU?si=yf6yzC0hazmWzYEh
	Line Integral	https://youtu.be/yCqLvRiVtng?si=iqbOrl9Bq28F9HIL
	Applications of Line integrals	https://youtu.be/mMBSb_dtkYU?si=rtFe1esglErwBr3b
	Green's Theorem	https://youtu.be/34aX-fNMS-c?si=v1hj0iSsVQ2ypsJp
	Divergence Theorem of Gauss	https://youtu.be/DtqTXJ5X3xo?si=J5KIjrjWImISylNH
	Stoke's Theorem	https://youtu.be/q-fgRrPayJY?si=MI5sFHwamcF8gApa
Unit-III	Definition of Partial Differential Equations.	https://youtu.be/Kk5SEzASkZU?feature=shared
	Solution to homogeneous and non-homogenous linear partial differential equations of second order	https://youtu.be/Kk5SEzASkZU?feature=shared
	Initial and boundary conditions of partial differential equations of second order	https://youtu.be/Kk5SEzASkZU?feature=shared
	Separation of variables method to simple problems in Cartesian coordinates.	https://youtu.be/Kk5SEzASkZU?feature=shared
Unit-IV	Introduction to Complex Numbers	https://www.youtube.com/watch?v=gFjlBKW8aZU
	Analytic Functions Of A Complex variable	https://youtu.be/b5VUnapu-qs?si=odZ34Xpop2x-xcob https://www.youtube.com/watch?v=q01b-lV6y5Q
	Calculus Of Residues (Part I)	https://youtu.be/o77UV7YrWvw?si=9T5nTIJ3krNNYKx4
	Calculus Of Residues(Part II)	https://youtu.be/Aq6K0lmv3Qw?si=rWyCcSJMlEVpimr6

ourse code	**PCC-CSE-203A**				
Category	Professional Core Course				
Course title	**Data Structures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the basics of data structures and algorithms. • To explain the concept of Stacks, Queues, Linked Lists, Trees, related operations and their implementation. • To understand sorting, hashing, and graph algorithms, including their design and complexity analysis • To develop the ability to evaluate algorithm efficiency in terms of time and space complexity.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**
CO1	Define the key terminologies of data structures and algorithms including their classifications, operations, and performance characteristics.
CO2	Describe the design and implementation of various linear and non-linear data structures, and their real-world applications including hashing and binary trees.
CO3	Apply appropriate data structures such as arrays, stacks, queues, linked lists, trees, and graphs to solve computational problems effectively.
CO4	Analyze the efficiency of algorithms and operations in searching, sorting, and traversals using time and space complexity metrics.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms, how to design and develop algorithm, Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Searching: Linear Search and Binary Search Techniques and their complexity analysis. Arrays: Array Definition, Types, Operations on array and their complexity analysis.

Unit-II

Stacks and Queues: Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. Tower of Hanoi problem. Queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit-III

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Path length, Huffman's algorithm, Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit-IV

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.
Graph: Basic Terminologies, Sequential representation of graphs, Adjacency matrices. Graph search and traversal algorithms and complexity analysis.

Suggested Readings:

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press. Programming in ANSI C by E. Balaguruswamy, Tata McGraw-Hill
2. Algorithms, Data Structures, and Problem Solving with C++, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
3. How to Solve it by Computer, 2nd Impression by R.G. Dromey, Pearson Education.
4. Data Structures and Algorithms Made Easy by Narasimha Karumanchi.
5. Data Structures Using C by Aaron M.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Data Structures and Algorithms	https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
	Linear Search Algorithm	https://www.youtube.com/watch?v=C46QfTjVCNU
	Binary Search	https://www.youtube.com/watch?v=V_T5NuccwRA
Unit-II	Stacks	https://youtu.be/g1USSZVWDsY?list=PLBF3763AF2E1C572F
	Stack and its Applications	https://www.youtube.com/watch?v=aG0HjeXBUDU
	Queues and Linked Lists	https://youtu.be/PGWZUgzDMYI?list=PLBF3763AF2E1C572F
Unit-III	Linked Lists-I	https://www.youtube.com/watch?v=K7VIKlUdo20
	Trees	https://youtu.be/tORLeHHtazM?list=PLBF3763AF2E1C572F
	Search Trees-II	https://www.youtube.com/watch?v=5jQGqaAUzOI
	AVL Trees	https://youtu.be/mRGQylRWAsI?list=PLBF3763AF2E1C572F
Unit-IV	Sorting	https://youtu.be/4OxBvBXon5w?list=PLBF3763AF2E1C572F
	Hashing	https://www.youtube.com/watch?v=2-h9193Ztqg
	Graphs	https://youtu.be/9zpSs845wf8?list=PLBF3763AF2E1C572F

Course Code	**PCC-CSE-205A**				
Category	Professional Core Courses				
Course Title	**Operating System**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the students to the fundamental concepts, types, and services of operating systems and their evolution. ● To develop understanding of process management, thread management, CPU scheduling, and inter-process communication mechanisms. ● To explain memory management, virtual memory, file systems, and disk scheduling techniques for effective resource utilization. ● To provide practical insight through case studies of UNIX and Windows, enhancing problem-solving and analytical skills for system performance optimization.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Recall basic OS concepts, types, services, and case studies.	Level 1: Remember
CO2	Explain process management, memory, file, and disk management techniques.	Level 2: Understand
CO3	Apply scheduling, synchronization, and memory management to solve OS problems.	Level 3: Apply
CO4	Analyze techniques and algorithms in operating systems for efficiency and performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Operating Systems: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Architecture (window, android, mac), 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 objectives, 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, Memory Protection (ASLR, DEP).
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, Modern file system (ZFS, Btrfs, APFS), 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.

Suggested Readings:

1. Operating System Concepts by Abraham Silberschatz, Peter B. Galvin, G. Gagne, Eighth edition, Wiley Publication.
2. Modern Operating Systems by Andrew S. Tanenbaum, Second Edition, Pearson India.
3. Operating System: A Design-oriented Approach by Charles Crowley, McGraw Hill Education.
4. Design of the Unix Operating Systems by Maurice Bach, Pearson Education India.

Useful Video links

Unit No.	Topics	Links
Unit-I	Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems	https://www.youtube.com/playlist?list=PLrpK1inhO61UQRHHuB8xSYulwJrAuVGPw
	Multithreading	https://www.youtube.com/watch?v=6rYOyIGfy3w&t=1440s
Unit-II	Critical Section, other Synchronization Problems	https://youtu.be/qKPCfuZAAEc
	Deadlocks, Resources, System State, Necessary and Sufficient conditions for a Deadlock.	https://www.youtube.com/watch?v=8ZS7xzWPo5A&list=PLEAYkSg4uSQ2Pach478muxnoeTNz_QeUJ&index=33
	Banker's algorithm	https://youtu.be/8ZS7xzWPo5A?list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk
Unit-III	Memory Management	https://youtu.be/_pKbqFyG03s
	Virtual Memory	https://www.youtube.com/watch?v=Ev4BET3i5R0
	Page Replacement algorithms	https://www.youtube.com/watch?v=Oho3QU-7pB8
Unit-IV	File Management	https://youtu.be/EiFHM-HhsEQ
	File Access Methods	https://archive.nptel.ac.in/courses/106/105/106105214/#
	Unix and Windows	https://www.youtube.com/watch?v=6El3RW9ZOKE

Course Code	**PCC-CSE-207A**				
Category	Professional Core Courses				
Course Title	**Python Programming**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce Python programming fundamentals, including syntax, data types, control structures and basic python libraries. ● To develop skills in Python data structures, functions, recursion and python libraries like NumPy, Pandas, Tkinter etc.. ● To explore Python's graphical programming, image processing, and GUI development.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

Cos	Skill Demonstrated	RBT Level
CO1	Define key terminology of Python syntax, data types, control structures, data structures, libraries, and GUI tools.	Level 1: Remember
CO2	Explain the functionality of Python programming constructs, data handling techniques, and graphical modules.	Level 2: Understand
CO3	Use Python programs for data processing, file handling, numerical computing, graphics, and GUI applications.	Level 3: Apply
CO4	Analyze Python programming constructs, data structures, libraries, graphics, image processing, and GUI techniques to solve real-world problems effectively.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Installing Python; basic syntax, interactive shell, editing, saving, and running a script; data types; variables, assignments; numerical types; arithmetic operators and expressions; Loops and selection statements, Control statements String manipulations: subscript operator, indexing, slicing a string; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file.

Unit-II

Lists, Tuple, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; Tuple: creating tuples, accessing elements, tuple immutability, operations, tuple methods, tuples vs. lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries. Hiding redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

Unit-III

Introduction to NumPy: NumPy arrays, Array Indexing and Slicing, Array Operations, Array Manipulation, Linear Algebra with NumPy, Random Number Generation and Statistics.
Introduction to Pandas: Pandas Series, Pandas Data Frames, Data Frame Indexing and Selection, Data Cleaning and Pre-processing, Data Manipulation, Group by Operations, Merging, Joining, and Concatenating Data Frames, Input/output Operations.

Unit-IV

Simple graphics and image processing: Simple graphics, Turtle operations, Manipulating turtle screen, Drawing two dimensional shapes, examining an object attributes, Taking a random walk, Colour and RGB scheme, Image processing: Image manipulation operations, properties of images, image module, copying, blurring and reducing image.
Graphical User Interfaces using Tkinter: Terminal based and GUI based programs, Introduction to Tkinter, Simple GUI-Based Programs, Windows and Window Components, Input and Output with Entry Fields, Defining and Using Instance Variables, Other Useful GUI Resources.

Suggested Readings:

1. Fundamentals of Python: First Programs by Kenneth Lambert, Course Technology, Cengage Learning, 2012.
2. Introduction to Computer Science Using Python: A Computational Problem-Solving by Dierbach, C. Focus, John Wiley & Sons, 2012.
3. Let Us Python by, Kanetkar, A., & Kanetkar, Y., BPB Publications.
4. Python – The Complete Reference by Brown, M. C., McGraw Hill Education.
5. Core Python Programming by Rao, R. N., Dream Tech Press.
6. Python Programming: Using Problem Solving Approach by Thareja, R., Oxford University Press.
7. Python Programming by Sridhar, S., Indumathi, J., & Hariharan, V. M., Pearson Education.
8. Python for Data Analysis by Wes McKinney, 3rd Edition, O'Reilly Media, 2022.
9. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media.

Useful Video links

Unit No.	Topics	Links
Unit-I	Variables and Input Statement	https://youtu.be/ruQb8jzkGyQ
	Data Types, Operators and Expressions	https://youtu.be/8n4MbjuDBu4
	Introduction to for loop	https://youtu.be/lvXuQ_x7EsI
	Introduction to while loop	https://youtu.be/KTvVNN7ia8o
	String Methods	https://youtu.be/p-4HU1rcG5s
	Reading and Writing to a File	https://www.youtube.com/watch?v=rYLJaAdgLhI
	Creating and reading a formatted file	https://www.youtube.com/watch?v=NBTSDtBy5bs
Unit-II	List operators	https://youtu.be/jMShssechMI
	Searching and sorting lists	https://youtu.be/4OxBvBXon5w
	Tuples	https://youtu.be/mzx74TdGYbg
	Dictionary literals, adding, and removing elements	https://youtu.be/Aj7PwBI99A4
	Recursive functions	https://youtu.be/Uo7RygJaaRQ
Unit-III	NumPy	https://youtu.be/rjY59WLMK2o
	Pandas	https://youtu.be/6DTFIKF8QIg?feature=shared
Unit-IV	Simple graphics	https://www.youtube.com/watch?v=pxKu2pQ7Ilo
	Graphical User Interfaces using Tkinter	https://youtu.be/-GhzpvvIXlM?si=itHn2839Kkhy89B3

Course Code	**HSMC-01A**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Fundamental of Management and Organizational Behaviour**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	3	0	0	3	
Course Objectives	The objectives of this course are • Introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework. • Develop understanding of individual and group behavior, motivation, communication, and leadership in organizational settings. • Equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively. • Foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental management concepts, functions, organizational processes, and organizational behavior elements.	Level 1: Remember
CO2	Explain the roles, skills, and interrelationships in management, individual behaviors, group dynamics, and communication processes within organizations.	Level 2: Understand
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behavior challenges.	Level 3: Apply
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.	Level 4: Analyse

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

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: 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 and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

1. Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
2. Organizational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
3. Management concept practice and cases by Ghuman Karminder, Aswathappa K., Tata McGraw Hill, New Delhi.
4. Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
5. Organizational Behaviour by Stephen P Robin, Pearson Education.
6. Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
7. Organizational Behaviour by FC Sharma, Shree Mahavir Publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Nature and Scope of Management	https://nptel.ac.in/courses/110105146
Unit-II	Perception and Personality	https://nptel.ac.in/courses/110103433
Unit-III	Group Dynamics	https://archive.nptel.ac.in/courses/110/106/110106145/
Unit-IV	Organizational Change, Resistance to Change.	https://nptel.ac.in/courses/110105146

Course Code	**ESC-ECE-206A**				
Category	Engineering Science Courses				
Course Title	**Digital Electronics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the basic concepts of Boolean algebra. ● To introduce the various combinational circuits and designing. ● To introduce the various sequential circuits and designing. ● To understand the working of analog-to-digital, digital-to-analog converters, programmable devices for building digital systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**
CO1	Apply the knowledge of Boolean algebra, K-MAP, and other digital design methods for simplification and optimization of digital circuits.
CO2	Design and implement combinational logic circuits using logic gates for arithmetic operations, code conversion, and control applications.
CO3	Understand and apply the concepts of latches, flip-flops, and counters in designing synchronous and asynchronous circuits for memory and storage applications.
CO4	Analyze memory types and programmable logic device architectures to interpret the functional organization of FPGA and CPLD systems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Logic Simplification: Review of Boolean Algebra and De Morgan's Theorem, Digital codes, Logic gates and their operations, Realization of logic gates using universal gates, Number system, Representation of Boolean functions in sum of products (SOP) form and product of sums (POS), Addition and subtractions of a complements numbers, Minimization of Boolean functions using Karnaugh map and Quine McCuskey methods, Error detection and correction code.

Unit-II

Combinational Logic Design: Half and Full Adders, Half and Full Subtractors, Multiplexers, Demultiplexers, Encoder, Decoder, Magnitude Comparators, Priority encoder, Parallel Adders, Adder with Look Ahead Carry, BCD Adder.

Unit-III

Sequential Logic Design: Latches, Concept of edge triggered and level triggered clock, Building blocks like S-R, JK and Master-Slave JK FF, D FF, T FF, Conversions of FF, Ripple and Synchronous counters, Ring and Johnson counter, UP & DOWN counter, Sequence Generator, Shift registers.

Unit-IV

A/D and D/A Converter: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel - comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.
Programmable Logic Devices: ROM, PLA, PAL, SRAM, DRAM, FPGA and CPLDs.

Suggested Readings:

1. Modern digital Electronics by R.P. Jain,Tata McGraw Hill, 4th edition.
2. Switching Theory & Logic Design by A.Anand Kumar, PHI.
3. Digital Electronics Circuit and System by V K Puri, TMH.
4. Digital Circuits and Systems by D.V. Hall, Tata McGraw Hill.
5. Principle of Digital Electronics by K Meena, PHI
6. Logic & Computer Fundamentals by Morris Mano,4th Edition, Pearson Education.

Useful Video links

Unit No.	Topics	Links
Unit-I	Boolean Algebra	https://www.youtube.com/shorts/xtAYbY_Pz7I
Unit-II	Multiplexer	https://www.youtube.com/watch?v=p6yPvw88BJk
	Combinational Circuits	https://www.youtube.com/watch?v=fXrbYMDevDU
Unit-III	Sequential Circuits	https://www.youtube.com/watch?v=S0mKCNLmCh4&list=PLgwJf8NK-2e4mEQv0ttgW-am4wiqrpdcX
	Counter	https://www.youtube.com/watch?v=NTCrCYPoA5A&list=PLgwJf8NK-2e6lcDg0NxW-_yO6Bl5dPBp8
Unit-IV	Finite state machines	https://www.youtube.com/watch?v=LOZxYBOKRLg
	PLD's	https://www.youtube.com/watch?v=m6975d-U6j8

Course Code	**LC-CSE-209A**					
Category	Professional Core Courses					
Course Title	**Data Structures Lab Using C**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	0	0	2	**1**		
Course Objectives	The objectives of this course are ● To learn how to create and perform basic operations on arrays linked lists, stacks, and trees using C. ● To understand and implement searching techniques like linear search and binary search. ● To gain practical knowledge of different sorting algorithms such as insertion sort, bubble sort, merge sort, quick sort, and heap sort. ● To improve problem-solving skills by writing and executing C programs for various data structure operations.					
Assessment	25 Marks					
End Semester Practical Examination	25 Marks					
Total Marks	50					
Duration of Exam	03 Hours					

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand the basics of C language and Turbo C Integrated Development Environment (IDE).	Level2: Understand
CO2	Apply C programming to implement data arrays, pointers, data structures, searching, sorting, and basic data structure operations like stacks and linked lists.	Level 3: Apply
CO3	Apply C programming techniques to implement and manipulate non-linear data structures such as trees and hash tables.	Level 3: Apply
CO4	Analyze the applicability of appropriate data structures, control statements, iteration statements to implement searching and sorting.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Study the basics of Turbo C IDE.	CO1
2	Write a Program in C programming language to insert and delete an Element in Linear Array.	CO2
3	Write a Program in C programming language to Implement Array Traversing.	CO2
4	Write a Program in C programming language to Implement Linear Search.	CO2

5	Write a Program in C programming language to Demonstrate Binary Search.	CO2
6	Write a Program in C programming language to Insert and Delete Nodes into Linked List.	CO2
7	Write a Program in C programming language to Implement PUSH and POP in Stack.	CO2
8	Write a Program in C programming language to Implement Insertion Sort.	CO4
9	Write a Program in C programming language to Implement Bubble Sort.	CO4
10	Write a Program in C programming language to Implement Merge Sort.	CO4
11	Write a Program in C programming language to Implement Quick Sort.	CO4
12	Write a Program in C programming language to Implement Heap Sort.	CO4
13	Write a program in C programming language to implement a binary tree and perform its inorder, preorder, and postorder traversals.	CO3
14	Write a Program in C programming language to Find the Height of a Binary Tree in C.	CO3
15	Write a Program in C programming language to implement a hash table with separate chaining for collision resolution.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	Virtual Lab Link
Write a Program in C to implement Linear Search and binary Search.	https://ds1-iiith.vlabs.ac.in/exp/unsorted-arrays/code-assessment.html
Write a Program in C programming language to Implement Bubble Sort.	https://ds1-iiith.vlabs.ac.in/exp/bubble-sort/code-assessment.html
Write a Program in C to implement Merge Sort.	https://ds1-iiith.vlabs.ac.in/exp/merge-sort/code-assessment.html
Write a Program in C programming language to Implement Quick Sort.	https://ds1-iiith.vlabs.ac.in/exp/quick-sort/code-assessment.html
Write a program in C programming language to implement a binary tree and perform its inorder, preorder, and postorder traversals.	https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/code-assessment.html
Write a Program in C to implement Linear Search and binary Search.	https://ds1-iiith.vlabs.ac.in/exp/unsorted-arrays/code-assessment.html

Course code	**LC-CSE-211A**				
Category	Professional Core Courses				
Course title	**Operating System Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To gain hands-on experience with UNIX/Linux commands, system calls, and shell programming. ● To implement basic operating system concepts such as process creation, scheduling, and synchronization. ● To develop practical skills in memory management, file systems, and disk scheduling algorithms.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Describe the basic concepts and features of Linux, Windows, UNIX Operating System, basic UNIX commands and vi editor usage.	Level2: Understand
CO2	Write shell scripts for system tasks like displaying user info, performing calculations, and managing files.	Level 3: Apply
CO3	Implement control structures in shell scripting to solve problems such as checking conditions and generating series.	Level 3: Apply
CO4	Analyze file allocation methods and CPU scheduling algorithms for efficient file and process management.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Explore the architecture, features, and file system of the Windows Operating System.	CO1
2	Explore the architecture, features, and file system of the Linux Operating System.	CO1
3	Study various UNIX Commands.	CO1
4	Understand the working of the VI editor and describe its modes, commands, and common file editing operations in UNIX/Linux.	CO1
5	Write a program to print the VI editor file data.	CO2
6	Write a shell program to implement a calculator.	CO2
7	Write a shell script to see current date, time, username and directory.	CO2

8	Write a program to check whether a number is odd or even using Shell Programming.	CO3
9	Write a program to find out the factorial of a number.	CO3
10	Write a program to generate Fibonacci Series.	CO3
11	Write a program to find the greatest number out of the seven numbers using a for loop.	CO3
12	Write a program to implement Do-While Loop.	CO3
13	Write a program to Implement any file allocation technique (Linked, Indexed or Contiguous)	CO4
14	Write a program to Implement any CPU scheduling technique (FCFS, SJF, SRJF, Priority and Round -Robin)	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Course code	**LC-CSE-213A**				
Category	Professional Core Courses				
Course title	**Python Programming Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To introduce students to the basics of Python programming including syntax, data types, control structures, and file operations. ● To enable students to use Python data structures and modular programming techniques effectively. ● To provide hands-on experience with data analysis using NumPy and Pandas libraries. ● To develop skills in GUI programming, simple graphics, and image processing using Python.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand the installation process, basic features and programming constructs in Python.	Level 2: Understand
CO2	Apply Python programming techniques to implement algorithms for mathematical operations, searching, sorting and other real life problems.	Level 3: Apply
CO3	Apply NumPy and Pandas for data manipulation, statistical operations.	Level 3: Apply
CO4	Analyze Python's graphics, image processing, and GUI programming concepts to develop interactive applications.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Study the basic features and installation of Python.	CO1
2	Write a Python program to compute the G.C.D. of two numbers.	CO1
3	Write a Python program to find the square root of a number.	CO1
4	Write a Python program to find the power of a number.	CO1
5	Write a Python program to find the maximum in a list of numbers.	CO2
6	Write a Python program to implement linear search and binary search in a list.	CO2
7	Write a Python program to sort the element using selection sort, insertion sort and merge sort.	CO2

8	Write a Python program to compute first “n” prime numbers.	CO2
9	Write a Python program to find the most frequent word in a text file.	CO2
10	Write a Python program to create and perform operations on arrays using NumPy.	CO3
11	Write a Python program to apply Pandas for manipulating a dataset and performing grouped statistical operations.	CO3
12	Write a Program in Python for a random walk using turtle.	CO4
13	Create simple graphics using Turtle: draw shapes and take random walks.	CO4
14	Perform image processing: copy, blur, and reduce images using PIL or OpenCV	CO4
15	Design a GUI application using Tkinter with input, output, and buttons.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Arithmetic Operations	https://python-iitk.vlabs.ac.in/exp/arithmetic-operations/
Built-in Functions	https://python-iitk.vlabs.ac.in/exp/built-in-functions/
Loops	https://python-iitk.vlabs.ac.in/exp/loops/
Strings	https://python-iitk.vlabs.ac.in/exp/strings/
File Handling	https://python-iitk.vlabs.ac.in/exp/file-operators/simulation.html

Course Code	**LC-ECE-224A**				
Category	Professional Core Courses				
Course Title	**Digital Electronics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- III**
	0	0	2	1	
Course Objectives	The objectives of this course are to ● Learn the basics of digital electronics and use logic gates and ICs. ● Design and check different combinational and sequential logic circuits. ● Understand the working operation of adders, subtractors, multiplexers, flip-flops, and counters in digital systems. ● Learn to build and test ADC, DAC, and practical counters for various applications.				
Assessment	25 Marks				
End Semester Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify and apply operational principles of logic gates used in digital systems.
CO2	Apply K-map techniques to simplify Boolean expressions and design efficient combinational and sequential circuits.
CO3	Verify the truth tables and behavior of various combinational circuits with different states and inputs.
CO4	Design and develop counters and shift registers using flip flops for various practical applications used in digital systems.

List of Experiments

Sr. No.	Contents
1	To study & design basic gates.
2	To study and realize logic functions with the help of universal gates.
3	To realize and minimize five & six variables using K-Map method .
4	To verify the operation of Multiplexer & De-multiplexer.
5	To perform half adder and full adder.
6	To perform half subtractor and full subtractor.
7	To verify the truth table of S-R, J-K,T & D Type flip flop.
8	To design & verify the operation of 3 bit synchronous counter.
9	To design & verify the operation of synchronous UP/DOWN decade counter using JK flip.

10	To design & verify operation of Asynchronous counter.
11	To design and implement a circuit to detect a count sequence.
12	To design & verify operation of ADC & DAC.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To study & design basic gates.	https://de-iitr.vlabs.ac.in/exp/truth-table-gates/
To study and realize logic functions with the help of universal gates.	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
To verify the operation of Multiplexer & De-multiplexer.	https://de-iitr.vlabs.ac.in/exp/multiplexer-demultiplexer/
To perform half adder and full adder	https://de-iitr.vlabs.ac.in/exp/half-full-adder/
To perform half subtractor and full subtractor.	https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/index.html
To verify the truth table of S-R, J-K, T & D Type flip flop.	https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/
To design & verify the operation of 3-bit synchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/
To design & verify operation of Asynchronous counter.	https://de-iitr.vlabs.ac.in/exp/4bit-synchronous-asynchronous-counter/

Course Code	**MC-201A**				
Category	Mandatory Courses				
Course Title	**Environmental Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester- III**
	2	0	1	-	
Course Objectives	The objectives of this course are • Create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • Develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • Foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • Engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Practical/Field Visits	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				
Remarks	The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.				

Course Outcomes: After successful completion of this course, the students will be able to

CO	**Skill Demonstrated**	**Level**
CO1	Describe key concepts of environmental studies, types of natural resources, ecosystem structures, pollution types, major environmental laws, and human-environment interactions.	Level 1: Remember
CO2	Explain the interrelationships among ecosystems, biodiversity, pollution, social issues, environmental ethics, and related legislation for sustainable development.	Level 2 : Understand
CO3	Apply principles of environmental management, pollution control, disaster preparedness, and sustainable practices in real-world and field-based environmental contexts.	Level 3: Apply
CO4	Analyze environmental problems, population growth impacts, climate change, welfare programs, and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

The Multidisciplinary nature of environmental studies. Definition scope and importance.
Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems.

a) Forest resources: Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, salinity, case studies. e) Energy resources: Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.
f) **Land resources:** Land as are source, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles

Unit-II

Ecosystems: Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food web sand ecological pyramids**,** Introduction, types, characteristic features, structure and function of Forest ecosystem, Grass land ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
Bio diversity and its conservation: Introduction, Definition, Genetic, Species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wild life, man-wild life conflicts, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.

Unit-III

Environmental Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards.

Solids Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies.

Disaster Management: Floods, Earthquake, Cyclone and Landslides.
Social issues and the Environment: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, its problems and concerns case studies.
Environmental Ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit-IV

Human population and the Environment: Population growth, Variation among Nations, Population explosion-Family Welfare Programme, Environment and human health, Human Rights. Value Education, HIV/AIDS, Woman and Child Welfare Role of Information Technology in Environment and human health. Case Studies.

Field Work (Field work equal to10 lecture hours)- Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hills, slopes, etc.

Suggested Readings:

1. Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
2. The Biodiversity of India by Bharucha, MA Pin Publishing Pvt. Ltd., Ahmedabad.
3. Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc., 1989
4. Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
5. Global Biodiversity Assessment by V.H. Heywood & R.T. Watson, Cambridge University Press, 1995, 1140p.
6. Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
7. Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
8. Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
9. Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
10. Survey of the Environment, The Hindu.
11. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
12. Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
13. Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
14. A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course Code	**PCC-CSE-202A**				
Category	Professional Core Courses				
Course Title	**Discrete Mathematics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are ● To introduce the concept of mathematical logic, concept of sets, relation and functions. ● To introduce the concept of algorithm and number theory. ● To understand the group theory and related examples. ● To applying discrete structures to areas such as algorithms, data structures, digital logic, and cryptography.				
Course Prerequisite	Mathematics up to 12thStandard and Engineering Mathematics-I &II				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Define the basic terms used in discrete mathematics and structures.	Level 1: Remember
CO2	Understand the fundamental techniques, laws, logics, relations, graphs and trees.	Level 2: Understand
CO3	Solve mathematical problems based on the concept of set theory, relations, functions and basic counting techniques.	Level 3: Apply
CO4	Classify lattices, logarithms, functions, algebraic structures, graphs and trees.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Sets, Relation, Function and Propositional Logic: Operations and Laws of Sets, Cartesian Products, Representation of relations, Binary Relation, Equivalence Relation, Partial Ordering Relation, POSET, Hasse Diagram, Lattices and its types, Function, Bijective functions, Inverse and Composite Function, Finite and infinite Sets, Countable and Uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem, Propositions, Logical operations, Conditional Statements, Tautologies, Contradictions, Logical Equivalence.

Unit-II

Basic Counting Techniques and Recurrence Relation: Pigeon-hole principle, Permutation andCombination, the Division algorithm: Prime Numbers, The GCD: Euclidean Algorithm, The Fundamental Theorem of Arithmetic., Linear recurrence relation with constant coefficients, Homogenous Solutions, Particular Solutions, Total Solutions, Solving recurrence relation using generating functions.

Unit-III

Algebraic Structures: Definitions and examples of Algebraic Structures with one Binary Operation: Semi Groups, Monoids, Groups; Congruence Relation and Quotient Structures, Permutation Groups, Cyclic groups, Normal Subgroups, Definitions and examples of Algebraic Structures with two Binary Operation: Rings, Integral Domain, Fields; Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Unit-IV

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Multigraph and Weighted graph, Shortest path in Weighted graphs, Eulerian paths and circuits, Hamiltonian path and circuits, Planar Graphs, Euler's formula, Graph Colouring, Trees, Binary trees and its traversals, Trees Sorting, Spanning tree, Minimal Spanning tree.

Suggested Readings:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill.
2. Satinder Bal Gupta: A Text Book of Discrete Mathematics and Structures, University Science Press, Delhi.
3. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics: A Computer Oriented Approach, Tata McGraw – Hill.
4. J.P. Tremblay and R. Manohar, Discrete mathematical structures with applications to computer science, TMG Edition, Tata McGraw-Hill.
5. Discrete Mathematics, Babu Ram, Pearson Publication.
6. Discrete Mathematics, SemyourLipschutz and Marc Lipson, Schaum's outline.

Useful Video links

Unit No.	Topics	Links
Unit-I	Sets	https://youtu.be/s-hRgTgdVe4?si=oN4wGgPzbqYvh-pv
	Functions	https://youtu.be/ceiMP4otA28?si=00SmukP2_XlqgeKK
	Representation of relations	https://youtu.be/wGLTV8MgLlA?si=KQ3UQ6hnj8szYIvN
	Propositions Calculus	https://youtu.be/WQ40fJskFIE?si=jVpwPuZ8pUW78QWj
Unit-II	Permutation and Combination, the Division algorithm	https://youtu.be/BI84sbsOtGQ?si=ZTFN88-qrGlOwquH
	The GCD: Euclidean Algorithm	https://youtu.be/BI84sbsOtGQ?si=ZTFN88-qrGlOwquH
	Pigeon-hole principle	https://youtu.be/a-O-ioYy1rI?si=_bIKGfCet8sM8csj
	Linear recurrence relation	https://youtu.be/CsvJPEgzF18?si=lpJz5yj1X8cVuTui
	Total Solutions, Solving recurrence relation using generating functions	https://youtu.be/ZxqBgiW1VBw?si=8_5FRbpei6fKRDX1
Unit-III	Algebraic Structures: Definitions and examples of Algebraic Structures with one Binary Operation	https://youtu.be/3zOtLEeHygg?si=k9s9ejEkVLKRc1kI
	Groups; Congruence Relation and Quotient Structures	https://youtu.be/3zOtLEeHygg?si=k9s9ejEkVLKRc1kI
	Definitions and examples of Algebraic Structures with two Binary Operations	https://youtube.com/playlist?list=PLq76ktDFTJEKPnC7dWNEOYHytKvrQ4en0&si=B1K2ne130ijMGoU5
Unit-IV	Graphs and their properties	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx
	Eulerian paths and circuits, Hamiltonian path	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx
	Trees, Binary trees and its traversals	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx
	Trees Sorting, Spanning tree, Minimal Spanning tree	https://youtu.be/3zOtLEeHygg?si=oXeg4i1GEzZ640wx

Course Code	**PCC-CSE-204A**				
Category	Professional Core Courses				
Course Title	**Computer Organization and Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To provide a solid foundation in data representation and internal data formats used in digital systems. ● To introduce the fundamental concepts of register transfer, bus structures, and microoperations. ● To develop an understanding of computer organization and architecture. ● To explain the principles of input-output organization and memory systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Describe key terminologies of data representation, micro operations, computer architecture, input/output organization, and memory systems.	Level 1: Remember
CO2	Explain the functioning of various components of a computer system including CPU organization, instruction execution, pipelining, and memory hierarchy.	Level 2: Understand
CO3	Apply knowledge of instruction formats, register transfer, and addressing modes to execute basic operations and solve system-level computing problems.	Level 3: Apply
CO4	Analyze the performance and structure of computing systems for evaluation of CPU design choices, pipeline efficiency, memory access methods, and data transfer mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes,
Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Micro-operations, 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: Basic Concepts of Pipelining, Throughput and Speedup, Performance Metrics (CPI, MIPS, MFLOPS), Pipeline Hazards.
Parallel Processors: Introduction to Parallel Processors, Concurrent access to memory and cache coherency.

Unit-IV

Input-output Organization: I/O device interface, I/O Interface Standards - PCI, USB; 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.

Suggested Readings:

1. Computer System Architecture, M. Morris Mano, Pearson.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy, Elsevier.
3. Computer Organization and Embedded Systems, Carl Hamacher, McGraw Hill Higher Education.
4. Computer Architecture and Organization, John P. Hayes, McGraw Hill Education.
5. Computer Organization and Architecture: Designing for Performance, William Stallings, Pearson Education.

Useful Video links

Unit No.	Topics	Links
Unit-I	Data Representation	https://youtu.be/Vc2KqHQKDNs
	Binary Codes	https://youtu.be/Y5yprWIPDps
	Shift Microoperations	https://youtu.be/U5aCveZ8VzE
Unit-II	Instruction Cycle	https://youtu.be/L2SLS9FgTx0
	Control Signals and Timing Sequence	https://youtu.be/LNLjGgsDjBk
	Hardwired controlled Control Unit	https://youtu.be/b5thcNYBrQc
Unit-III	Pipelining Introduction	https://youtu.be/3p8kZpT56lQ
	Pipeline Hazards	https://youtu.be/l7auULi7zls?list=PLbMVogVj5nJQmNqgs7GLBE-HhMi0GQOPW
	Cache coherence and memory consistency	https://youtu.be/QfZa8gKzFJA
Unit-IV	DMA Transfer	https://youtu.be/CSkN0wj0zZU
	Memory Hierarchy	https://youtu.be/X-XwOXdUPU4
	Cache Memory	https://youtu.be/XZF4khqXmNI

Course Code	**PCC-CSE-206G**					
Category	Professional Core Courses					
Course Title	**Object Oriented Programming**					
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**	
	3	0	0	**3**		
Course Objectives	The objectives of this course are ● To understand OOP principles and distinguish them from procedural programming. ● To implement C++ classes using key features like constructors, access specifiers, and class types. ● To apply inheritance, manage memory, and use composition in class design. ● To utilize polymorphism, operator overloading, and type conversion for flexible program design.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total Marks	100					
Duration of Exam	03 Hours					

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Recall the fundamentals of object oriented programming.	Level 1: Remember
CO2	Understand the basic concept of object oriented programming.	Level 2: Understand
CO3	Apply the concepts of object oriented programming like C++ and associated library to develop object oriented programs	Level 3: Apply
CO4	Analyze object-oriented programming principles to design efficient and scalable C++ applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

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 inheritance, 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, pointers to objects, array of objects, pointers to object members, memory allocation (static and dynamic), dynamic memory management using new and delete operators, 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 classes, virtual destructors.

Unit-IV

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, re-throwing an exception, specifying exceptions.
Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples. Introduction to STL, Inheritance of class template, class template containership, class template with overloaded operators.

Suggested Readings:

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

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to Object-Oriented Programming.	https://youtu.be/K3g4srbkUNM?feature=shared
	Classes and Objects in C++	https://youtu.be/Fvb0dPTm3fk?feature=shared
	Introduction to Paradigms of OOP	https://youtu.be/d62teoIJtOw?feature=shared
Unit-II	Inheritance - Single Inheritance	https://youtu.be/gzCOAmbR9cc?feature=shared
	Multilevel Inheritance	https://youtu.be/PaqAhlb5XVw?feature=shared
	Polymorphism	https://youtu.be/piK6my-0frA?feature=shared
Unit-III	Constructors in C++	https://youtu.be/ItkQswAvOLI?feature=shared
	Access Specifiers in C++	https://youtu.be/xKtO4yipsIY?feature=shared
	Overloading-Operator and Constructor	https://youtu.be/WUiKCKc-3v0?feature=shared
Unit-IV	Exception Handling in C++	https://youtu.be/nGFzkmUvO_I?feature=shared
	Template Class in C++	https://youtu.be/jNmyE17nRYo?feature=shared

Course Code	**PCC-CSE-208A**				
Category	Professional Core Courses				
Course Title	**Database Management System**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce basic concepts, architecture, and characteristics of database systems. • To understand relational algebra and SQL for querying and manipulating relational data. • To understand storage strategies, indexing methods, and transaction processing mechanisms. • To explore database security models and advanced database systems like distributed and object-oriented databases.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Define the DDL, DML commands, Database servers, storage strategies, security methods and components of the database.	Level 1: Remember
CO2	Understand the fundamental concepts of DBMS such as Query languages, transaction processing, type of databases etc.	Level 2: Understand
CO3	Apply the knowledge of DBMS to solve real life situations/problems & architecture.	Level 3: Apply
CO4	Analyze the characteristics of normal forms, concurrency control schemes, various data models and their architecture schemes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

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, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. 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

Storage strategies: Indices, B-trees, hashing, Single level indexes, Multi-level indexes.
Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

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.

Suggested Readings:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledgebase 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

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to DBMS	https://www.youtube.com/watch?v=rbwXdTsCk2c&list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy-U3M&index=1&pp=iAQB
	Conceptual Modelling(E-R Model)	https://www.youtube.com/watch?v=ftDZ_44jhQo&list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy-U3M&index=3&pp=iAQB
Unit-II	SQL Query-I	https://youtu.be/k-KHHN7nDI8?list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy-U3M
	SQL Query-II	https://www.youtube.com/watch?v=cGQaaVlbcCQ&list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy-U3M&index=11&pp=iAQB
	Integrity Constraint	https://youtu.be/8lRc-Pt_krk?list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy-U3M
	Functional Dependency	https://www.youtube.com/watch?v=wQB_6o1UQa0&list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy-U3M&index=15&pp=iAQB
Unit-III	Storage and file structure	https://youtu.be/1IWtpmIniHQ?list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
	Indexing and Hashing	https://www.youtube.com/watch?v=PYsA4xTL3e4&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh&index=26&pp=iAQB
	Concurrency Control	https://www.youtube.com/watch?v=L0m4k1ApZtA&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh&index=35&pp=iAQB
Unit-IV	DAC - MAC and RBAC security models	https://www.youtube.com/watch?v=n8anyniHbvI
	Introduction to Data Warehousing and OLAP	https://youtu.be/m-aKj5ovDfg?list=PL9426FE14B809CC41

Course Code	**PCC-CSE-209A**				
Category	Professional Core Courses				
Course Title	**Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce Python programming basics, including syntax, data types, and control structures. ● To develop skills in Python data structures, functions, and recursion. ● To explore Python's graphical programming, image processing, and GUI development. ● To explain object-oriented programming, exception handling, and multithreading concepts.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Recall fundamental Python programming concepts including syntax, data types, control structures, functions, object-oriented principles, and multithreading.	Level 1: Remember
CO2	Explain the use of Python data structures, file operations, graphical libraries, and GUI components for developing structured programs.	Level 2: Understand
CO3	Solve real life problem by developing Python programs using logic, functions, graphics, OOP, and multithreading.	Level 3: Apply
CO4	Analyze programming constructs and design techniques for efficient Python applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems.
Problem solving by search: Uninformed Search: Depth First Search (DFS), Breadth First Search(BFS). Informed Search: Best First Search, A*. Local Search: Hill Climbing. Problem Reduction Search: AO*. Population Based Search: Ant Colony Optimization, Genetic Algorithm. Game Playing: MinMax Algorithm, Alpha-Beta Pruning.

Unit-II

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames, Knowledge representation issues, Rule based systems.

Unit-III

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.

Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

Unit-IV

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, Current trends in Artificial Intelligence.

Suggested Readings:

1. Artificial Intelligence: A Modern Approach, Third Edition by Stuart Russell and Peter Norvig, 2010, Pearson Education.
2. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009.
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010.
4. Artificial intelligence, Patrick Henry Winston, 1992, Addition Wesley.

Useful Video links

Unit No.	Topics	Links
Unit-I	Introduction to AI	https://youtu.be/iF1tOCEXLXY
	DFS, BFS	https://youtu.be/TMLyKcBtHuo
	Hill Climbing	https://youtu.be/ZOvRZ7UJMjk
	A* Algorithm	https://youtu.be/yMcZvZayJUA
Unit-II	Propositional Logic	https://youtu.be/5fZ_RnhvGMQ
	Semantic Nets	https://youtu.be/RTmafl2rzEw
	Rule based System	https://youtu.be/6kRYg1QVcWo
Unit-III	Bayesian Reasoning	https://youtu.be/cMN6ykIYF_U
	Probability Theory	https://nptel.ac.in/courses/117105085
	Partial-order Planning	https://www.youtube.com/watch?v=kyCibTQQQBE
Unit-IV	Introduction to Neural Networks	https://www.youtube.com/watch?v=QlhHqMnd9Wo
	Expert Systems	https://www.youtube.com/watch?v=nE5c5w4aizU

Course Code	**HSMC-02A**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Economics for Engineers**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III/IV**
	3	0	0	3	
Course Objectives	The objectives of this course are to • Introduce the basic concepts of economics and their relevance to science, engineering, and national development. • Develop a foundational understanding of microeconomic principles such as demand, supply, production, cost, and market structures. • Equip students with tools to apply economic reasoning to real-world pricing, output, and market decisions. • Familiarize students with macroeconomic elements like the Indian economy, banking system, privatization, and globalization.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Describe economic concepts, the connection between economics with engineering and technological development, along with economic laws relevant to resource based decision making in society.	Level 1: Remember
CO2	Explain economic growth theories and illustrate the role of engineering and technology in supporting economic development.	Level 2: Understand
CO3	Apply theories of consumption and production to the design and development of engineering products.	Level 3: Apply
CO4	Analyze market conditions, evaluate cost structures and financial aspects to assess the feasibility of engineering projects.	Level 4: Analyse

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

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 affecting the Elasticity of Demand, Practical Application and Importance.

Unit-II

Production: Meaning of Production and Factors of production, Law of Variable Proportions, Returns to Scale, Internal and External Economies and Diseconomies of Scale, Various concepts of Cost of Production- Fixed Cost, Variable Cost, Money Cost, Real Cost, 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 and 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 underdeveloped, developing and mixed economy (brief and elementary introduction).
Privatization: Meaning, Merits and Demerits.
Globalization of the Indian Economy: Merits and Demerits
Banking: Concept of a Bank, Commercial Bank, Central Bank, Functions of a Bank, Difference between Commercial and Central Bank.

Suggested Readings:

1. Modern Microeconomics: Theory and Applications by H.L. Ahuja, S. Chand & Company Pvt. Ltd.
2. Indian Economy by S.K. Misra & V.K. Puri, Himalaya Publishing House
3. Indian Economy : Principles and Policies by Srirangam, SriRam, ; Rohit Deo, Pearson Education
4. Managerial Economics by R. Cauvery et al., S. Chand & Company Pvt. Ltd.
5. Microeconomic Theory by Andreu; Whinston, Michael D; Green, Jerry R, Oxford University Press.
6. Principles of Economics by Case, Karl E; Fair, Ray C ; Oster, Sharon E, Pearson Education

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Fundamental concepts of microeconomics, including definitions, types, and the nature of economic problems.	https://www.youtube.com/watch?v=IFtOcNbej0o&list=PLFNFJbo2hfBGRTCMuroZGykNzacwmAH2L
Unit-II	Production and Cost of production	https://www.youtube.com/watch?v=VU1zySe-8NA
Unit-III	Theory of Markets	https://www.youtube.com/watch?v=HylqSa58lqQ
Unit-IV	Nature and characteristics of the Indian economy, highlighting aspects of underdevelopment and development.	https://www.youtube.com/watch?v=ME-0GOhhZcs&list=PLFW6lRTa1g83winAoIK92HL4xTytJaW7S

Course Code	**LC-CSE-212G**					
Category	Professional Core Courses					
Course Title	**Object Oriented Programming Lab Using C++**					
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**	
	0	0	2	**1**		
Course Objectives	The objectives of this course are ● To enable students to develop C++ programs using classes, member functions, and constructors to apply object-oriented principles to real-world problems. ● To implement static members, constant members, and various constructors in C++ for designing efficient and robust class structures. ● To apply operator overloading, inheritance, polymorphism, and exception handling techniques for building maintainable and flexible C++ applications. ● To create and utilize templates and manage dynamic memory allocation and deallocation in C++ for efficient program development.					
Assessment	25 Marks					
End Semester Practical Examination	25 Marks					
Total Marks	50					
Duration of Exam	03 Hours					

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Understand object-oriented concepts for programming in C++.	Level 2: Understand
CO2	Implement classes, member functions, and constructors in C++ to solve real-world problems using object-oriented principles.	Level 3: Apply
CO3	Demonstrate the use of operator overloading, inheritance, polymorphism, and exception handling in C++ to create robust and maintainable code.	Level 3: Apply
CO4	Analyze advanced OOP features in C++ programming language for better programs.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study Object Oriented Programming Concepts in C++.	CO1
2	Write a program that uses a class where the member functions are defined inside a class.	CO1
3	Write a program that uses a class where the member functions are defined outside a class.	CO1
4	Write a program to demonstrate the use of static data members.	CO1
5	Write a program to demonstrate the use of const data members.	CO1

6	Write a program to demonstrate the use of zero argument and parameterized constructors.	CO2
7	Write a program to demonstrate the use of dynamic constructor	CO4
8	Write a program to demonstrate the use of explicit constructors.	CO2
9	Write a program to demonstrate the use of initializer list.	CO2
10	Write a program to demonstrate the overloading of increment and decrement operators.	CO2
11	Write a program to demonstrate the overloading of binary arithmetic operators.	CO2
12	Write a program to demonstrate the overloading of memory management operators.	CO4
13	Write a program to demonstrate the multilevel inheritance.	CO3
14	Write a program to demonstrate the virtual derivation of a class.	CO3
15	Write a program to demonstrate the runtime polymorphism.	CO4
16	Write a program to demonstrate the exception handling.	CO4
17	Write a program to demonstrate the use of function templates.	CO4
18	Write a program to demonstrate the use of class templates.	CO4
19	Write a program to find the mean of two numbers of different classes using the Friend function.	CO3
20	Write a program to swap two numbers of the same class using the Friend function.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a program that uses a class where the member functions are defined inside a class.	https://www.youtube.com/watch?v=c9vSNQtQVaA&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=3
Write a program to demonstrate the use of zero argument and parameterized constructors	https://www.youtube.com/watch?v=gL7GBhvbvIo&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=7
Write a program to demonstrate the use of const data members	https://www.youtube.com/watch?v=8HQHZVLbVUg&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=17
Write a program to demonstrate the overloading of increment and decrement operators.	https://www.youtube.com/watch?v=Lvl6xi0JAkA&list=PLduM7bkxBdOekXfkEqIBAivzG99V2LrAS&index=24

Course Code	**LC-CSE-213G**				
Category	Professional Core Courses				
Course Title	**Database Management System Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	**1**	
Course Objectives	The objectives of this course are ● To introduce basic concepts, architecture and characteristics of database system ● To introduce relational model concepts and PL/SQL programming ● To introduce relational database design and Normal forms based on functional dependencies.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Explain the basics of SQL, PL/SQL Block and Procedures.	Level 2: Understand
CO2	Write the SQL Queries, PL/SQL Block to satisfy some conditions and exception.	Level 3: Apply
CO3	Apply the concepts of relationships in relational databases.	Level 3: Apply
CO4	Analyze the use of views, sequences, indexes, constraints, and relationships to ensure data integrity and performance.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study the basic features, syntax and components of SQL.	CO1
2	Create a database and write SQL queries to retrieve information from the database.	CO2
3	Perform Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	CO2
4	Use Aggregate Functions- COUNT, SUM, AVG, MIN, MAX with GROUP BY and HAVING Clause.	CO2
5	Create Views, Synonyms, Sequence, Indexes, Save point.	CO4
6	Create an Employee database to set various constraints.	CO4
7	Create relationships between the databases.	CO4
8	Study the PL/SQL blocks.	CO1

9	Write a PL/SQL block to satisfy some conditions by accepting input from the user.	CO3
10	Write a PL/SQL block that handles all types of exceptions.	CO3
11	Create Procedures.	CO3
12	Create and implement database triggers and functions.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab links

Experiment Name	**Link**
Using Aggregate Functions-COUNT, SUM, AVG, MIN, MAX with GROUP BY and HAVING Clause	https://youtu.be/muwEdPsx534?si=6Ys2whV9ekMGng93
Creation of Views, Synonyms, Sequence, Indexes, Save point.	https://www.youtube.com/watch?v=tdRihGrzOg4
PL/SQL block code that handles all types of exceptions.	https://www.youtube.com/watch?v=0fzTqyk3dmQ
Creation of database triggers and functions	https://www.youtube.com/watch?v=hTRr-tVVfZ4

Course code	**LC-CSE-217A**				
Category	Lab Course				
Course title	**Artificial Intelligence Lab using Python**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To introduce the foundational concepts of Artificial Intelligence and familiarize students with classical AI techniques for problem solving. ● To equip students with the ability to model real-world problems using AI representations such as state-space, search trees, and logic-based systems. ● To provide hands-on experience in implementing AI algorithms using Python for solving puzzles, games, and optimization problems.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Understand the fundamental concepts and working principles of classical AI search algorithms such as BFS, DFS.	Level2: Understand
CO2	Apply search algorithms to solve standard AI problems such as Tic-Tac-Toe, and Water Jug problem using Python.	Level 3: Apply
CO3	Implement heuristic-based and problem-specific algorithms like A and AO* for solving real-world path finding and decision problems.	Level 3: Apply
CO4	Analyze various AI techniques in context to their suitability for solving complex problems such as Monkey-Banana, Missionaries-Cannibals, and 8-Queens.	Level 4: Analyze

List of Experiments

Sr. No.	Content	COs
1	Study and explain the logic and flow of BFS and DFS search algorithms.	CO1
2	Write a Program to implement Breadth First Search using Python.	CO1, CO2
3	Write a Program to implement Depth First Search using Python.	CO1, CO2
4	Write a Program to implement A* algorithm using Python.	CO3
5	Write a Program to implement AO* algorithm using Python.	CO3
6	Write a Program to implement Tic-Tac-Toe game using Python.	CO2
7	Write a Program to implement 8-Puzzle problem using Python.	CO3

8	Write a Program to implement Water-Jug problem using Python.	CO2
9	Write a Program to implement Travelling Salesman Problem using Python.	CO3
10	Write a Program to implement Tower of Hanoi using Python.	CO2
11	Write a Program to implement Monkey Banana Problem using Python.	CO4
12	Write a Program to implement Missionaries-Cannibals Problems using Python.	CO4
13	Write a Program to implement 8-Queens Problem using Python.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Course Code	**PEC-CSE-218A**				
Category	Professional Elective Courses				
Course Title	**Cloud Computing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamental concepts, characteristics, and service models of cloud computing including SaaS, PaaS, and IaaS. ● To explain key cloud technologies such as virtualization, web services (SOAP and REST), and cloud platforms like Amazon EC2, Google App Engine, and Microsoft Azure. ● To develop skills in managing cloud data systems including distributed file systems, databases, and parallel processing models like Map Reduce. ● To analyze cloud security principles, quality of service (QoS) issues, and intercloud challenges, preparing students to design secure and efficient cloud solutions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, characteristics, and service models of cloud computing, including key technologies such as virtualization, cloud platforms, and security principles.	Level 1: Remember
CO2	Explain the concepts, architecture and components of cloud computing environments, and interpret the role of virtualization and web services in cloud technologies.	Level 2: Understand
CO3	Apply cloud computing concepts, technologies and tools, to deploy and manage cloud-based applications and services effectively.	Level 3: Apply
CO4	Analyze cloud computing principles, concepts, challenges in data management, virtualization, security, QoS, and intercloud to optimize cloud performance and reliability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure.

Unit-II

Introduction to Cloud Technologies, Study of Hypervisors, SOAP, REST, Comparison of SOAP and REST, Web services, mashups-Web services, Mashups: user interface services, Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores.

Unit-III

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo, Map-Reduce and extensions: Parallel computing, The map-Reduce model. MICEF Computing (Mist, IOT, Cloud, Edge and FOG Computing): Concept and Application.

Unit-IV

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture, Issues in cloud computing, Issues in Intercloud environments, QoS Issues in Cloud, Streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment, Inter Cloud issues, load balancing, resource optimization.

Suggested Readings:

1. Cloud Computing Bible by Sosinsky Barrie, Wiley India, 2011.
2. Cloud computing: Principles and paradigms by Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds., Vol. 87, John Wiley & Sons, 2010.
3. Cloud Computing Black Book by Jayaswal, Kailash, John Wiley & Sons, 2014.
4. Cloud Computing: A Practical Approach by Velte, Anthony T., Toby J. Velte, and Robert Elsenpeter, McGraw-Hill, Inc. 2019.
5. Cloud Computing : A Complete Guide by Gerardus Blokdyk, Starcooks, 2019.

Useful Video links

Unit No.	Topics	Links
Unit-I	Cloud Computing	https://youtu.be/NzZXz3fJf6o?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
	SAAS, PAAS, IAAS	https://youtu.be/lOh2x-UACaU?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
Unit-II	Cloud Computing Web Services	https://youtu.be/GtJGB1WxRW8?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
Unit-III	Cloud file system, GFS	https://youtu.be/Dr6MSqRFaZQ?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
	Map reduce	https://youtu.be/XWNEhv-b2PM?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
Unit-IV	Cloud Security	https://youtu.be/LcAPj95KeSA?list=PL-FqPEn1dZJDg-6LHNYnappA6DcXz3ieZ

Course Code	**PEC-CSE-220A**				
Category	Professional Elective Courses				
Course Title	**Nature Inspired Computing Techniques**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamental concepts and biological motivations behind nature-inspired computing. ● To explore various algorithms derived from evolutionary, swarm-based, immune, and DNA models. ● To develop the ability to apply nature-inspired techniques to solve real-world computational problems. ● To cultivate analytical skills for evaluating the behavior and effectiveness of bio-inspired algorithms.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define key concepts and terminology of nature-inspired computing techniques.	Level 1: Remember
CO2	Explain the working principles of biologically inspired algorithms and models.	Level 2: Understand
CO3	Apply nature-inspired algorithms to computational and optimization problems.	Level 3: Apply
CO4	Analyze the performance and behavior of nature-inspired approaches in varied scenarios.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction, Overview of Philosophy, Nature to Nature Computing, A Brief Overview of Three Branches, Individuals, Entities and agents, Parallelism and Distributivity Interactivity, Adaptation- Feedback, SelfOrganization, Complexity, Emergence, Bottom-up Vs Top-Down Approach, Determination, Chaos and Fractals.

Unit-II

Evolutionary Computing, Hill Climbing, Simulated Annealing, Simulated Annealing, Genetics Principles, Standard Evolutionary Algorithm, Genetic Algorithms, Reproduction, Crossover Mutation, Evolutionary Programming, Genetic Programming.

Unit-III

Swarm Intelligence – Introduction, Ant Colony Optimization, Ant Foraging Behavior, Ant Colony Optimization, SACO algorithm, Ant Colony Algorithm (ACA), Scope of ACO algorithms, Swarm Robotics, Social Adaptation of Knowledge, Particle Swarm Optimization. Immune System-Introduction to Immune System, Physiology and main components, Pattern Recognition and Binding, Immune Network Theory, Danger Theory, Immune Algorithms, Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.

Unit-IV

DNA Computing, DNA Molecule, Adleman's experiment, PAM Model, Splicing Systems, From Classical to DNA Computing, Universal DNA Computers, Scope of DNA Computing, Lipton's Solution to SAT Problem, Recent Trends and real world applications.

Suggested Readings:

1. Fundamentals of Natural Computing, Basic Concepts, Algorithms And Applications by Leandro Nunesde Castro, Chapman &Hall/CRC, Taylorand Francis Group,2007.
2. Bio- Inspired Artificial Intelligence: Theories, Methods and Technologies by FloreanoD.and MattiussiC., MIT Press, Cambridge,2008.
3. Handbook of Nature-Inspired and Innovative Computing by AlbertY.Zomaya,Springer,2006.
4. Ant Colony Optimization by Marco Dorrigo, Thomas Stutzle, PHI,2005.

Useful Video links

Unit No.	Topics	Links
Unit-I	Nature to Nature Computing	https://youtu.be/LBGninIdu1k?feature=shared
	Chaos and Fractals	https://www.youtube.com/watch?v=INXuVxhJfc4
Unit-II	Hill Climbing	https://youtu.be/ZOvRZ7UJMjk
	Simulated Annealing	https://youtu.be/TC9WNwM2noM
	Genetic algorithms	https://www.youtube.com/watch?v=WueuYdDqUt0
	Evolutionary Programming	https://www.youtube.com/watch?v=Yma8Y-W0SYE
Unit-III	Ant Colony Optimization	https://www.youtube.com/watch?v=u7bQomllcJw
	Particle Swarm Optimization.	https://www.youtube.com/watch?v=HmDjfL3R39M
	Immune Network Theory	https://www.youtube.com/watch?v=b5LojEVC97M
	The Danger Theory	https://www.youtube.com/watch?v=urd4uWJ2rH4
Unit-IV	DNA Computing	https://www.youtube.com/watch?v=vefBhhjodpE
	Adleman's experiment	https://www.youtube.com/watch?v=C_f7ky0mBsk
	PAM Model	https://www.youtube.com/watch?v=c0751ITCi5g
	DNA Computing	https://www.youtube.com/watch?v=vefBhhjodpE

Course Code	**PEC-CSE-222A**				
Category	Professional Elective Courses				
Course Title	**Human Computer Interaction**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To understand the basics and significance of HCI and user interface design. • To understand the screen design process based on human factors. • To understand various interface components and emerging interaction technologies. • To understand usability principles, design rules, and evaluation methods in HCI				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Recall the basic concepts, definitions, and scope of Human-Computer Interaction, user interfaces, and the history of graphical user interfaces.	Level 1: Remember
CO2	Explain the importance of human characteristics, interaction speeds, and screen design principles in the context of effective user interface development.	Level 2: Understand
CO3	Apply standard design rules, usability principles, and interface patterns to create user-friendly screen layouts and interactive interfaces.	Level 3: Apply
CO4	Analyze various evaluation techniques, including expert analysis and user participation, to assess and improve the usability of human-computer interfaces.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition and scope of HCI, Importance and applications of HCI, Importance of user Interface – definition, importance of good design, Benefits of good design, A brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Unit-II

Design process: Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions. Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information

simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Unit-III

Windows: New and Navigation schemes selection of window, selection of devices based and screen-based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colours,Voice-based interaction (Alexa, Siri, and Google Assistant), Augmented Reality (AR) and Virtual Reality (VR) interfaces.

Unit-IV

HCI in the software process: the software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction.

Suggested Readings

1. The essential guide to user interface design by Wilbert O Galitz, Wiley Dream Tech.
2. Human – Computer Interaction by Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson Education
3. Designing the user interface by Ben Shneidermann, 3rd Edition, Pearson Education Asia.
4. Interaction Design Prece by Rogers, Sharps, Wiley Dreamtech.
5. User Interface Design by Soren Lauesen, Pearson Education.

Unit No.	Topics	Links
Unit-I	Definition and scope of HCI	https://www.youtube.com/watch?v=sAShrCXzgC8
	Graphical User Interface	https://youtu.be/aaGPJzO9FIk?feature=shared
Unit-II	Design process-Human interaction with computers	https://youtu.be/uFYuHHglC6U?feature=shared
	Screen Designing	https://www.youtube.com/watch?v=lpIBwp7txhY
Unit-III	Multimedia	https://www.youtube.com/watch?v=fAJzLuce_ms&t=106s
	Virtual Reality (VR) interfaces	https://youtu.be/aNC5YMUTcQ4?feature=shared
Unit-IV	Software life cycle	https://www.youtube.com/watch?v=c1QR6EapK4k
	Evaluation techniques	https://www.youtube.com/watch?v=PMr3wWfAH0c

Course Code	**PEC-CSE-224A**				
Category	Professional Elective Courses				
Course Title	**Cyber Security**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To understand the key cyber security terms and common attack types. ● To understand the CIA triad, non-repudiation, and incident response phases. ● To configure basic firewalls and IDS/IPS tools in a lab setup. ● To analyze attack scenarios via the Cyber Kill Chain and propose mitigations				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skill Demonstrated	RBT Level
CO1	Define and recall fundamental cyber security concepts, key terms, and common threat types.	Level 1: Remember
CO2	Explain the roles, processes, and frameworks used in risk assessment, incident response, and governance.	Level 2: Understand
CO3	Apply and configure basic security controls using firewalls and IDS/IPS tools.	Level 3: Apply
CO4	Analyze real-world attack scenarios to identify vulnerabilities and recommend appropriate countermeasures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Cyber security: Cyber security Definition, Key Terms, Security Threats, Vulnerability Assessments, Roles in Security, Cyber security Today, Critical Thinking in Cyber security.
Overview of actors and their motives: Hacking organizations, Major types of cyber-attacks, Network Security Model, Security services, Security Mechanisms, Threat Examples, Malware and Ransomware, Threat Protection, Internet Security Threats, Security Threat, The Cyber Kill Chain, Social Engineering, Cyber warfare

Unit-II

Overview of key security concepts: CIA Triad, Non - Repudiation - How does it apply to CIA? Access Management, Key Concepts – Incident Response, Incident Response Process, Introduction to Frameworks and Best Practices, IT Governance Process, Cyber security Compliance and Audit Overview.
Overview of key security tools: Packet Filtering, Firewalls Application Gateway, Firewalls - XML Gateway, Firewalls - Stateless and Stateful, Antivirus/Antimalware

Unit-III

Overview of People, Process and Technologies: IT Security, Frameworks and their purpose, Roles in Security, Introduction to Process, Overview Business Process Management. Overview of Information Technology Infrastructure Library (ITIL), Key ITIL Processes, identification and AAA, Access Control Methods, Access Control - Physical and Logical, Open Web Application Security Project (OWASP)

Unit-IV

Intrusion Detection and Prevention: Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.
Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

Suggested Readings:

1. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Cyber Security Essentials 1/e, Sybex Wiley, 2019.
2. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.
3. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015.

Useful Video links

Unit No.	Topics	Links
Unit-I	Major types of cyber-attacks	https://www.youtube.com/watch?v=Dk-ZqQ-bfy4&t=102s
	Cyber security	https://youtu.be/WAImfXGwhOs?feature=shared
Unit-II	Firewalls - Stateless and Stateful	https://www.youtube.com/watch?v=nh4C7u3xGGY
	Incident Response Process Cyber Security	https://www.youtube.com/watch?v=LMs7wmQQ8as
Unit-III	Information Technology Infrastructure Library	https://youtu.be/8jyD53vtp0I?feature=shared
	Open Web Application Security Project	https://www.youtube.com/watch?v=QZrPxPNMer8
Unit-IV	Need for Firewalls	https://youtu.be/F5KwJEVGIxg?feature=shared
	Network -Based Intrusion Detection	https://www.youtube.com/watch?v=Azjy4JVadKI