Sister Nivedita University

DG 1/2 New Town, Kolkata – 700156 www.snuniv.ac.in

School of Engineering Department of Computer Science & Engineering

SYLLABUS

FOR

Department of Computer Science & Engineering Bachelor of Computer Application (BCA)

Regulations (R24) [NEP]





R24–25 Academic Session



Credit Definition

Туре	Duration (in Hour)	Credit
Lecture (L)	1	1
Tutorial (T)	1	1
Practical (P)	2	1
Sessional (S)	2	1

Total Credit Distribution

Comestan					Cr	edits					Cuedita/Semester
Semester	MC	ME	Project	NM	NV	MDC	AEC	SEC	VAC	INT	Creans/Semester
1	9	0	0	4	2	3	2	0	2	0	22
2	9	0	0	4	1	3	2	3	2	0	24
3	13	0	0	4	4	3	2	0	0	0	26
4	14	0	0	4	1	0	2	3	0	0	24
5	13	0	0	4	1	0	0	3	0	0	21
6	9	3	0	4	1	0	0	0	2	0	19
7	3	3	4	4	0	0	0	0	0	2	16
8	0	0	8	4	0	0	0	0	0	0	12
Credits/Course	70	6	12	32	10	9	8	9	6	2	164

Category Definition

Definition of Category/Type	Abbreviation
Major Compulsory	MC
Major Elective	ME
Non-Major Specific Subject Course	NM
Non-major Vocational Education and Training	NV
Multidisciplinary Courses	MDC
Ability Enhancement Courses	AEC
Skill Enhancement Courses	SEC
Value Added Courses	VAC
Internship	INT



Program Outcomes (POs)

PO1: Apply Knowledge of Computing: Graduates will be able to apply the knowledge of mathematics, science, and computing to solve complex computing problems and meet the specific needs of organizations and society.

PO2: Problem Analysis: Graduates will have the ability to identify, formulate, research literature, and analyze complex computing problems reaching substantiated conclusions using fundamental principles of mathematics and computer science.

PO3: Design and Development of Solutions: Graduates will be skilled in designing and developing solutions for complex computing problems, designing system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Conduct Investigations: Graduates will use research-based knowledge and research methods, including design of experiments, analysis, and interpretation of data, and synthesis of information to provide valid conclusions.

PO5: Modern Tool Usage: Graduates will be proficient in selecting, using, and applying appropriate techniques, resources, and modern computing tools to complex computing activities, understanding the limitations.

PO6: Professional Ethics: Graduates will understand and commit to professional ethics and responsibilities, and norms of computing practice.

PO7: Individual and Team Work: Graduates will be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO8: Communication: Graduates will communicate effectively on complex computing activities with the computing community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO9: Computing and Society: Graduates will understand the impact of professional computing solutions in societal and environmental contexts, and demonstrate knowledge of, and need for sustainable development.

PO10: Life-long Learning: Graduates will recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO11: Project Management and Finance: Graduates will demonstrate knowledge and understanding of computing and management principles and apply these to their own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Innovation and Entrepreneurship: Graduates will be capable of identifying opportunities and innovating new solutions in the field of computing, and will possess an entrepreneurial mindset to pursue new business ventures or contribute to the innovation goals of an organization.



FIRST YEAR

SEMESTER-I

Sl No	Course Title	Code	Category	Credit		Ту	pe	
					L	Т	P	S
1	Introduction to C Programming		MC	4	3	1	0	0
2	Digital Electronics		MC	4	3	1	0	0
3	Mathematics I		MDC	3	2	1	0	0
4	NM Elective I: E-Commerce		NM	4	3	1	0	0
5	Soft Skill Development I		NV	1	1	0	0	0
6	EAA I (Yoga/Sports/NCC/NSS)		NV	1	0	0	2	0
7	Communicative English I		AEC	2	2	0	0	0
8	Environmental Science I		VAC	2	2	0	0	0
	Pra	octical						
9	Introduction to C Programming Lab		MC	1	0	0	2	0
	Total Credit=22							

SEMESTER-II

Sl No	Course Title	Code	Category	Credit		Ту	pe	
					L	Т	P	S
1	Computer Organization and Architecture		MC	4	3	1	0	0
2	Data Structures		MC	4	3	1	0	0
3	Mathematics II		MDC	3	2	1	0	0
4	NM Elective II: Principal of Management		NM	4	3	1	0	0
5	Soft Skill Development II		NV	1	1	0	0	0
6	Communicative English II		AEC	2	2	0	0	0
7	SEC1: Introduction to Python		SEC	3	3	0	0	0
8	Environmental Science II		VAC	2	2	0	0	0
Practical								
9	Data Structures Lab		MC	1	0	0	2	0



SECOND YEAR

SEMESTER-III

Sl No	Course Title	Code	Category	Credit		Type			
					L	Т	P	S	
1	Database Management Systems		MC	4	3	1	0	0	
2	Operating Systems		MC	4	3	1	0	0	
3	Object Oriented Programming with		MC	3	2	1	0	0	
	Java								
4	NM Elective III: Business Ethics and		NM	4	3	1	0	0	
	Corporate Governance								
5	Mathematics III		MDC	3	2	1	0	0	
6	Foreign Language I		AEC	2	2	0	0	0	
7	Technical Writing and Presentation		NV	2	0	0	4	0	
8	EAA II (Yoga/Sports/NCC/NSS)		NV	1	0	0	2	0	
9	Soft Skill Development III		NV	1	0	0	2	0	
	Prac	tical							
10	Database Management Systems Lab		MC	1	0	0	2	0	
11	Object Oriented Programming with		MC	1	0	0	2	0	
	Java Lab								
			Total C	redit=26					

SEMESTER-IV

SI No	Course Title	Code	Category	Credit		Ту	pe	
					L	Т	P	S
1	Computer Graphics		MC	4	4	0	0	0
2	Computer Networks		MC	4	3	1	0	0
3	Web Technology		MC	3	2	1	0	0
4	NM Elective IV: Operational Research		NM	4	3	1	0	0
5	Soft Skill Development IV		NV	1	0	0	2	0
6	Foreign Language II		AEC	2	2	0	0	0
7	SEC2: Entrepreneurship		SEC	3	2	1	0	0
	Prac	tical					•	
8	Computer Graphics Lab		MC	2	0	0	4	0
9	Web Technology Lab		MC	1	0	0	2	0
	redit=24			•				



THIRD YEAR

SEMESTER-V

Sl No	Course Title	Code	Category	Credit		Ту	ре	
					L	Т	Р	S
1	Unix and Shell Programming		MC	4	4	0	0	0
2	Cryptography and Network Security		MC	4	3	1	0	0
3	NM Elective V: Organisational Behaviour		NM	4	3	1	0	0
4	PHP with MySQL		MC	3	2	1	0	0
5	Soft Skill Development V		NV	1	0	0	2	0
6	SEC3: Logical Ability		SEC	3	2	1	0	0
	Practi	ical				•		
7	Unix and Shell Programming Lab		MC	1	0	0	2	0
8	PHP with MySQL Lab		MC	1	0	0	2	0
Total Credit=21								

SEMESTER-VI

Sl No	Course Title	Code	Category	Credit		Ту	pe		
					L	Т	Р	S	
1	Fundamental of Data Science		MC	4	3	1	0	0	
2	Software Engineering		MC	4	3	1	0	0	
3	NM Elective VI: Decision Support System		NM	4	3	1	0	0	
4	Cloud Computing/ Cyber Security		ME	3	3	0	0	0	
5	Soft Skill Development VI		NV	1	0	0	2	0	
6	Ethic Study and IPR		VAC	2	2	0	0	0	
	Practical								
7	Software Engineering Lab		MC	1	0	0	2	0	
			Total C	redit=19					



FOURTH YEAR

SEMESTER-VII

Sl No	Course Title	Code	Category	Credit		Туре			
					L	Т	P	S	
1	Data Warehousing and Data Mining		MC	3	3	0	0	0	
2	Advanced Database and PL-SQL		ME	3	3	0	0	0	
3	NM Elective VII: Digital Marketing		NM	4	3	1	0	0	
4	Internship		INT	2	0	0	0	4	
5	Project-I		Project	4	0	0	0	8	
	Total Credit=16								

SEMESTER-VIII

Sl No	Course Title	Code	Category	Credit		Ту	pe	
					L	Т	P	S
1	Non-Major Elective VIII: Human		NM	4	3	1	0	0
	Resource Management							
2	Project-II		Project	8	0	0	0	16
			Total C	redit=12				



FIRST YEAR

SEMESTER-I

Sl No	Course Title	Code	Туре	Credit		Ту	pe	
					L	Т	P	S
1	Introduction to C Programming		MC	4	3	1	0	0
2	Digital Electronics		MC	4	3	1	0	0
3	Mathematics I		MDC	3	2	1	0	0
4	NM Elective I: e-Commerce		NM	4	3	1	0	0
5	Soft Skill Development I		NV	1	1	0	0	0
6	EAA I (Yoga/Sports/NCC/NSS)		NV	1	0	0	2	0
7	Communicative English I		AEC	2	2	0	0	0
8	Environmental Science I		VAC	2	2	0	0	0
	Practical							
9	Introduction to C Programming Lab		MC	1	0	0	2	0
Total Credit=22								



INTRODUCTION TO C PROGRAMMING

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Introduction to C Programming	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 1 st

THEORY

Learning objectives: On completion of the course, student will be able to: Understand basics of Computer fundamentals, concepts of program as sequences and operation of computers. Understand the need of programming languages and problem solving techniques. This course is intended to develop an in-depth understanding of functional and logical concepts of C Programming and to provide exposure to problem-solving through C programming.

Prerequisite: Before learning the concepts of Fundamentals of Computer Science and Introduction to C Programming, you should have a basic knowledge of working of computer, basic understanding of Computer Programming terminologies. A basic understanding of any of the programming languages will help you in understanding the C programming concepts and move fast on the learning track.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to C Programming	10	21%
Module-II: Function and Function Recursion	12	25%
Module-III: Pointers and Arrays	14	30%
Module-IV: String	4	8%
Module-V: Structure	4	8%
Module-VI: File Handling	4	8%

Module I: Introduction to C Programming: [10L]

Basics of programming and algorithm development, Data types, variables, and constants, Instructions, Input/output operations, Program structure.

Operators: Arithmetic (Binary, Unary), Relational, Logical, Assignment, Bitwise, Shift, and Ternary (or Conditional) Operators. Precedence of Operators



Decision Control Structure: if-else, if-else if ladder, Nested if and Switch Statement

Loop Control Structure: for, while, and do-while loop, Nested loops, Infinitive loops, Flow control statements (break, continue keywords).

Module II: Function and Function Recursion: [12L]

Function: Definition, and purpose. Anatomy of a Function: Function Declaration, Definition, and Call; Syntax of Function Declaration, Definition and Call; Examples, Advantages of Using Functions, Types of Functions, Function naming conventions, return values and types, Parameter Passing Techniques: Call by value, Call by reference. Storage classes in functions: Automatic (auto) variables, external (extern) variables, static variables, register variables, Macro.

Recursive Function: Definition and concept of recursion, Base case and recursive case, Simple examples of recursive functions, Advantages and disadvantages of recursion, Recursion vs. iteration, Tail recursion.

Module III: Arrays and Pointers: [14L]

Arrays: Definition, declaration syntax, initialization, accessing elements of 1D, 2D, 3D arrays; Uses of arrays, Advantages and disadvantages of arrays.

Pointers: Basic concept and Definition, declaration and initialization, Pointer operators: * and &; precedence of * and & operator, dereferencing of Pointer. Double pointers, Pointer arithmetic: Incrementing and decrementing pointers. Concept of various Pointers (NULL, Wild, Generic, Dangling). Pointers and arrays: Relationship between pointers and arrays, accessing array elements using pointers. Usages of pointer, Advantages and Disadvantages of pointer.

Module V: Strings: [4L]

Strings: Definition, declaration and initialization, memory representation of strings, reading and writing strings: Using scanf() and printf() functions, gets() and puts() functions, getchar() and putchar() functions; use of sscanf() and sprintf() functions, string handling library functions.

Module V: Structure: [4L]

Structure: Definition, Structure declaration and initialization, Accessing structure members, Array of structures, nested structures, Pointers to structures. concept of Self Referential Structure, Typedef of Structure.

Module VI: File Handling: [4L]

I/O functions, File Pointer, File Operations: Opening & Closing a File, reading from and writing to files using fgetc(), fputc(), fgets(), fputs(), fread(), and fwrite(); Creation of a new file, Reading file contents, Append contents in a file, Copy one file content to another file, Compare two files, Rename & Delete a file.



- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Programming in ANSI C by E. Balagurusamy, McGraw Hill Education, 8th Edition.
- 2) Let Us C by Yashavant P. Kanetkar, BPB Publications, 17th Edition.
- The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, Pearson Education, 2nd Edition.

Reference Books:

- 1) C Programming: A Modern Approach by K. N. King, W. W. Norton & Company, 2nd Edition.
- 2) C: How to Program by Paul Deitel and Harvey Deitel, Pearson, 8th Edition.
- 3) Expert C Programming: Deep C Secrets by Peter van der Linden, Pearson Education, 1st Edition.

PO9

PO10

PO11

PO12

4) The Complete Reference: C by Herbert Schildt, McGraw Hill Education, 4th Edition.

	r							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1					
CO2	3	3	3	1				
CO3	3	3	3	2				
CO4	3	3	3	1				
CO5	3	3	3	2				

2

1.33

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

3

3

CO6

Avg.

Course Learning Outcome: (CO)

3

2.83

3

2.66

CO1: Students will be able to Data types, variables, and constants, Instructions, Operators, Decision Control Structure, Loop Control Structure.

CO2: Able to understand and apply the concepts of arrays and strings.



CO3: Able to define, declare, and implement functions and function recursion in C, understand different parameter passing techniques, and use various storage classes within functions.

CO4: Understand the basic concepts of pointers, including their declarations, initializations, operations, and perform dynamic memory allocation.

CO5: Able to handle structures in C and Typedef of Structure.

CO6: Proficient in performing file operations in C, including opening, closing, reading, writing, appending, and manipulating files.



DIGITAL ELECTRONICS

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Digital Electronics	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 1 st

THEORY

Learning objectives: By the end of this course, students will be able to understand the fundamental concepts of digital electronics, including number systems, logic gates, and Boolean algebra. They will be proficient in designing and analyzing combinational and sequential circuits, such as adders, multiplexers, and flip-flops. Additionally, students will gain practical skills in using digital simulation tools and implementing digital circuits for real-world applications.

Prerequisite: Students should have a basic understanding of high school level mathematics, as these skills are essential for understanding the concepts of logic gates and Boolean algebra. Familiarity with basic electronics principles, including voltage, current, and resistance, is also beneficial. Prior exposure to programming concepts can be helpful but is not mandatory for this course.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Number Systems and Code conversion	8	17%
Module-II: Boolean Algebra	10	21%
Module-III: Logic Gates	4	8%
Module-IV: Combinational Logic	12	25%
Module-V: Sequential Logic	6	12%
Module-VI: Registers & Counters	8	17%

SYLLABUS OUTLINE:

Module I: Number Systems and Code conversion [8L]

Number system: Binary, octal, hexadecimal and decimal Number systems and their inter conversion, Binary addition and subtraction, representation of unsigned binary number, representation of signed binary number using signed magnitude, 1's and 2's complement method.

BCA-R24



Codes: BCD, ASCII, EBCDIC, gray code, excess–3 code; Code Conversion: Binary to BCD and BCD to Binary, Binary to Gray and Gray to Binary, Binary to Excess-3 and Excess-3 to Binary, BCD to Excess-3 and Excess-3 to BCD.

Module II: Boolean Algebra: [10L]

Boolean Algebra: Laws of Boolean algebra, De-Morgan's theorem, Minterm and Maxterm, Sum of product(SOP), Product of Sum (POS), Conversion of POS to SOP form and SOP form to POS form, Boolean Function, K-map Method, Simplification using K-map, De-Morgan's Theorem, Don't Care Condition

Module III: Logic Gates: [4L]

Basic Logic Gates: AND Gate, OR Gate, NOT Gate; Universal Logic Gates: NAND Gate, NOR Gate; Other Logic Gates: Ex-OR (XOR) Gate.

Module IV: Combinational Logic: [12L]

Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder, Binary Adder-Subtractor, Magnitude Comparator, Decoder, Encoder, Multiplexer, De-multiplexer, Encoders

Module V: Sequential Logic: [6L]

Sequential circuits, Latch, Basics of flip flop, SR-flip flop, JK-flip flop, D-flip flop, T-flip flop, Masterslave flip flop.

Module VI: Registers & Counters: [8L]

Register: Basic concept of register, Shift registers: Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out, Parallel In Parallel Out, Bi-directional Shift Register, Universal Shift Register, applications of registers.

Counters: Basic concept of counter, Ripple counter, Ring counter, Johnson counter Synchronous/Asynchronous counter operation, Up/down synchronous counter, applications of counter.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) "Digital Circuits And Design" by S. Salivahanan, S. Arivazhagan, 5th edition.
- 2) "Digital Logic and Computer Design" by Morris and Mano.

Reference Books:



- 1) "Digital Fundamentals" by Thomas L. Floyd
- 2) "Digital Electronics: Principles, Devices and Applications" by Anil K. Maini
- "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, and Gregory L. Moss

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	2
CO2	3	3	2	2	3	-	-	-	-	-	-	2
CO3	3	3	2	2	3	-	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2
CO6	3	3	3	3	3	-	-	-	-	-	3	2
Avg.	3	2.83	2.17	2.17	2.83	-	-	-	-	-	0.5	2

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Students will be familiar with different number systems and their inter-conversion, along with binary arithmetic operations and various coding systems, enabling accurate data representation and manipulation.

CO2: Understand the laws of Boolean algebra, De-Morgan's theorem, and Karnaugh Map (K-map) simplifications, allowing them to simplify and optimize digital circuits effectively.

CO3: Comprehend the operation of basic, universal, and other logic gates and will be able to implement fundamental digital logic functions in practical applications.

CO4: Design and analyze combinational logic circuits such as adders, subtractors, comparators, decoders, encoders, multiplexers, and demultiplexers, enhancing their ability to solve complex digital logic problems.

CO5: Understand sequential circuits and the operation of various flip-flops, allowing them to design and implement reliable memory and timing devices in digital systems.

CO6: Learn the functionality and applications of registers and counters, including different types of shift registers and counters, enabling them to design and implement efficient data storage and counting mechanisms in digital circuits.



MATHEMATICS I

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Mathematics I	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: MDC
CODE: XXXXXX	SEMESTER: 1 st

THEORY

Learning objectives: On completion of the course, student will be able to: apply the knowledge of counting techniques and graph theory to solve complex problems.

Prerequisite: Before learning the concepts of Discrete Mathematics, you should have a basic knowledge of set, relation, mapping, matrix etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Algebraic Structures	12	25%
Module-II: Theory of Equations	4	8%
Module-III: Propositional Calculus	4	8%
Module-IV: Counting Techniques	8	17%
Module-V: Basics of Graph Theory	8	17%
Module-VI: Tree	12	25%

SYLLABUS OUTLINE:

Module I: Algebraic Structures: [12L]

Sets, algebra of sets and their applications, Relations, Mapping, Groups, Abelian groups, Subgroups, Cyclic groups, Permutation group.

Module II: Theory of Equations: [4L]

Polynomials, Division algorithm, Fundamental theorem of classical algebra (statement only), Descart's rule of sign, Relation between roots and coefficients

Module III: Propositional Calculus: [4L]

Proposition, propositional variables, combination of propositions, Conjunction, Disjunction, Negation and



their truth table, derived connectors. Logical Equivalence.

Module IV: Counting Techniques: [8L]

Permutations, Combinations, Binomial coefficients, Generating functions, Recurrence Relations and their solutions using generating function.

Module V: Basics of Graph Theory: [8L]

Graphs, Simple and Multi graph, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub graph, Walks, Paths, Circuits, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph, Vertex Degrees and Counting, Degree-sum formula

Module VI: Tree: [12L]

Definition and properties, Binary tree, Spanning tree of a graph, Minimum spanning tree, properties of trees, Graph Traversal algorithms: Depth First Search, Breath First Search, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Discrete Mathematics, Mott, Kandel & Baker, PHI
- 2) Graph Theory, N. Deo, PHI
- 3) Discrete Mathematical Structure, C.L. Liu, TMH
- 4) Discrete Mathematical Structure, Somasundaram, PHI
- 5) Discrete Mathematical Structure, G.S. Rao, New Age International

Reference Books:

- 1) Discrete Mathematics with Applications, Rosen, TMH
- 2) Discrete Mathematical Structure, Dubey, EXCEL BOOKS
- 3) Discrete Mathematics, Iyengar, VIKAS
- 4) Discrete Structures and Graph Theory, Rao, Scitech
- 5) Mathematical Foundations, Vijayarangan, Scitech
- 6) Discrete Structures and Graph Theory, Rathor, EPH.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	2	-	-	-	-	-	-	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-
CO5	3	3	-	3	3	-	-	-	-	-	-	-
CO6	3	3	-	3	3	-	-	-	-	-	2	2
Avg.	3	2.67	0.33	1.33	-	-	-	-	-	-	0.33	1

Highly Correlated: **3** Moderately Correlated: **2**

Slightly Correlated: 1

Course Learning Outcome: (CO)

CO1: Analyze sets, relations, and algebraic structures to understand the foundational principles of groups and their applications in mathematical modeling.

CO2: Apply the fundamental theorem of algebra and Descartes' rule of signs to solve polynomial equations and analyze the relationship between roots and coefficients.

CO3: Construct and evaluate logical expressions and their truth tables, demonstrating logical equivalence and reasoning.

CO4: Utilize combinatorial techniques, such as permutations, combinations, and recurrence relations, to solve counting problems and analyze generating functions.

CO5: Apply concepts of graph theory, such as graph representations, properties, and algorithms, to model and solve problems involving connectivity and graph isomorphism.

CO6: Implement graph traversal algorithms and minimum spanning tree algorithms to solve optimization and traversal problems in graph structures.



E-COMMERCE

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: E-Commerce	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: NM
CODE: XXXXXX	SEMESTER: 1 st

THEORY

Learning objectives:

- 1) Understand the fundamental concepts of E-Commerce, including value chain management, EDI, and analyze its benefits, limitations, and impact on supply chain management.
- 2) Explore various business models in E-Commerce, strategies for success, and the infrastructure required to support online businesses.
- 3) Gain insights into different electronic payment system.
- 4) Analyze the legal and ethical issues related to E-Commerce, focusing on privacy, intellectual property, and the regulatory framework.
- 5) Understand the technical aspects of network infrastructure, including internet services, client-server models, and HTML basics, for developing and maintaining E-Commerce websites.
- 6) Explore digital marketing strategies, website design for E-Commerce, internet marketing, mobile commerce, and other tools essential for branding and advertisement in the online environment.

Prerequisite: Basic knowledge of information technology and the internet, familiarity with web technologies like HTML and browser-based interactions, understanding of business processes and general commerce concepts, basic understanding of computer security and privacy concerns.

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to E-Commerce	8	17%
Module-II: Business Models of E-Commerce	6	12%
Module-III: Electronic Payment System	10	21%
Module-IV: Legal and Ethical Issues in E-Commerce	6	12%
Module-V: Network Infrastructure for E-Commerce	10	21%
Module-VI: Marketing Strategies, Digital Marketing	Q	170/2
and E-Commerce	0	1/%

Course content/ Syllabus table:



SYLLABUS OUTLINE:

Module I: Introduction to E-Commerce: [8L]

E - Business, E-Commerce: Definition, Internet Commerce, Value Chain Management, Electronic Data Interchange [EDI], Importance, Features and benefits of E-Commerce, Limitation of E-Commerce, Supply Chain Management (SCM), Types of SCM.

Module II: Business Models of E-Commerce: [6L]

Types of E-Commerce Business Models, E-Commerce Strategy, Impact and Failure of E-Commerce Strategy, E-Business Infrastructure, Types of Business Model.

Module III: Electronic Payment System : [10L]

Online Payment Systems, Electronic Tokens, Digital Cash, Credit and Debit Cards, Electronic Purse, Electronic Cheques, Third-Party Payment Processing, Standard For Electronic Payment System, Basic Security Issues.

Module IV: Legal and Ethical Issues in E-Commerce : [6L]

Legal and Ethical Policy Issues: Protection of Privacy and Intellectual Property, Strategy Planning for E-Business, Regulatory Framework of E-Commerce, Information Technology Act-2000, Information Technology [Amendment] Act,2008.

Module V: Network Infrastructure for E-Commerce: [10L]

Internet, Browser, Domain Names and Websites, Client-Server Model, Hyper Text Markup Language (html), Simple exercises In html, Basic of Network and connectivity, ISP, www, Internet Services, Internet Software, File Uploading and Accessing, Multimedia Objects Viewing.

Module VI: Marketing Strategies, Digital Marketing and E-Commerce: [8L]

Concept and Designing Website for E-Commerce, Process of setting up Website for E-Commerce, Internet Marketing, Advertisement and Display on Internet, Digital Marketing, E-Branding, Mobile Commerce, Overview of M-Commerce and Applications.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

1) S Joseph - "E-Commerce: An Indian Perspective" - PHI Publications



2) Whiteley, D. (2017). E-Commerce: Strategy, Technology, and Applications. McGraw-Hill Education.

Reference Books:

- U S Pandey and Saurabh Shukla "E-commerce And Mobile Commerce Technologies" S Chand Publication
- 2) Milind Oka "E Commerce" Everest publishing house.
- 3) Laudon, K. C., & Traver, C. G. (2020). E-Commerce 2020: Business, Technology, Society. Pearson.
- 4) Turban, E., King, D., Lee, J. K., & Viehland, D. (2017). Introduction to E-commerce. Springer.
- 5) Turban, E., King, D., & Lang, J. (2018). Electronic Commerce 2018: A Managerial and Social Networks Perspective. Springer.
- 6) Chaffey, D. (2015). Digital Business and E-Commerce Management. Pearson.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	1	1	-	-	1	-	2
CO2	3	3	3	2	3	1	1	-	1	2	1	2
CO3	3	2	3	3	3	1	1	-	-	2	-	2
CO4	2	2	2	2	2	2	2	3	-	2	-	2
CO5	3	3	3	3	3	2	-	-	-	2	2	3
CO6	2	2	2	2	3	1	-	-	-	3	1	2
Avg.	2.67	2.5	2.5	2.17	2.67	1.33	1.17	3	1	2	1.33	2.17

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understand the fundamental concepts and value of E-Commerce and its role in modern supply chain management.

CO2: Analyze various E-Commerce business models and develop strategic frameworks for effective implementation.

CO3: Evaluate electronic payment systems, including security concerns and technological advancements in digital transactions.

CO4: Identify and assess the legal and ethical implications of E-Commerce, focusing on privacy and



intellectual property protection.

CO5: Demonstrate proficiency in basic web development and network infrastructure necessary for successful E-Commerce operations.

CO6: Analyze effective digital marketing strategies, including website design and mobile commerce initiatives, to enhance online presence.



SOFT SKILL DEVELOPMENT I

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Soft Skill Development I	COURSE CREDIT: 01[1-0-0]
DEPARTMENT: Computer Science	CATEGORY: NV
CODE: MVSSU122T01	SEMESTER: 1 st

THEORY

Learning objectives: The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage. The course would enhance student's vocabulary, language and fluency.

Prerequisite: Nil

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Essentials of English Grammar	4	30%
Module-II: Spoken English Communication	4	30%
Module-III: Vocabulary	2	20%
Module-IV: Introduction to Written English	1	10%
Module-V: Prose	1	10%

SYLLABUS OUTLINE:

Module I: Essentials of English Grammar: [4L]

- Tenses
- Article
- Parts of Speech
- Sentence Structure
- Subject Verb Agreement
- Punctuations

Activities: Grammar worksheets, Bingo, Grammar puzzles, Quizzes, Conversations, Role Play

Module II: Spoken English Communication: [4L]



- Introduction to phonetics
- Syllable, Consonant and vowel sounds
- Stress & Intonation
- Pronunciation & accent

Activities: Role Play, Picture description, Story Telling, Information Gap Activities, Audio & Video recordings

Module III: Vocabulary: [2L]

- Use of dictionary
- Diminutives, Homonyms & Homophones
- Synonyms & Antonyms
- Idioms & Phases
- Vocabulary Drills

Activities: Word Association, Vocabulary Cards, Contextual word usage, quizzes

Module IV: Introduction to Written English: [1L]

- Progression of Thought/ideas
- Paragraph Writing
- Essay Writing

Activities: Peer editing, writing prompts, sentence expansion

Module V: Prose: [1L]

- "The Night Train at Deoli" by Ruskin Bond
- "The Postmaster" by Rabindranath Tagore
- "The Prospect of Flowers" by R.K. Narayan
- "The Woman on Platform No. 8" by Ruskin Bond
- "The Dog of Tithwal" by Saadat Hasan Manto

Comprehension Questions will be set in the End-Semester Exam

- Pedagogy for Course Delivery: Workshop, Group Discussions, Presentations, Extempore.
- Continuous Assessment: Quiz/assessment/presentation/problem solving etc.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	-	-	-	2	3	2	3
CO2	-	-	-	-	-	-	-	-	1	3	2	3
CO3	-	-	-	-	-	-	-	-	1	3	1	3
CO4	-	-	-	-	-	-	-	-	1	3	2	3
CO5	-	-	-	-	-	-	-	-	2	3	2	3
CO6	-	-	-	-	-	-	-	-	1	3	2	3
Avg.	-	-	-	-	-	-	-	-	1.33	3	1.83	3

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: To build a strong foundation in essential English language skills, fostering effective communication in diverse situations

CO2: To be learn to apply English language skills in real-world scenarios, improving their proficiency in both academic and professional settings.

CO3: To be able to acquire comprehensive knowledge of grammar, mastering the rules and structures necessary for accurate and effective communication.

CO4: To be able to enhance their listening skills, enabling them to comprehend spoken English in various contexts.

CO5: To expand vocabulary, learning new words and phrases to express more precisely and eloquently

CO6: To be able to write clearly and persuasively, as well as to read and analyse texts critically.



COMMUNICATIVE ENGLISH I

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Communicative English I	COURSE CREDIT: 02[2-0-0]
DEPARTMENT: Computer Science	CATEGORY: AEC
CODE: XXXXXXX	SEMESTER: 1 st

THEORY

Learning objectives:

- 1) To know about Fundamentals of Communicative English and Communication Skills in general. To train to identify the nuances intonation and enhance pronunciation skills for better communication skills.
- 2) To impart basic English grammar and essentials of important language skills.
- 3) To enhance English vocabulary and language proficiency for better communication skills. To learn about Techniques of Information Transfer through presentation.

Prerequisite: Nil

Teaching-Learning Process (General Instructions):

These are sample strategies that teachers can use to accelerate the attainment of the various course outcomes.

- 1) Teachers shall adopt suitable pedagogy for an effective teaching-learning process. The pedagogy shall involve a combination of different methodologies that suit modern technological tools and software to meet the present requirements of the global employment market.
 - i) Direct instructional method (Low/Old Technology)
 - ii) Flipped classrooms (High/Advanced Technological Tools)
 - iii) Blended learning (Combination of both)
 - iv) Enquiry and evaluation-based learning
 - v) Personalized learning
 - vi) Problem-based learning through discussion
- vii) Following the method of expeditionary learning tools and techniques
- viii) Use of audio-visual methods through language labs in teaching of LSRW skills (Listening, Speaking, Reading, Writing)



2) Apart from conventional lecture methods, various types of innovative teaching techniques through videos and animation films may be adapted so that the delivered lessons can progress the students' theoretical, applied, and practical skills in teaching communicative skills in general.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Basics of the Theory of Communication	6	25%
Module-II: Development of Listening and Speaking	6	25%
Skills	0	2.3 /0
Module-III: Basic Writing Skills	6	25%
Module-IV: Reading and Comprehension	6	25%

SYLLABUS OUTLINE:

Module I: Basics of the Theory of Communication: [6L]

Fundamentals of Communicative English, process of communication, barriers to effective communicative English, different styles and levels in communicative English (communication channels). Interpersonal and intrapersonal communication skills, how to improve and develop interpersonal and intrapersonal communication skills.

Module II: Development of Listening and Speaking Skills: [6L]

Development of listening and speaking skills, appreciating effective communication/miscommunication, usage of dialogue.

Module III: Basic Writing Skills: [6L]

Email writing, letter writing.

Module IV: Reading and Comprehension: [6L]

How to summarize a text, effective paraphrasing, précis writing.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:



- 1) Communication Skills by Sanjay Kumar and Pushp Lata, Oxford University Press, 2019.
- 2) English for Engineers by N.P. Sudharshana and C. Savitha, Cambridge University Press, 2018.
- 3) A Textbook of English Language Communication Skills, Infinite Learning Solutions (Revised Edition), 2021.

Reference Books:

- 1) A Course in Technical English by D. Praveen Sam and K.N. Shoba, Cambridge University Press, 2020.
- 2) Technical Communication by Gajendra Singh Chauhan et al., Cengage Learning India Pvt. Limited (Latest Revised Edition), 2019.
- English Language Communication Skills Lab Manual cum Workbook, Cengage Learning India Pvt. Limited (Latest Revised Edition), 2019.
- 4) Practical English Usage by Michael Swan, Oxford University Press, 2016.
- 5) Technical Communication Principles and Practice, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press, 2017.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	2	3
CO2	-	-	-	-	-	-	-	-	1	3	1	3
CO3	-	-	-	-	-	-	-	-	2	3	2	3
CO4	-	-	-	-	-	-	-	-	1	3	2	2
CO5	-	-	-	-	-	-	-	-	2	3	2	3
CO6	-	-	-	-	-	-	-	-	1	3	2	3
Avg.	-	-	-	-	-	-	-	-	1.33	3	1.83	2.83

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: To understand the basics of communicative English and general communication skills.

CO2: To train to identify nuances in intonation and enhance pronunciation for improved communication.

CO3: To learn essential English grammar and foundational language skills.

CO4: To enhance English vocabulary for better language proficiency and effective communication.

CO5: To develop overall language proficiency to communicate confidently in various contexts.



CO6: To cultivate effective communication skills through comprehensive training in grammar, pronunciation, and vocabulary.



ENVIRONMENTAL SCIENCE I

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Environmental Science I	COURSE CREDIT: 02[2-0-0]
DEPARTMENT: Computer Science	CATEGORY: VAC
CODE: XXXXXX	SEMESTER: 1 st

THEORY

Learning objectives:

- 1) To understand the basic concepts of components of atmosphere
- 2) To understand the classification of resources (perpetual, renewable, non-renewable)
- 3) To learn about the components of environment and individual resources
- 4) To learn about origin and importance of air, water, forest, food, land, mineral and energy resources
- 5) To become aware of the degradation of all above resources.

Prerequisite: Passed 10+2 in any discipline

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)	
	Contact hour		
Module-I: Components of Environment and	1	16 670%	
Atmosphere	4	10.07 %	
Module-II: Water resource	4	16.67%	
Module-III: Forest resource and Food resource	4	16.67%	
Module-IV: Land resource	4	16.67%	
Module-V: Mineral resource	4	16.67%	
Module-VI: Energy resource	4	16.67%	

SYLLABUS OUTLINE:

Module I: Components of Environment and Atmosphere: [4L]

Classification of natural resources (four atmospheric spheres); Perpetual, renewable and non-renewable resources.Names and compositions of different layers of atmosphere; introduction of pollutant and contaminant.

BCA-R24



Module II: Water resource: [4L]

Classification and quantization of water resource; Sweet and saline water; Fresh water resource : surface water, water table and aquifer; use and over use of water; causes of flood and draught; conflict over water; benefit and harms of dams; water harvesting and our responsibilities.

Module III: Forest resource and Food resource: [4L]

Classification and importance of forest; use and over exploitation of forests; deforestation : cause (timber extraction, mining and dam construction)and effect (global warming, erosion, lower rain fall); afforestation : forest growth, preservation and laws, tribal people and forest.

Different types of foods their origin and their importance; global food problems; food production and food loss; modern agriculture, GM food.

Module IV: Land resource: [4L]

Importance of land as a resource and its classification; land fertility and degradation; over grazing and over cultivation; effect of pesticide and fertilizer, land erosion, landslide, desertification (by human activity).

Module V: Mineral resource: [4L]

Introduction of minerals and their classification; use and importance; effect of extracting mineral (mining) on environment.

Module VI: Energy resource: [4L]

Introduction and origin; Perpetual, renewable and non-renewable energy resources; growing energy needs; energy harvesting, green energy, alternative energy resources.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

1) Environmental Science : Fundamentals, Ethics & Laws, Asish Shukla, Renu Singh, Anil Kumar, Wiley (2019)

Reference Books:

1) Environmental Science, Dr Biplab Kumar Das, Dr Mofidul Islam, Mahaveer Publications (2023)



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	3	3					
CO2	3	2	1	1	2	3	3					
CO3	3	2	2	1	3	3	3					
CO4	3	2	2	1	3	3	3					
CO5	3	2	1	1	2	3	3					
CO6	3	2	1	1	2	3	3					
Avg.	3	2	1.33	1	2.33	3	3					

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: This part of Environmental science course include detailed description of different natural resources. Students will learn about origin, classification and importance of different resources as well as their and impact on human life.

CO2: This course deals with preservation of natural resources and not with pollution of them.

CO3: Classification of perpetual, renewable and non-renewable resources and the principles behind their preservation is included in the outcome of this course.

CO4: Classification of atmospheric layers as per their distance from earth surface and composition of different layers.

CO5: Students will learn about introduction, classification, importance, degradation and preservation of water, food, land and forest resources.

CO6: Students will learn about introduction, classification and importance of mineral and energy resources. Importance of energy harvesting and alternative energy resource will also be learned as an integral part of this course.



INTRODUCTION TO C PROGRAMMING LAB

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Introduction to C Programming Lab	COURSE CREDIT: 01[0-0-2]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 1 st

List of Practical:

- 1) Write a c program to display the word "welcome".
- 2) Write a c program to take a variable int and input the value from the user and display it.
- 3) Write a c program to add 2 numbers entered by the user and display the result.
- 4) Write a c program to calculate the area and perimeter of a circle.
- 5) Write a C program to find maximum between two numbers.
- 6) Write a C program to check whether a number is divisible by 5 and 11 or not.
- 7) Write a C program to input angles of a triangle and check whether triangle is valid or not
- 8) Write a C program to check whether a year is leap year or not.
- 9) Write a C program to input basic salary of an employee and calculate its Gross salary according to following: Basic Salary <= 10000 : HRA = 20%, DA = 80% Basic Salary <= 20000 : HRA = 25%, DA = 90% Basic Salary > 20000 : HRA = 30%, DA = 95%
- 10) Write a c program to print "welcome" 10 times.
- 11) Write a c program to print first n natural numbers using while loop.
- 12) Write a c program to print all the odd numbers in a given range.
- 13) Write a c program to add first n numbers using while loop.
- 14) Write a c program to print all numbers divisible by 3 or 5 in a given range.
- 15) Write a c program to add even numbers in a given range.
- 16) Write a c program to find the factorial of a given number.
- 17) Write a c program to find whether a number is prime or not.
- 18) Write a c program to print the reverse of a number.
- 19) Write a c program to add the digits of a number.
- 20) Write a c program to print the fibonacci series in a given range.
- 21) Write a c program to check whether a number is an Armstrong number or not.
- 22) Write a c program to find g.c.d. and l.c.m. of two numbers.



SEMESTER-II

Sl No	Course Title	Code	Category	Credit		Ту	ре	
					L	Т	P	S
1	Computer Organization and Architecture		MC	4	3	1	0	0
2	Data Structures		MC	4	3	1	0	0
3	Mathematics II		MDC	3	2	1	0	0
4	NM Elective II: Principal of Management		NM	4	3	1	0	0
5	Soft Skill Development II		NV	1	1	0	0	0
6	Communicative English II		AEC	2	2	0	0	0
7	SEC1: Introduction to Python		SEC	3	3	0	0	0
8	Environmental Science II		VAC	2	2	0	0	0
	Practi	ical	•					
9	Data Structures Lab		MC	1	0	0	2	0
		•	Total C	redit=24		•	•	•



COMPUTER ORGANIZATION AND ARCHITECTURE

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Computer Organization and Architecture	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 2 nd

THEORY

Learning objectives: On completion of the course, student will be able to: Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. Analyse the performance of commercially available computers. This course is intended to teach the basics involved in data representation and digital logic circuits used in the computer system.

Prerequisite: Before learning the concepts of Computer Architecture and Organization, you should have a basic knowledge prior to basic functional units of a computer system, Binary numbers etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Principles of Computer design	6	13%
Module-II: Machine language instructions	6	13%
Module-III: Control unit, Data path and control path	8	17%
design	0	1770
Module-IV: Memory system and Storage technologies	8	17%
Module-V: Input-output devices and characteristics	4	8%
Module-VI: Performance evaluation	4	8%

SYLLABUS OUTLINE:

Module I: Principles of Computer design: [6L]

Software, hardware interaction layers in computer architecture, Central processing unit.

Module II: Machine language instructions: [6L]

Addressing modes, instruction types, Instruction set selection, Instruction cycle and execution cycle.

Module III: Control unit, Data path and control path design: [8L]



Microprogramming Vs hardware control, RISC Vs CISC, Pipelining in CPU design: Superscalar processors.

Module IV: Memory system and Storage technologies: [8L]

Memory array organization, Memory hierarchy, interleaving, cache and virtual memories and architectural aids to implement these.

Module V: Input-output devices and characteristics: [4L]

Input-output processing, bus interface, data transfer techniques, I/O interrupts, channels.

Module VI: Performance evaluation: [4L]

SPEC marks, Transaction Processing benchmarks

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Mano, M, "Computer System and Architecture", (3rd edition) Prentice Hall of India, New Delhi, 1994.
- 2) Pal Chauduri, P., "Computer Organization and Design", Prentice Hall of India, New Delhi, 1994.
- 3) Rajaraman, V., and Radhakrishnan, T., "Introduction to Digital Computer Design" (4th edition). Prentice Hall of India, New Delhi, 1997.

Reference Books:

- 1) Stallings. W, "Computer Organization and Architecture, (2nd edition) Prentice Hall of India, New Delhi
- 2) Book-2


CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	1	-	2
CO2	3	3	2	2	2	-	-	-	-	1	-	2
CO3	3	2	3	2	2	-	-	-	-	1	-	1
CO4	3	2	2	3	2	-	-	-	-	1	-	2
CO5	3	2	3	2	3	-	-	-	-	1	-	2
CO6	3	2	3	3	2	-	-	-	-	1	-	2
Avg.	3	2.2	2.5	2.3	2.2	-	-	-	-	1	-	1.8

Highly Correlated: 3 Moderately Correlated: 2

Slightly Correlated: 1

Course Learning Outcome: (CO)

- CO1: Discuss the working of functional components of the computer.
- **CO2:** Demonstrate instruction execution cycle.
- CO3: Categories various memory types according to their properties
- CO4: Describe the principles of memory management.
- CO5: Explain how interrupts are used to implement I/O control and data transfers.
- CO6: Examine various inter connection structures of multi processors.



DATA STRUCTURES

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Data Structures	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 2 nd

THEORY

Learning objectives: On completion of the course, student will be able to: Understand basic data structures and their implementation. Develop skills to apply appropriate data structures in problem solving.

Prerequisite: Learning data structures requires a solid foundation in programming fundamentals including variables, loops, conditional statements, and basic algorithms such as searching and sorting. Familiarity with at least one programming language is essential, along with understanding algorithmic complexity (big O notation) and basic mathematical concepts like set theory and combinatorics. Problem-solving skills and critical thinking are crucial for analyzing problems and designing efficient solutions using data structures, which often involve abstract thinking and conceptualization of data organization and access patterns. Knowledge of object-oriented programming concepts and recursion is beneficial for implementing and understanding various data structures effectively.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to Data Structure	2	4%
Module-II: Array	6	12%
Module-III: Linked List	10	21%
Module-IV: Stack and Queue	8	17%
Module-V: Trees	10	21%
Module-VI: Searching, Sorting and Hashing	12	25%

SYLLABUS OUTLINE:

Module-I: Introduction to Data Structure [2L]

Data and Information, Concepts of data structures, Data Type and Abstract Data Type (ADT).

Module-II: Array [6L]

Arrays and their Applications, Different representations- row major, column major. Sparse matrix - its



implementation and usage. Array representation of polynomials.

Module-III: Linked List [10L]

Review of Pointers and Functions, Concepts of linked list, Types of linked list-Singly linked list, doubly linked list, circular linked list, linked list representation of polynomials and applications.

Module-IV: Stack and Queue [8L]

Stack: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions.

Queue: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions.

Module-V: Trees [10L]

Binary Trees- definition, binary tree traversal (pre-, in-, post- order), expression tree, Binary Search Treescreation, insertion, deletion, searching, Height-Balanced Tree– AVL tree (insertion, deletion with examples only), B-Trees: operations (insertion, deletion with examples only), B+ -Trees: operations (insertion, deletion with examples only). Applications of Trees.

Module-VI: Searching, Sorting and Hashing [12L]

Searching Algorithms: Linear and Binary search, Sorting Algorithms: Bubble sort, insertion sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue). Hashing: Terminologies, Hashing Functions, Types of Hashing, Collision Resolution Techniques.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Data Structures Through C (a Practical Approach)-G S Baluja
- 2) Fundamentals of Data Structures in C++, E.Horowitz- S.Sahni, Galgotia-2006

Reference Books:

- 1) Data Structures, Algorithms and Applications in C++, Sartaj Sahni, University Press
- 2) Data Structures using C and C++ by Yedidyah Langsam, Moshe J. Augenstein and Aron M. Tananbaum, PHI.2002
- 3) Data Structures and Algorithm Analysis in C++, M.A.Weiss, Pearson Education-Fourth Edition



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	1	-	1
CO2	3	3	3	2	2	-	-	-	-	1	-	1
CO3	3	3	3	3	2	-	-	-	-	1	-	2
CO4	3	3	3	3	3	-	-	-	-	1	-	2
CO5	3	3	3	3	3	-	-	-	-	1	-	2
CO6	3	3	3	3	2	-	-	-	-	1	-	3
Avg.	3	3	2.8	2.7	2.3	-	-	-	-	1	-	1.8

Highly Correlated: **3** Moderately Correlated: **2**

Slightly Correlated: 1

Course Learning Outcome: (CO)

CO1: To be able to classify linear and non-linear data structure.

CO2: To be able to solve different problems using Arrays.

CO3: To be able to make use of linked list for various operations on polynomials, sparse matrix etc.

CO4: To be able to utilize the knowledge of Stack, Queues in solving real life problem.

CO5: To be able to apply the knowledge of several binary trees in problem solving.

CO6: To be able to identify of the most appropriate searching or sorting algorithm for enhancing the efficiency (i.e. reduce the run-time) or for better memory utilization.



MATHEMATICS II

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Mathematics II	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: MDC
CODE: XXXXXX	SEMESTER: 2 nd

THEORY

Learning objectives: On completion of the course, student will be able to: apply the knowledge of linear algebra, differential calculus and differential equations to solve complex problems.

Prerequisite: Before learning the concepts of Mathematics-II, you should have a basic knowledge of set, mapping, matrix etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)	
	Contact hour		
Module-I: Linear Algebra	12	25%	
Module-II: Differential Calculus	8	17%	
Module-III: Functions of several variables	6	13%	
Module-IV: Integral Calculus	8	17%	
Module-V: First Order Ordinary Differential Equations	8	17%	
Module-VI: Second Order Ordinary Differential Equa-	6	120%	
tions	0	13%	

SYLLABUS OUTLINE:

Module I: Linear Algebra: [12L]

Determinant and its properties (up to third order), Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric matrices and their properties, Adjoint, Inverse matrix, Solution of linear equations in three variables by Cramer's rule, matrix inversion method.

Module II: Differential Calculus : [8L]

Limits of function and continuity, fundamental properties of continuous functions (without proof), Derivatives, successive differentiation, Rolle's theorem, Mean value theorems, Taylor's and Maclaurin's finite expansion.



Module III: Functions of several variables : [6L]

Limit and Continuity, Partial derivatives, Total differential, Euler's theorem on homogeneous functions of two variables

Module IV: Integral Calculus: [8L]

Indefinite integrals, Definite integrals and their elementary properties, Definite integral as the limit of sum, Idea of improper integrals.

Module V: First Order Ordinary Differential Equations : [8L]

Order, degree, formation of a differential equation, Solutions of ODE, First order and first degree: Variable separation method, Homogeneous equations, Exact equations, Condition of exactness (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation. General solution of ODE of first order and higher degree, Clairaut's equation.

Module VI: Second Order Ordinary Differential Equations : [6L]

Second order linear ODE with constant coefficients, Solutions using D operator method. Cauchy-Euler equations and their solutions.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
- 2) Advanced Engineering Mathematics, E Kreyszig, Wiley

Reference Books:

- 1) Higher Algebra, S. K. Mapa, Levant Books
- 2) Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
- 3) Co-ordinate Geometry, S. L. Loney
- 4) Interal Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	1	-	2
CO2	3	3	2	2	2	-	-	-	-	1	-	2
CO3	3	2	2	2	2	-	-	-	-	1	-	2
CO4	3	3	3	2	2	-	-	-	-	1	-	2
CO5	3	3	2	2	3	-	-	-	-	1	-	2
CO6	3	3	2	3	3	-	-	-	-	1	-	2
Avg.	3	2.83	2.17	2.17	2.17	-	-	-	-	1	-	2

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understand and apply the concepts of determinants, matrices, and their properties to solve systems of linear equations.

CO2: Demonstrate knowledge of limits, continuity, and differentiation and apply theorems like Rolle's, Mean Value, and Taylor's to solve calculus problems.

CO3: Analyze and evaluate functions of several variables using partial derivatives, total differentials, and Euler's theorem.

CO4: Apply the principles of integral calculus to compute definite and indefinite integrals and understand improper integrals.

CO5: Solve first-order ordinary differential equations using various methods such as variable separation, homogeneous equations, and linear equations.

CO6: Solve second-order ordinary differential equations using constant coefficients, D operator methods, and Cauchy-Euler equations.



PRINCIPAL OF MANAGEMENT

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Principal of Management	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: NM
CODE: XXXXXX	SEMESTER: 2 nd

THEORY

Learning objectives:

- 1) Understand management theories, the evolution of management over the years, and the basic concepts of management.
- 2) Develop an understanding of how organizations work.
- 3) Explore the intricacies of different management areas, such as finance, marketing, strategy, etc.

Prerequisite: Nil

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Management Theories		%
Module-II: Functions of Management		%
Module-III: Organization Behavior		%
Module-IV: Organizational Design		%
Module-V: Motivation & Organizational culture		%
Module-VI: Managerial Ethics and Leadership		%

SYLLABUS OUTLINE:

Module I: Management Theories: [L]

Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical Management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

Module II: Functions of Management: [L]



Planning, Organizing, Staffing, Directing, Controlling

Module III: Organization Behavior: [L]

Introduction, Personality, Perception, Learning and Reinforcement, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making

Module IV: Organizational Design: [L]

Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

Module V: Motivation & Organizational culture: [L]

Motivation, Group Dynamics, Power & Influence, Organizational Culture, Managing Cultural Diversity

Module VI: Managerial Ethics and Leadership: [L]

Ethics and Business, Ethics of Marketing and Advertising, Ethics of Finance and Accounting, Decisionmaking Frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, and Corporate Social Responsibility.

Concept, Nature, Importance, Attributes of a Leader, Developing Leaders Across the Organization, and Leadership Grid.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Richard L. Daft, Understanding the Theory and Design of Organizations.
- 2) Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior.
- 3) Harold Koontz, Essentials of Management.

Reference Books:

- 1) Cyril J. O'Donnell and Harold Koontz, Principles of Management: An Analysis of Managerial Functions.
- 2) Arnold Bakker, Positive Interventions in Organizations.
- 3) Journals: Academy of Management Journal, Journal of Management, Harvard Business Review



(HBR).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	2	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	2	-	-	-
CO4	3	3	3	3	2	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	3	3	3	-	-	-
CO6	-	-	3	-	-	3	3	2	3	2	3	3
Avg.	2	1.67	1.5	0.83	0.33	0.83	1	0.83	1.67	0.33	0.5	0.5

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understanding the basic theoretical concepts of Management.

CO2: Understanding the basic theoretical concepts of Organizational Behavior.

CO3: Understanding and linking the concepts with contemporary issues.

CO4: Understanding real-time management problems, analyzing them, and finding solutions.

CO5: Developing and exhibiting cross-cultural competencies by working in teams.

CO6: Developing managerial skills needed to become an effective manager.



SOFT SKILL DEVELOPMENT II

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Soft Skill Development II	COURSE CREDIT: 01[1-0-0]
DEPARTMENT: Computer Science	CATEGORY: NV
CODE: MVSSU122T02	SEMESTER: 2 nd

THEORY

Learning objectives: To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisite: Nil

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Fundamentals of Communication		30%
Module-II: Verbal Communication		30%
Module-III: Non-Verbal Communication		20%
Module-IV: Listening Skills		10%
Module-V: Prose		10%

SYLLABUS OUTLINE:

Module I: Fundamentals of Communication: [L]

- Process & Importance
- Role and purpose of communication: 7 C's of Communication
- Effective Communication & Barriers
- Types & Channels
- Models of Communication (Linear & Shannon Weaver)
- Communication Networks

Activates: Daily conversation practice, pronunciation exercises, Listening comprehension, Cultural discussions

Module II: Verbal Communication: [L]



- Oral Communication: Forms, Advantages, Disadvantages
- Written Communication: Forms, Advantages & Disadvantages
- Introduction to Communication skills: Listening, Speaking, Reading, Writing

Activities: Debate discussion, public speaking challenges, Group presentations

Module III: Non-Verbal Communication: [L]

- Principles & Significance of Non-Verbal Communication
- KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics)
- Visible Code/Object Language
- Haptics
- Body Language

Activities: Facial expression challenge, silent discussion, body language detective, Mirror exercise, Dumb-Charades

Module IV: Listening Skills: [L]

- Process, Importance and Types of Listening
- Effective Listening: Principles & Barriers

Activities: Dictation exercise, listen & sequence, listen & draw, note taking

Module V: Prose: [L]

- "Karma" by Khushwant Singh
- "Most Beautiful" by Ruskin Bond
- "The Last Question" by Isaac Asimov
- "The Fun They Had" by Isaac Asimov
- "An Astrologer's Day" by R.K. Narayan
- Pedagogy for Course Delivery: Extempore, Presentations
- Continuous assessment: Quiz/assessment/presentation/problem solving etc.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	1	2
CO2	-	-	-	-	-	-	-	-	1	3	2	3
CO3	-	-	-	-	-	-	-	-	2	3	1	1
CO4	-	-	-	-	-	-	-	-	1	3	2	3
CO5	-	-	-	-	-	-	-	-	1	3	2	3
CO6	-	-	-	-	-	-	-	-	1	3	2	3
Avg.	-	-	-	-	-	-	_	-	1.17	3	1.67	2.5

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: To develop clear and concise spoken communication skills for diverse contexts and audiences, enhancing overall verbal expression and clarity.

CO2: To master the use and interpretation of body language and non-verbal cues to communicate effectively and confidently.

CO3: To enhance active listening abilities, ensuring better comprehension and engagement in various situations through improved note-taking and attentiveness.

CO4: To improve the ability to comprehend and analyze complex written materials, fostering a deeper understanding and critical thinking skills.

CO5: To develop professional writing skills, enabling clear, persuasive, and effective written communication in various formal and informal contexts.

CO6: To cultivate a holistic approach to communication, integrating verbal, non-verbal, listening, and reading skills to excel in personal, academic, and professional interactions.



COMMUNICATIVE ENGLISH II

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Communicative English II	COURSE CREDIT: 02[2-0-0]
DEPARTMENT: Computer Science	CATEGORY: AEC
CODE: XXXXXX	SEMESTER: 2 nd

THEORY

Learning objectives: This course intends to acquaint the students with the communicative aspects of the English language in use today. The course hones their Listening, Speaking, Reading and Writing skills and makes them industry ready.

Prerequisite: Nil

Teaching-Learning Process (General Instructions):

These are sample strategies that teachers can use to accelerate the attainment of the various course outcomes.

- 1) Teachers shall adopt suitable pedagogy for an effective teaching-learning process. The pedagogy shall involve a combination of different methodologies that suit modern technological tools and software to meet the present requirements of the global employment market.
 - i) Direct instructional method (Low/Old Technology)
 - ii) Flipped classrooms (High/Advanced Technological Tools)
 - iii) Blended learning (Combination of both)
 - iv) Enquiry and evaluation-based learning
 - v) Personalized learning
 - vi) Problem-based learning through discussion
- vii) Following the method of expeditionary learning tools and techniques
- viii) Use of audio-visual methods through language labs in teaching of LSRW skills (Listening, Speaking, Reading, Writing)
- 2) Apart from conventional lecture methods, various types of innovative teaching techniques through videos and animation films may be adapted so that the delivered lessons can progress the students' theoretical, applied, and practical skills in teaching communicative skills in general.



Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)		
	Contact hour			
Module-I: Introduction to Speaking Skill	8	33%		
Module-II: Advance Reading Skills	8	33%		
Module-III: Advanced Writing Skills	8	34%		

SYLLABUS OUTLINE:

Module I: Introduction to Speaking Skill: [8L]

Speaking Skills, Group Discussion, Interview, Public Speaking

Module II: Advance Reading Skills: [8L]

Reading and Understanding Comprehension, Close Reading Analysis and Interpretation

Module III: Advanced Writing Skills: [8L]

Writing Skills, Advanced Grammar, Report Writing, Making Notes

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Communication Skills by Sanjay Kumar and Pushp Lata, Oxford University Press, 2019.
- 2) English for Engineers by N.P. Sudharshana and C. Savitha, Cambridge University Press, 2018.
- 3) A Textbook of English Language Communication Skills, Infinite Learning Solutions (Revised Edition), 2021.

Reference Books:

- 1) A Course in Technical English by D. Praveen Sam and K.N. Shoba, Cambridge University Press, 2020.
- 2) "Speak With Confidence: A Practical Guide" by Albert J. Vasile
- English Language Communication Skills Lab Manual cum Workbook, Cengage learning India Pvt Limited [Latest Revised Edition] – 2019.
- 4) Practical English Usage by Michael Swan, Oxford University Press 2016.



- Technical Communication Principles and Practice, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2017.
- 6) "The Discussion Book: 50 Great Ways to Get People Talking" by Stephen D. Brookfield and Stephen Preskill

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	2	3
CO2	-	-	-	-	-	-	-	-	2	3	1	3
CO3	-	-	-	-	-	-	-	-	1	3	2	3
CO4	-	-	-	-	-	-	-	-	2	3	2	3
CO5	-	-	-	-	-	-	-	-	1	3	1	3
CO6	-	-	-	-	-	-	-	-	1	3	2	3
Avg.	-	-	-	-	-	-	-	-	1.33	3	1.66	3

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: To acquaint students with the communicative aspects of contemporary English language use.

CO2: To hone listening, speaking, reading, and writing skills to prepare students for professional environments.

CO3: To develop interpersonal communication skills for effective interaction in diverse professional and social settings.

CO4: To equip students with critical thinking abilities through practical exercises.

CO5: To enhance problem-solving skills with real-world scenarios.

CO6: To improve overall English language proficiency for diverse applications.



INTRODUCTION TO PYTHON

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Introduction to Python	COURSE CREDIT: 03[3-0-0]
DEPARTMENT: Computer Science	CATEGORY: SEC
CODE: XXXXXX	SEMESTER: 2 nd

THEORY

Learning objectives: After the end of the course, the student will learn to:

- 1) Understand Python basics, syntax, and control structures for problem solving.
- 2) Develop modular and reusable code using functions and modules.
- 3) Utilize Python's data structures for efficient data manipulation.
- 4) Handle different types of files in python.

Prerequisite: Basic computer literacy, logical reasoning, and a willingness to learn programming, with optional familiarity in basic programming concepts or mathematics.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to Python	4	11%
Module-II: Python Decision-making Statements and	1	110%
Loops	4	1170
Module-III: Data Structures in Python	4	11%
Module-IV: Python Functions and Recursive Functions	6	17%
Module-V: Python File Handling and Matplotlib	8	22%
Module-VI: Case Studies and Applications	10	28%

SYLLABUS OUTLINE:

Module I: Introduction to Python: [4L]

Overview of Python, features, and applications, Installation and setup of Python environment, Python syntax, variables, and data types, Input and output operations. Operators: Arithmetic, Relational, Logical, Assignment, Bitwise, Membership, and Identity Operators.



Module II: Python Decision-making Statements and Loops: [4]

Decision-making statements: if, if-else, nested if-else; Loops, Control statements (break, continue, pass).

Module III: Data Structures in Python: [4]

Arrays, String, Lists, Tuples, Sets, Dictionary

Declaration syntax, Initialization syntax, Methods, and Length of the Data Structures. Adding Elements to/ Removing Elements from the Data Structures.

Module IV: Python Functions and Recursive Functions: [6L]

Definition and purpose of functions, Advantages of using functions in programming, Function syntax and structure, Calling a function, Scope and lifetime of variables, Function Arguments, return Statement, Anonymous (lambda) functions.

Recursive Functions: Concept of recursion, Base case and recursive case, Examples of recursion (e.g., factorial, Fibonacci series)

Module V: Python File Handling and Matplotlib: [8L]

File operations: open, read, write, and close; Read, Write/Create an image File, a CSV File, a text File and an Excel File.

Python Matplotlib: Matplotlib Pyplot, Plotting, Markers, Line, Labels, Grid, Subplot, Scatter, Bars, Histograms, Pie Charts.

Module VI: Case Studies and Applications: [10L]

Exploration of real-world Python applications:

- a) **Simple Calculator:** Create a command-line calculator that performs basic arithmetic operations (addition, subtraction, multiplication, division). Extend it to support advanced features like trigonometric functions or factorials.
- b) **Text File Analyzer:** Write a program to read a text file, count the number of words, characters, and lines, and identify the most frequently used words.
- c) **Currency Converter:** Create a Python program that converts one currency to another using real-time exchange rates fetched from an API (e.g., ExchangeRate-API).
- d) **Student Marks Management System:** Build an application to manage student records, including storing names, marks, and grades. Use file handling or databases to save the data for future use.
- e) **Quiz Application:** Design a Python-based quiz game with multiple-choice questions. The program can calculate and display the score at the end, with feedback on correct/incorrect answers.
- f) **Password Generator:** Develop a tool that generates secure random passwords based on user-defined criteria like length and the inclusion of special characters.



- g) **Prime Number Checker:** Develop a program that checks if a given number is prime. Extend it to display all prime numbers within a user-defined range.
- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Barry, P., & Griffiths, D. (2016). Head First Python: A Brain-Friendly Guide (2nd ed.). O'Reilly Media.
- 2) Lutz, M. (2013). Learning Python (5th ed.). O'Reilly Media.
- Zelle, J. M. (2017). Python Programming: An Introduction to Computer Science (3rd ed.). Franklin, Beedle & Associates Inc.

Reference Books:

- 1) Severance, C. (2016). Python for Everybody: Exploring Data Using Python 3. CreateSpace Independent Publishing Platform.
- Beazley, D. M., & Jones, B. K. (2013). Python Cookbook: Recipes for Mastering Python 3 (3rd ed.). O'Reilly Media.
- 3) Ramalho, L. (2015). Fluent Python: Clear, Concise, and Effective Programming. O'Reilly Media.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	2
CO2	3	3	2	-	2	-	-	-	-	-	-	2
CO3	3	2	3	2	3	-	-	-	-	-	-	2
CO4	3	3	3	2	3	-	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2
CO6	3	3	3	3	3	-	-	-	-	-	3	2
Avg.	3	2.67	2.33	1.67	2.67	-	-	-	-	-	0.5	2

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**



Course Learning Outcome: (CO)

CO1: Understand the fundamentals of Python, including syntax, data types, and basic operations, to develop foundational programming skills.

CO2: Apply control structures for decision-making and iterative processes to solve real-world problems programmatically.

CO3: Utilize built-in data structures for efficient data storage and manipulation.

CO4: Design reusable and modular code using functions and modules.

CO5: Perform file operations and handle exceptions to ensure data persistence and reliable program execution.

CO6: Apply Python knowledge to develop small-scale real-world applications and solve practical problems.



SECOND YEAR

SEMESTER-III

Sl No	Course Title	Code	Category	Credit		Ту	pe			
					L	Т	Р	S		
1	Database Management Systems		MC	4	3	1	0	0		
2	Operating Systems		MC	4	3	1	0	0		
3	Object Oriented Programming with		MC	3	2	1	0	0		
	Java									
4	NM Elective III: Business Ethics and		NM	4	3	1	0	0		
	Corporate Governance									
5	Mathematics III		MDC	3	2	1	0	0		
6	Foreign Language I		AEC	2	2	0	0	0		
7	Technical Writing and Presentation		NV	2	0	0	4	0		
8	EAA II (yoga/Sports/NCC/NSS)		NV	1	0	0	2	0		
9	Soft Skill Development III		NV	1	0	0	2	0		
	Prac	tical								
10	Database Management Systems Lab		MC	1	0	0	2	0		
11	Object Oriented Programming with		MC	1	0	0	2	0		
	Java Lab									
	Total Credit=26									



DATABASE MANAGEMENT SYSTEMS

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Database Management Systems	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 3 rd

THEORY

Learning objectives: On completion of the course, student will be able to: Understand the relational database design principles. Familiar with the basic issues of transaction processing and concurrency control. Familiar with database storage structures and access techniques.

Prerequisite: Before learning the concepts of DBMS, you should have a basic knowledge of computer knowledge and Data Structure and Algorithm.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Database System Concepts & Architecture	4	8%
Module-II: Data Modelling	6	12%
Module-III: Relational Data Model	12	25%
Module-IV: Database Design	10	21%
Module-V: Query Processing And Optimization	6	12%
Module-VI: Transaction	10	21%

SYLLABUS OUTLINE:

Module I: Database System Concepts & Architecture: [4L]

Data Independence, Schemas, Instances, Database Languages, Database System Environments Data Models, Basic Structure of Oracle System, Storage Organization in Oracle.

Module II: Data Modelling: [6L]

Use of High –level Conceptual Data Models, ER Diagrams, Subclasses, Super classes and Inheritance, Specialization & Generalization, Conceptual Object Modeling using UML Class Diagrams, Knowledge Representation Concepts, Exercises.



Module III: Relational Data Model: [12L]

Relational constraints, domain constraints, key constraints referential integrity, Constraints, relational algebra, fundamental operations of relational algebra & their Implementation, interdependence of operations, example queries. ER and EER to Relational Mapping: Mapping EER model concepts to relation, tuple relational calculus, domain relational Calculus queries.

Module IV: Database Design: [10L]

Functional dependencies, irreducible sets of dependencies, loss less decomposition, 1^{st} , 2^{nd} & 3^{rd} NF, dependency preservation, Boyce Codd NF, Multivalued Dependency & 4^{th} NF, join Dependency & 5 NF, domain key normal form, restriction –union normal form, Denormalization

Module V: Query Processing And Optimization: [6L]

SQL Basic Queries in SQL, Subqueries, Retrieving a Query Plan – Table Space Span & I/O, Index Scan, Equal Unique Index Lookup, Clustered vs. Non Clustered Indexing, Index Only Scan, Methods for Joining Tables –Nested Loop Join Merge Join, Hybrid Join, Multiple table Join, Transforming Nested Queries to Joins, Object Relational SQL, Procedural SQL, Introduction to Embedded SQL.

Module VI: Transaction: [10L]

Schedules, Serializability, Precedence Graph, Concurrency Control Techniques, Implementation of Transaction in Programs, Cursors and Transaction, Dynamic SQL, Locking Levels of Isolation, Recovery, Checkpoints.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Fundamental of Database Systems- Elmasri Navathe- Pearson Education Asia
- 2) An Introduction to Database Systems C.J.Date, Addison Wesley, Pearson EducationPress
- 3) Database System Concepts- Abraham Silberschat, Henry F. Korth, S.Sudarshan, Tata McGraw Hill.

Reference Books:

- Database- Principles, Programming and Performance- Parick O' Neil Elizabeth O'Niel, Harcort Asia PTE Limited
- 2) Database Management Systems-Raghu Ramakrishnan, Johannes Gehrke, Tata McGraw Hill.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	1	-	2
CO2	3	3	2	2	2	-	-	-	-	1	-	2
CO3	3	3	3	2	2	-	-	-	-	1	-	2
CO4	3	2	3	2	2	-	-	-	-	1	-	2
CO5	3	3	2	3	3	-	-	-	-	1	-	2
CO6	3	2	3	3	2	-	-	-	-	1	-	2
Avg.	3	2.67	2.5	2.33	2	-	-	-	-	1	-	2

Highly Correlated: 3 Moderately Correlated: 2

Slightly Correlated: 1

Course Learning Outcome: (CO)

CO1: Explain DBMS architecture, physical and logical database designs, database modelling, relational, hierarchical and network models.

CO2: Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.

CO3: Learn and apply Structured Query Language (SQL) for database definition and database manipulation

CO4: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.

CO5: Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

CO6: Improve the database design by applying normalization techniques



OPERATING SYSTEMS

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Operating Systems	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 3 rd

THEORY

Learning objectives: On completion of the course, student will be able to: Understand how Operating System is Important for Computer System and aware of different types of Operating System and their services. Familiar with different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.

Prerequisite: Before learning the concepts of Operating System, you should have a basic knowledge of Data Structures and Computer Organization.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction	2	4%
Module-II: Process Management	10	21%
Module-III: Process Synchronization	8	17%
Module-IV: Deadlocks	10	21%
Module-V: Memory Management	10	21%
Module-VI: I/O Hardware, File Management and Disk	Q	160%
Management	0	10%

SYLLABUS OUTLINE:

Module I: Introduction: [2L]

Generations Concept of Operating Operating Systems, Systems, Types of 3 Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Module II: Process Management: [10L]

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, Concept of multithreads, 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, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Module III: Process Synchronization: [8L]

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module IV: Deadlocks: [10L]

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

Module V: Memory Management: [10L]

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. 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), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

Module VI: I/O Hardware, File Management and Disk Management: [8L]

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free- space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.



Text & Reference books:

Text Books:

- Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
- Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook - 2018)
- 4) Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing

Reference Books:

- 1) Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, AddisonWesley
- 2) Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- 3) Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	2
CO2	2	3	2	-	-	-	2	-	-	-	-	2
CO3	3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	2	3	3	3	-	-	-	-	-	-	-
CO5	2	2	-	-	3	-	-	-	-	-	-	2
CO6	2	-	-	-	2	2	3	2	-	-	-	2
Avg.	2.5	2	2.33	0.83	2	0.33	0.83	0.33	-	-	-	1.33

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understands the different services provided by Operating System at different level

CO2: They learn real life applications of Operating System in every field

CO3: Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock



CO4: They will learn different memory management techniques like paging, segmentation and demand paging, etc

CO5: Compare file naming in Linux and Windows.

CO6: Awareness of Android Operating System



OBJECT ORIENTED PROGRAMMING WITH JAVA

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Object Oriented Programming with Java	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 3 rd

THEORY

Learning objectives: The learning objectives of Object-Oriented Programming (OOP) with Java include understanding the core principles of OOP: encapsulation, inheritance, polymorphism, and abstraction. Students will learn to define and use classes and objects, implement constructors, methods, and fields, and work with access modifiers to control visibility. They will gain proficiency in creating and using interfaces and abstract classes, understanding.

Prerequisite: Before learning the concepts of Object-Oriented Programming (OOP) with Java, students should have knowledge of problem solving, introductory knowledge of programming logic and algorithmic thinking.

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to OOPs	2	6%
Module-II: Java Basics	10	28%
Module-III: Java Array, String, and Exception Handling	10	28%
Module-IV: Inheritance, Abstraction, Encapsulation and Polymorphism	6	16%
Module-V: Packages and Interfaces	4	11%
Module-VI: Java Multithreading	4	11%

Course content/ Syllabus table:

SYLLABUS OUTLINE:

Module I: Introduction to OOPs: [2L]

Concept of Object Oriented Programming (OOPs), Properties of OOPs (Object, Class, Inheritance, Abstraction, Encapsulation, Polymorphism), Need for OOP Paradigm, Benefits of OOP, Applications of OOP.

Module II: Java Basics: [10L]



History of Java, Concept of JVM, JRE, JDK; Features of java, Constants, Variables, Data Types, Type Conversion and Type Casting; Operators, Decision making and Branching, Loops. Simple Java Program: compilation, execution, Java Class declaration and Object creation, the byte code. Java Methods, Java Constructor, Java Access Modifiers and Non-Access Modifiers.

Module III: Java Array, String, and Exception Handling: [10L]

Array: Declaration, initialization, and accessing array elements of single-dimensional and multi-dimensional arrays. Traversing arrays using loops. Common array operations: insertion, deletion, searching, and sorting.

String: Creating string, String arrays, String methods, Immutable String, StringBuffer class.

Exception Handling: Error-Concept of error, types of errors, Exceptions-Syntax of exceptions handling, exception hierarchy, types of exception, usage of exception handling keywords: try, catch, throw, throws, final, finally and finalize, Advantages of Exception Handling.

Module IV: Inheritance, Abstraction, Encapsulation and Polymorphism: [6L]

Inheritance:Concept of Inheritance, Why use Inheritance, Types of inheritance, uses of super, static and final keyword.

Abstraction: Concrete class, Abstract Class, Abstract Methods, Interface: Why we use Interface? Properties of Interface. Similarity and Dissimilarity between interface and class. Difference between abstract class and interface.

Encapsulation: Concept of Encapsulation, Advantages of Encapsulation.

Polymorphism: Compile Time Polymorphism and Runtime Polymorphism

Module V: Packages and Interfaces: [4L]

Defining, Creating and Accessing a Package, Java package hierarchy, built-in package and user-defined package, subpackage in java, Advantages of Java Package.

Module VI: Multithreading: [4L]

Concept of thread, Life cycle of a Thread, Creating Thread, Thread Scheduling, Thread Priority, daemon threads, Advantages Multithreading in Java.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:



Text Books:

- 1) E Balagurusamy: "Programming with Java", McGraw Hill Education
- 2) Herbert Schildt: "Java: The Complete Reference", McGraw Hill Education

Reference Books:

- 1) Sachin Malhotra and Saurabh Choudhary: "Programming in Java", Oxford University Press
- 2) Y. Daniel Liang: "Introduction to Java Programming, Brief Version", Pearson Education
- 3) Y. Daniel Liang: "Introduction to Java Programming, Comprehensive Version", Pearson Education
- 4) Cay S. Horstmann: "Core Java Vol. I, Vol. II and Vol. II", Pearson Education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	2	1	2	1	-	-	1	2	-	2
CO2	3	3	2	-	2	1	-	-	-	2	-	3
CO3	3	3	3	2	2	2	-	-	-	2	-	3
CO4	3	3	3	3	2	2	-	-	1	2	-	3
CO5	3	2	3	2	3	1	-	-	-	2	-	2
CO6	3	3	3	3	2	3	-	-	1	2	-	3
Avg.	3	2.83	2.67	1.83	2.17	1.67	-	-	0.5	2	-	2.67

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Students will understand the fundamental concepts and properties of Object Oriented Programming, recognizing its necessity, benefits, and applications in software development.

CO2: Acquire basic Java programming skills, including working with constants, variables, data types, operators, control structures, and methods, as well as understanding JVM, JRE, and JDK.

CO3: Develop proficiency in handling arrays and strings, and effectively managing exceptions, enabling robust and error-resistant Java programming.

CO4: Explore advanced OOP principles such as inheritance, abstraction, encapsulation, and polymorphism, enhancing their ability to design flexible and maintainable Java applications.



CO5: Understand how to define, create, and access packages and interfaces in Java, promoting organized code and reuse through package hierarchies.

CO6: Gain insights into multithreading concepts, learning to create and manage threads to improve the performance and responsiveness of Java applications.



MATHEMATICS III

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Mathematics III	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: MDC
CODE: XXXXXX	SEMESTER: 3 rd

THEORY

Learning objectives: On completion of the course, student will be able to: apply the knowledge of numerical methods to solve complex engineering problem.

Prerequisite: Before learning the concepts of Numerical methods student should have a basic knowledge of differentiation, integration etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Error and Calculus of differences	6	16.67%
Module-II: Interpolation	6	16.67%
Module-III: Numerical integration	6	16.67%
Module-IV: Numerical solution of Algebraic equation	6	16.67%
Module-V: Numerical solution of a system of linear equations	6	16.67%
Module-VI: Numerical solution of ordinary differential equation	6	16.67%

SYLLABUS OUTLINE:

Module I: Error and Calculus of differences: [6L]

Numerical errors and their computations, Truncation and rounding-off errors, absolute error, relative error, Forward, Backward, Shift, Average, Central, Differential and Divided difference operators, Relation between the operators, Problems on missing terms

Module II: Interpolation: [6L]

Newton's forward and backward interpolation, Lagrange's interpolation, Newton's divided difference.



Module III: Numerical integration: [6L]

General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Expression for corresponding error terms.

Module IV: Numerical solution of Algebraic equation: [6L]

Bisection method, Regula-Falsi method, Method of Iteration, Newton Raphson method

Module V: Numerical solution of a system of linear equations: [6L]

Gauss elimination method, LU factorization method, Gauss Seidel method.

Module VI: Numerical solution of ordinary differential equation: [6L]

Euler's method, Modified Euler's method, Runga-Kutta method, Predictor-Corrector method.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Numerical Methods, U. N. Dhur & Sons Private Ltd.
- 2) Introductory Methods of Numerical Analysis, S.S.Sastry, PHI

Reference Books:

- 1) Numerical Methods, Jain, Iyenger & Jain, New Age International Publishers
- 2) 2. Numerical Analysis and Computational Procedure, S.A.Mollah, Books & Allied Pvt. Ltd

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2
CO4	3	3	3	3	3	2	-	-	-	-	-	3
CO5	3	3	3	3	3	2	-	-	-	-	-	2
CO6	3	3	3	3	2	3	-	-	-	-	-	3
Avg.	3	3	2.83	2.5	2.17	1.17	-	-	-	-	-	2.33



Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Students will understand and compute numerical errors, including truncation and rounding-off errors, and apply difference operators for solving problems involving missing terms.

CO2: Students will learn and apply interpolation techniques such as Newton's forward and backward interpolation, Lagrange's interpolation, and Newton's divided difference.

CO3: Students will understand and implement numerical integration methods, including Trapezoidal rule and Simpson's 1/3rd rule, and analyze their corresponding error terms.

CO4: Students will acquire skills to solve algebraic equations using numerical methods such as Bisection, Regula-Falsi, Method of Iteration, and Newton-Raphson methods.

CO5: Students will learn numerical techniques to solve systems of linear equations, including Gauss elimination, LU factorization, and Gauss-Seidel methods.

CO6: Students will implement numerical solutions for ordinary differential equations using methods like Euler's, Modified Euler's, Runge-Kutta, and Predictor-Corrector methods.



SOFT-SKILL DEVELOPMENT-III

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Soft-Skill Development-III	COURSE CREDIT: 01[0-0-2]
DEPARTMENT: Computer Science	CATEGORY: NV
CODE: MVSSU122T03	SEMESTER: 3 rd

THEORY

Learning objectives: To develop logical reasoning skills for effective problem-solving and decisionmaking. To master the principles and techniques of clear and impactful written communication. To cultivate professional skills essential for success in various professional environments.

Prerequisite: Nil

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Logic & Analytics		20%
Module-II: Quantitative Aptitude		20%
Module-III: Reasoning Skills		20%
Module-IV: Mastering MS Office		30%
Module-V: Professional Skills		10%

SYLLABUS OUTLINE:

Module I: Logic & Analytics: [L]

- Blood Relation
- Direction Sense
- Seating Arrangement
- Syllogism
- Binary Logic & Data Caselets

Module II: Quantitative Aptitude: [L]

- Basic Maths Vedic, shortcut tricks
- Classification of Numbers


- HCF & LCM
- Factors & Factorial
- Average, Ratio, and Proportion
- Time Work & Time-speed
- Boats & Streams

Module III: Reasoning Skills: [L]

- Data Sufficiency
- Cause & Effect
- Course of Action
- Decision Making

Module IV: Mastering MS Office: [L]

- MS Word
- MS Excel
- MS PowerPoint

Module V: Professional Skills: [L]

- Critical Thinking
- Problem Solving
- Leadership
- Work Ethics
- Pedagogy for Course Delivery: Extempore, Presentations
- Continuous assessment: Quiz/assessment/presentation/problem solving etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	1	3
CO2	-	-	-	-	-	-	-	-	1	1	2	2
CO3	-	-	-	-	-	-	-	-	2	3	2	3
CO4	-	-	-	-	-	-	-	-	2	2	2	3
CO5	-	-	-	-	-	-	-	-	2	2	2	3
CO6	-	-	-	-	-	-	-	-	2	2	1	3
Avg.	-	-	-	-	-	-	-	-	1.67	2.17	1.67	2.83



Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: To develop logical reasoning skills to enhance problem-solving and decision-making abilities in various contexts.

CO2: To master principles and techniques for clear, concise, and impactful written communication.

CO3: To cultivate essential professional skills for success in diverse professional environments.

CO4: To master workplace etiquette to navigate professional settings with confidence and respect.

CO5: To enhance networking abilities to build and maintain valuable professional relationships.

CO6: To develop strategies for effective career development, including goal-setting, planning, and continuous improvement.



DATABASE MANAGEMENT SYSTEM LAB

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Database Management System Lab	COURSE CREDIT: 01[0-0-2]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 3 rd

List of Practical:

1) Introduction to SQL:

- a) Basic concepts of databases and DBMS
- b) Introduction to Structured Query Language (SQL)
- c) Creating, querying, updating, and deleting tables using SQL

2) Data Definition Language (DDL):

- a) Creating and modifying database schema using DDL commands (CREATE, ALTER, DROP)
- b) Constraints (PRIMARY KEY, FOREIGN KEY, UNIQUE, NOT NULL, CHECK)

3) Data Manipulation Language (DML):

- a) Inserting, updating, and deleting data using DML commands (INSERT, UPDATE, DELETE)
- b) Retrieving data using SELECT statement
- c) Filtering data using WHERE clause
- d) Sorting data using ORDER BY clause
- e) Aggregating data using GROUP BY and aggregate functions (SUM, AVG, COUNT, MAX, MIN)

4) Joins and Subqueries:

- a) Performing joins (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN)
- b) Writing subqueries to retrieve data
- c) Understanding correlated subqueries

5) Indexes and Views:

- a) Creating indexes for efficient data retrieval
- b) Creating and managing views
- c) Understanding materialized views

6) Transactions and Concurrency Control:

- a) Introduction to transactions
- b) ACID properties of transactions
- c) Isolation levels (READ UNCOMMITTED, READ COMMITTED, REPEATABLE READ, SERI-ALIZABLE)



d) Locking mechanisms for concurrency control

7) Database Connectivity:

- a) Connecting to databases using programming languages (e.g., Java, Python) and APIs (e.g., JDBC, SQLAlchemy)
- b) Performing CRUD operations through programming languages

8) Database Administration:

- a) Managing users and permissions
- b) Backup and recovery strategies
- c) Monitoring database performance
- d) Tuning SQL queries for better performance

9) Normalization:

- a) Understanding normalization forms (1NF, 2NF, 3NF, BCNF)
- b) Applying normalization techniques to improve database design
- 10) Stored Procedures and Triggers:
 - a) Creating and executing stored procedures
 - b) Defining and executing triggers

Database Design Project:

Students may be assigned a database design project where they have to design a database schema, implement it using SQL, and develop a simple application to interact with the database.



OBJECT ORIENTED PROGRAMMING WITH JAVA LAB

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Object Oriented Programming with Java Lab	COURSE CREDIT: 01[0-0-2]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 3 th

List of Practical:

Java Array, String, and Exception Handling

- 1.) Write a Java program to find the largest, smallest, and average value of elements in an array.
- 2.) Write a Java program to count the number of vowels, consonants, digits, and spaces in a given string.
- 3.) Create a Java program that performs matrix multiplication of two 3x3 matrices and prints the resulting matrix.
- 4.) Write a Java program to divide two numbers provided by the user. Handle exceptions for invalid inputs and division by zero using try-catch.
- 5.) Create a custom exception NegativeNumberException and write a program that throws this exception when the user enters a negative number.

Inheritance, Abstraction, Encapsulation, and Polymorphism

- 1.) Write a program demonstrating single and multilevel inheritance. Create classes like Animal \rightarrow Dog \rightarrow Puppy and demonstrate their properties and behaviors.
- 2.) Create an abstract class Shape with abstract methods area() and perimeter(). Implement these methods in subclasses like Circle and Rectangle.
- 3.) Write a program to demonstrate encapsulation by creating a class Student with private fields for name, age, and marks. Provide getter and setter methods to access and modify these fields.
- 4.) Implement method overloading by creating a Calculator class that has multiple add() methods for adding integers, doubles, and three numbers.
- 5.) Create a program where a superclass Vehicle has a method run(). Override this method in subclasses Car and Bike to demonstrate run-time polymorphism.



Packages and Interfaces

- 1.) Create a package mypackage that contains a class MathOperations with methods for addition, subtraction, multiplication, and division. Write a program to use this package.
- 2.) Write a program to read a file using classes from the java.io package and display its content on the console.
- 3.) Create an interface Bank with methods deposit() and withdraw(). Implement this interface in classes SavingsAccount and CurrentAccount.
- 4.) Create two interfaces Printable and Showable with a method display(). Implement both interfaces in a single class to demonstrate multiple inheritance.

Java Multithreading

- 1.) Write a program to see the different states of the Java Thread by extending Thread class.
- 2.) Write a program to create some threads and apply **join** method to complete a threads before other threads.
- 3.) Write a program to display names threads by using the getName() method and set the names setName() method.
- 4.) Write a program to display get priority of the threads and set priority of the threads.
- 5.) Write a program to create and run three threads by extending the Thread class. Each thread should print numbers from 1 to 5 with a delay of 1 second.
- 6.) Implement a program to create threads using the Runnable interface. The threads should display the square and cube of numbers from 1 to 5.
- 7.) Write a program to demonstrate thread synchronization by creating a shared class BankAccount where multiple threads can deposit and withdraw money. Ensure the balance remains consistent.
- 8.) Create a program to demonstrate thread priorities. Create three threads with different priorities and observe their execution order.
- 9.) Write a program to demonstrate a deadlock scenario using two synchronized methods and two threads. Explain how the deadlock occurs and how it can be resolved.



SEMESTER-IV

Sl No	Course Title	Code	Category	Credit		Ту	pe	
					L	Τ	Р	S
1	Computer Graphics		MC	4	4	0	0	0
2	Computer Networks		MC	4	3	1	0	0
3	Web Technology		MC	3	2	1	0	0
4	NM Elective IV: Operational Research		NM	4	3	1	0	0
5	Soft Skill Development IV		NV	1	0	0	2	0
6	Foreign Language II		AEC	2	2	0	0	0
7	SEC2: Entrepreneurship SEC 3						0	0
	Prac	tical						
8	Computer Graphics Lab		MC	2	0	0	4	0
9	Web Technology Lab	MC	1	0	0	2	0	
Total Credit=24								



COMPUTER GRAPHICS

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Computer Graphics	COURSE CREDIT: 04[0-0-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 4 th

THEORY

Learning objectives: On completion of the course, student will be able to decide the best techniques to be used or implemented in the creation, design and implementation of a graphical or multimedia application. During the course we will describe the structure of multimedia systems that include storage, processing and interaction of different media (graphics, video, sound, images, etc.) in an interactive and user friendly system. It provides the basics of OpenGL application programming interface which allows students to develop programming skills in CG.

Prerequisite: Before learning the concepts of Computer Graphics & Multimedia Systems, you should have a basic knowledge prior to object-oriented programming languages (C++, Java, Python, etc.), Basic Data Structures, Basics of 2D and 3D Computer Graphics. etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Overview of Graphics Systems	4	10%
Module-II: Output Primitives	8	25%
Module-III: Two Dimensional Geometric Transforma-	6	150%
tions	0	1370
Module-IV: Two-Dimensional Viewing	8	25%
Module-V: Multimedia Systems Design	6	15%
Module-VI: Data & File Format Standards	4	10%

SYLLABUS OUTLINE:

Module I: Overview of Graphics Systems: [4L]

Video Display Devices, Refresh Cathode Ray Tubes, Raster-Scan and Random-Scan Systems, Input Devices, Hard-Copy Devices and Graphics Software.

BCA-R24



Module II: Output Primitives: [8L]

Points, Line Drawing Algorithms (DDA and Bresenham's Line Drawing Algorithm), Circle- Generating Algorithms (Bresenham's and Midpoint Circle Algorithms), Ellipse-Generating Algorithms (Midpoint Ellipse Algorithm only), And Filled- Area Primitives: Scan –Line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm.

Module III: Two Dimensional Geometric Transformations: [6L]

Basic Transformations, Matrix Representations and Homogeneous Coordinates, Composite Transformations, Reflection and Shear, Transformations between Coordinates Systems, Raster Methods for Transformations.

Module IV: Two-Dimensional Viewing: [8L]

The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-View Port Coordinate Transformation, Clipping- Point, Line (Cohan-0Sutherland Line Clipping and Liang –Barsky Line Clipping) and Polygon Clipping (Sutherland- Hodgeman Polygon Clipping).

Module V: Multimedia Systems Design: [6L]

Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Multimedia Data Interface Standards, the Need for Data Compressions, Multimedia Database.

Module VI: Data & File Format Standards: [4L]

Rich – Text Format, TIFF File Format, RIFF, MIDI File Format, JPEG DIB File Format, MPEG Standards.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) D.Hearn & M. P. Baker -Computer Graphics C Version, 2nd Edition Pearson Education, New Delhi, 2006
- 2) J. F. Koegel Buferd -Multimedia Systems, Pearson Education, New Delhi, 2006
- 3) J.D.Foley- Computer Graphics, 2nd Edition, Pearson Education, New Delhi, 2004



Reference Books:

1) R.A. Plastock et.al. - Computer Graphics (Schaums Outline Series), 2nd Edition, TMH, New Delhi, 2006.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	2	-	-	-	-	-	-	2
CO2	3	3	2	-	3	-	-	-	-	-	-	2
CO3	3	3	3	-	3	-	-	-	-	-	-	3
CO4	3	2	3	2	3	-	-	-	2	-	-	2
CO5	3	3	3	2	3	3	-	-	3	2	-	3
CO6	3	3	3	3	3	2	-	-	2	3	-	3
Avg.	3	2.83	2.67	1.5	2.83	1.67	-	-	1.17	0.83	-	2.5

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Have a knowledge and understanding of the structure of an interactive computer graphics system, and the separation of system components.

CO2: Have a knowledge and understanding of geometrical transformations and 3D viewing.

CO3: Have a knowledge and understanding of techniques for representing 3D geometrical objects.

CO4: Have a knowledge and understanding of interaction techniques.

CO5: Be able to create interactive graphics applications and use C++ builds functions or equivalent graphics tools (Java, Pascal) to perform item (3), above.

CO6: Perform simple 2D graphics with lines, curves and can implement algorithms to rasterizing simple shapes, fill and clip polygons and have a basic grasp of anti- aliasing techniques.



COMPUTER NETWORKS

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Computer Networks	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 4 th

THEORY

Learning objectives: On completion of the course, student will be able to

- 1) To develop an understanding of computer networking basics.
- 2) To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
- 3) Comprehend the knowledge gained in areas of Networking and Engineering
- 4) Analyze and build a robust foundation for layered protocols like TCP/IP etc.
- 5) Achieve expertise in designing, implementation and development of computer based networking environments
- 6) Comprehend the knowledge gained in areas of Networking and Engineering

Prerequisite: Before learning the concepts of Computer Networks, you should have a basic knowledge prior to computer networking basics, Basic of Internet applications and their protocols, Basics of areas of Networking and Engineering etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Data Transmission Basic Concepts and	6	170%
Terminology	0	1770
Module-II: Computer Network	6	17%
Module-III: Data Line Devices	8	22%
Module-IV: Network Layer	6	17%
Module-V: Local Area Network	6	17%
Module-VI: Network Security	4	8%

BCA-R24



SYLLABUS OUTLINE:

Module I: Data Transmission Basic Concepts and Terminology: [6L]

Data Communication Model, Communication Tasks, Parallel & Serial Transmission, Transmission Models, Transmission Channel, Data Rate, Bandwidth Signal Encoding Schemes, Data Compression, Transmission Impairments, Layering and Design Issues, OSI Model, Services and Standards.

Module II: Computer Network: [6L]

Network Topology, Performance of Network, Network Classification, Advantages & Disadvantages of Network, Transmission Media (guided and unguided), Network Architecture, OSI Reference Model, TCP/IP, SNA and DNA.

Module III: Data Line Devices: [8L]

Modems, DSL, And ADSL, Multiplexer and Different Multiplexing Techniques: (FDM, TDM). Data Link Layer: Need for Data Link Control, Frame Design Consideration, Flow Control & Error Control (Flow control mechanism, Error Detection and Correction techniques) Data Link Layer Protocol, and HDLC.

Module IV: Network Layer: [6L]

Routing, Congestion control, Internetworking principles, Internet Protocols (IPv4 packet format, Hierarchal addressing sub netting, ARP, PPP), Bridges, and Routers. Physical Layer: Function and interface, physical layer standard, null modem.

Module V: Local Area Network: [6L]

Definition of LAN, LAN topologies, Layered architecture of LAN, MAC, IEEE standard. Ethernet LAN, CSMA, CSMA/ CD, Token passing LAN.

Module VI: Network Security: [4L]

Security Requirement, Data encryption strategies, authentication protocols, Firewalls. Basic Applications: Telnet, FTP, NFS, SMTP, SNMP and HTTP.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) B. Fourauzan, "Data Communications and Networking", 6th Edition, Tata McGraw-Hill
- 2) William Stallings- Data & Communications, 10th Edition, Pearson Education



3) Tanenbaum- Computer Networks, 5th Edition, PHI, New Delhi.

Reference Books:

- 1) Data Communications & Networks, Achyut S. Godbole, Tata McGraw Hill Education Private Limited.
- 2) Data and Computer Communication, William Stalling, 7/e, Prentice Hall of India Private Ltd.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	2	-	-	-	-	-	-	2
CO2	3	3	3	-	3	-	-	-	-	-	-	2
CO3	3	3	3	-	3	-	-	-	-	-	-	2
CO4	3	3	2	-	3	-	-	-	-	-	-	2
CO5	3	3	2	2	3	3	2	3	-	-	-	3
CO6	3	3	2	3	3	3	2	3	-	-	-	3
Avg.	3	3	2.33	0.83	2.83	1	0.67	1	-	-	-	2.33

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

- CO1: To develop an understanding of Various IEEE standards for computer networks.
- CO2: Understanding the Internet protocol in multicasting routing protocols and routing algorithms.
- CO3: To learn mechanisms for overlay networks and various routing protocols
- CO4: To know the multicasting and routing algorithms.
- CO5: To acquire the basic network security principle including encryption algorithms.
- **CO6:** Examine the issues related to security in computer networks.



WEB TECHNOLOGY

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Web Technology	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: ME
CODE: XXXXXX	SEMESTER: 4 th

THEORY

Learning objectives: On completion of the course, student will be able to the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web' – HTML, the fundamentals of how the Internet and the Web function, a basic understanding of graphic production with a specific stress on creating graphics for the Web, and a general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web publishing.

Prerequisite: Before learning the concepts of Web Technology, you should have a basic knowledge prior to principles and protocols, Basic structure design of HTML, Basics of areas of network security threats etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction	2	5%
Module-II: World Wide Web and TCP/IP	5	14%
Module-III: IP Sub netting, addressing and Internet	7	100%
Routing Protocol	1	1970
Module-IV: HTML	5	14%
Module-V: JavaScript and Applets	10	29%
Module-VI: Network security techniques and Firewall	7	19%

SYLLABUS OUTLINE:

Module I: Introduction: [2L]

Overview, Network of Networks, Intranet, Extranet and Internet.



Module II: World Wide Web and TCP/IP: [5L]

Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.

Module III: IP Sub netting, addressing and Internet Routing Protocol: [7L]

Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables. Routing - Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. POP3, SMTP.

Module IV: HTML: [5L]

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. map, area, attributes of image area.

Module V: JavaScript and Applets: [10L]

Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Definition of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications. Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks.

Module VI: Network security techniques and Firewall: [7L]

Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Introduction to Firewall, Packet filtering, Stateful, Application layer, Proxy.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

1) Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.

Reference Books:

1) Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	1	-	-	2
CO2	3	3	3	3	3	2	-	-	1	-	-	3
CO3	3	3	3	3	3	-	-	-	1	-	-	3
CO4	3	3	3	3	3	2	-	-	1	-	-	3
CO5	3	3	3	3	3	2	-	-	2	2	-	3
CO6	3	3	3	3	3	3	2	3	1	-	-	3
Avg.	3	3	2.83	2.83	2.83	1.5	0.33	0.5	1.17	0.33		2.83

Highly Correlated: 3

Moderately Correlated: 2

Slightly Correlated: 1

Course Learning Outcome: (CO)

CO1: Understand the foundational concepts of networking and apply them to analyze and troubleshoot basic network connectivity issues. (Knowledge/Comprehension)

CO2: Explain the principles and protocols of the World Wide Web and TCP/IP, and demonstrate the ability to design and implement basic web applications. (Application/Analysis)

CO3: Analyse and design IP sub netting schemes, address allocation strategies, and internet routing protocols to optimize network performance and scalability. (Analysis/Evaluation)

CO4: Create well-structured HTML documents with appropriate tags and attributes, and effectively use stylesheets and multimedia elements to enhance web page presentation. (Application/Analysis)

CO5: Develop interactive web applications using JavaScript and applets, incorporating event handling, DOM manipulation, and form validation to enhance user experience. (Application/Analysis)

CO6: Identify common network security threats, implement security measures such as encryption and authentication, and configure firewalls to protect web applications and network infrastructure. (Evaluation/Synthesis)



SOFT SKILL DEVELOPMENT IV

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P-S
NAME: Soft Skill Development IV	COURSE CREDIT: 01[1-0-2-0]
DEPARTMENT: Computer Science	CATEGORY: NV
CODE: XXXXXXXXX	SEMESTER: 4 th

THEORY

Learning objectives:

- 1) To master advanced reasoning techniques.
- 2) To improve quantitative, verbal, and analytical reasoning skills.
- 3) To acquire proficiency in aptitude and reasoning across various test sections.
- 4) To enhance presentation and public speaking abilities.

Prerequisite: Nil

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Advance logic & reasoning		65%
Module-II: Aptitude and Reasoning		25%
Module-III: Personality Development		5%
Module-IV: Professional grooming		5%

SYLLABUS OUTLINE:

Module I: Advance logic & reasoning: [L]

- Coding–Decoding
- Number Series
- Odd One Out
- Abstract Reasoning Puzzles
- Cube, Cuboid, Unboxing
- Statements & Conclusion

Module II: Aptitude and Reasoning: [L]



- Classification of Numbers II
- Factors & Factorial II
- Profit and Loss
- Dishonest Seller
- Variation and Progression
- Pipes & Cisterns
- Permutations & Combinations (P&C)
- Probability

Module III: Personality Development: [L]

- Communication Skills and Personality Development
- Attitude Development
- Character Development
- Time Management

Activities: In prompt to speeches, mock presentations, postmaster exercises, audience interaction, stage presence

Module IV: Professional grooming: [L]

- Body Language Do's and Don'ts
- A Guide to Dressing
- Small Talk
- Building Rapport
- Expanding Social and Corporate Associations

Activities: Role play, emotional intelligence exercises, conflict resolution, peer feedback, cultural awareness

• Pedagogy for Course Delivery: Workshop, Group Discussions, Presentations, Lectures.

- List of Professional Skill Development Activities (PSDA):
 - In prompt to speeches,
 - mock presentations,
 - postmaster exercises,
 - audience interaction,
 - stage presence,
 - Role play,
 - emotional intelligence exercises,
 - conflict resolution,



- peer feedback,
- cultural awareness.
- Continuous Assessment: Quiz/assessment/presentation/problem solving etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	2	3
CO2	-	-	-	-	-	-	-	-	1	2	1	3
CO3	-	-	-	-	-	-	-	-	1	3	2	3
CO4	-	-	-	-	-	-	-	-	1	2	2	3
CO5	-	-	-	-	-	-	-	-	1	2	2	3
CO6	-	-	-	-	-	-	-	-	1	2	1	3
Avg.	-	-	-	-	-	-	-	-	1	2.33	1.67	3

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: To improve quantitative reasoning skills for effective problem-solving in mathematical contexts.

CO2: To enhance verbal and analytical reasoning skills for comprehensive understanding and logical analysis.

CO3: To acquire proficiency in aptitude and reasoning across various test sections to excel in competitive exams.

CO4: To enhance presentation and public speaking abilities for clear and confident communication.

CO5: To cultivate a professional demeanor and appearance, essential for career advancement and work-place success.

CO6: To develop skills and strategies to enhance career readiness and professional growth.



ENTREPRENEURSHIP

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Entrepreneurship	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: SEC
CODE: XXXXXX	SEMESTER: 4 th

THEORY

Learning objectives: The objectives of the course are to

- 1) Introduce various qualities required for entrepreneurship
- 2) Explain various entrepreneurship models
- 3) Organize interaction with successful entrepreneurs
- 4) Introduce to various tools as examples Six hat techniques

Prerequisite: Understanding of basic marketing and general awareness.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Identify qualities of entrepreneurs	8	17%
Module-II: Write project proposal	10	20%
Module-III: Use various entrepreneurship models	8	17%
Module-IV: Understand various schemes supporting entrepreneurship	8	17%
Module-V: Think creative and innovative	8	17%
Module-VI: Future of entrepreneur in India	6	12%

SYLLABUS OUTLINE:

Module I: Identify qualities of entrepreneurs: [8L]

Understanding the meaning of Entrepreneurship, Characteristics of an Entrepreneur, Classification of Entrepreneurs, Entrepreneurial Scene in India, Factors influencing Entrepreneurship.

Module II: Write project proposal: [10L]

Entrepreneurial growth - Role played by government and Non-Government agencies



Module III: Use various entrepreneurship models: [8L]

How to enter into Market - Business idea generation Techniques- Identification of Business Opportunities-Marketing Feasibility- Financial Feasibility- Technical - Legal- Managerial and Locational Feasibility.

Module IV: Understand various schemes supporting entrepreneurship: [8L]

Project Appraisal, Preparation of Business Plan, Content of a Business Plan, Project Report.

Module V: Think creative and innovative: [8L]

Franchising and Acquisition, Product Strategies, Pricing Strategies, Distribution Strategies, Promotional Strategies, Understanding the growth Stage.

Module VI: Future of entrepreneur in India: [6L]

Future of entrepreneur in India

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Dr. Gupta and Dr. Srinivasan, Entrepreneurship development in India
- 2) Vasant Desai, Dynamics of Entrepreneurial Development and Management
- 3) Sarugadharan and Resia Begum, Women Entrepreneurship; institutional support and problems

Reference Books:

- 1) VenkateshwaraRao and UdaiPareek,(Eds)Developing Entrepreneurship-A Handbook
- 2) Raja Gopal, Agriculture Business and Entrepreneurship



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	2	-	2	-	-
CO2	-	-	-	-	-	3	3	3	-	3	-	1
CO3	-	-	-	-	-	3	2	3	-	3	-	1
CO4	-	-	-	-	-	3	2	3	-	3	-	1
CO5	-	-	-	-	-	3	2	3	-	3	-	1
CO6	-	-	-	-	-	3	3	3	-	2	-	1
Avg	-	-	-	-	-	2.83	2.33	2.83	-	2.66	-	0.83

Highly Correlated: 3

Moderately Correlated: 2

Slightly Correlated: 1

Course Learning Outcome: (CO)

- CO1: Explain the background of different Entrepreneur.
- **CO2:** Utilize Entrepreneurial growth.
- CO3: Understand how to enter into Market.
- CO4: Understand Project Appraisal.
- CO5: Utilize different technique of risk management.
- CO6: Illustrate future of entrepreneur in India.



THIRD YEAR

SEMESTER-V

Sl No	Course Title	Code	Category	Credit		Ту	pe	
					L	Т	P	S
1	Unix and Shell Programming		MC	4	4	0	0	0
2	Cryptography and Network Security		MC	4	3	1	0	0
3	NM Elective V: Organisational Behaviour		NM	4	3	1	0	0
4	PHP with MySQL		MC	3	2	1	0	0
5	Soft Skill Development V		NV	1	0	0	2	0
6	SEC3: Logical Ability		SEC	3	2	1	0	0
	Practi	ical						
7	Unix and Shell Programming Lab		MC	1	0	0	2	0
8	PHP with MySQL Lab		MC	1	0	0	2	0
			Total C	redit=21				



UNIX AND SHELL PROGRAMMING

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Unix and Shell Programming	COURSE CREDIT: 04[4-0-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 5 th

THEORY

Learning objectives: On completion of the course, student will be able

- 1) To provide introduction to UNIX Operating System and its File System
- 2) To gain an understanding of important aspects related to the SHELL and the process
- 3) To develop the ability to formulate regular expressions and use them for pattern matching.
- 4) To provide a comprehensive introduction to SHELL programming, services and utilities.

Prerequisite: Student must know at least the basics of how to use a computer, and should be able to start a command line shell and Operating System. If you are new to programming then Introduction to Programming is strongly recommended. If you already know C,java and python unix should be easy to pick up.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to Unix	4	8%
Module-II: The File system	8	17%
Module-III: UNIX Files	4	8%
Module-IV: Filters	10	21%
Module-V: Shell Programming	12	25%
Module-VI: Unix Process	10	21%

SYLLABUS OUTLINE:

Module I: Introduction to Unix: [4L]

Introduction to UNIX: UNIX operating system, UNIX architecture: Kernel and Shell, Files and Processes, System calls, Features of UNIX, POSIX and single user specification, Internal and external commands.



Utilities of UNIX: Calendar (cal), Display system date (date), Message display (echo), Calculator (bc), Password changing (password), Knowing who are logged in (who), System information using uname, File name of terminal connected to the standard input (tty)

Module II: The File system: [8L]

File system, Types of file, File naming convention, Parent – Child relationship, HOME variable, inode number, Absolute pathname, Relative pathname, Significance of dot (.) and dotdot (..), Displaying pathname of the current directory (pwd), Changing the current directory (cd), Make directory (mkdir), Remove directories (rmdir), Listing contents of directory (ls), Very brief idea about important file systems of UNIX: /bin, /usr/bin, /etc, /dev, /lib, /usr/lib, /usr/include, /usr/share/man, /temp, /var, /home

Module III: UNIX Files: [4L]

Ordinary file handling: Displaying and creating files (cat), Copying a file (cp), Deleting a file (rm), Renaming/ moving a file (mv), Paging output (more), Printing a file (lp), Knowing file type (file), Line, word and character counting (wc), Comparing files (cmp), Finding common between two files (comm), Displaying file differences (diff), Creating archive file (tar), Compress file (gzip), Uncompress file (gunzip), Archive file (zip), Extract compress file (unzip), Brief idea about effect of cp, rm and mv command on directory

File attributes: File and directory attributes, File ownership, File permissions, Changing file permissions – relative permission & absolute permission, Changing file ownership, Changing group ownership, File system and inodes, Hard link, Soft link, Significance of file attribute for directory, Default permissions of file and directory and using umask, Listing of modification and access time, Time stamp changing (touch), File locating (find)

Module IV: Filters: [10L]

Introduction to UNIX Filters: Overview of filters and their role in UNIX systems, Basic command-line usage and piping in UNIX. Common UNIX Filters: grep, sed, awk, cut, sort, uniq, tr, head, tail, Brief idea of using Basic Regular Expression (BRE), Extended Regular Expression (ERE), and egrep, grep –E

Module V: Shell Programming: [12L]

Introduction: Overview of shell and types of shells (Bourne shell, C shell, Korn shell, etc.), Role of the shell in UNIX/Linux systems, Basic shell commands and syntax. **Shell Script Basics:** Writing and executing simple shell scripts, Understanding shell script structure (shebang, comments, variables, etc.), Input/ output redirection and pipes. **Shell Variables:** Types of variables (user-defined and environment variables) Variable scope and exporting variables, Command substitution. **Conditional Statements:** if, else, and elif constructs, Testing conditions using test command and conditional expressions, Case statements for pattern matching (case). **Loops and Iteration:** for, while, and until loops for iteration Nested loops and control flow (break, continue). **Functions in Shell:** Defining and using functions in shell scripts,



Function arguments and return values Scope of variables in functions. **File Handling in Shell Scripts:** Reading from and writing to files, File manipulation commands (cat, rm, mv, cp, etc.) File tests and permissions. **Input/Output Handling:** Command-line arguments and positional parameters (\$1, \$2, etc.), Handling user input with read, Output formatting and redirection, **Advanced Shell Scripting:** Arrays and handling multiple values, Signal handling and trapping (trap command).

Module VI: Unix Process: [10L]

The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command-The Kill Command-Job Control. Sending job to background (bg) and foreground (fg), Listing jobs (jobs), Suspend job, Kill a job, Execute at specified time (at and batch)

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
- 2) Introduction to Unix Shell Programming by M.G. Venkateshmurthy, Pearson.

Reference Books:

- "Beginning Unix", Paul Love, Joe Merlino, Craig Zimmerman, Jeremy C. Reed, and Paul Weinstein, 2nd ed., Indianapolis: Wrox Press, 2015.
- 2) "Learning the Bash Shell", Cameron Newham, 4th ed., Sebastopol: O'Reilly Media, 2020.
- "The Linux Command Line: A Complete Introduction", William E. Shotts, 2nd ed., San Francisco: No Starch Press, 2019.
- 4) "Shell Scripting: How to Automate Command Line Tasks Using Bash Scripting and Shell Programming", David A. Wheeler, Create Space Independent Publishing, 2021.
- 5) "Bash Scripting and Shell Programming (Linux Command Line)", Sorin Dumitrascu CreateSpace Independent Publishing, 2019.
- 6) "Mastering Unix Shell Scripting: Bash, Bourne, and Korn Shell Scripting for Programmers, System Administrators, and UNIX Gurus", Jon Emmons, 3rd ed., Indianapolis: Addison-Wesley, 2022.



	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	1	-	1	1	-	-	1
CO2	3	3	2	-	2	1	-	1	1	-	-	1
CO3	3	3	3	2	2	1	-	1	2	-	-	1
CO4	2	2	-	3	3	2	-	1	1	-	-	1
CO5	2	2	-	3	3	2	-	1	2	1	-	2
CO6	2	3	2	-	3	3	2	1	2	2	1	2
Avg.	2.5	2.5	1.17	1.33	1.5	1.67	0.33	1	1.5	0.5	0.17	1.33

Highly Correlated: **3** Moderately Correlated: **2**

Slightly Correlated: 1

Course Learning Outcome: (CO)

CO1: Student will understand the architecture of UNIX, including the Kernel, Shell, and key system utilities, and demonstrate the use of basic UNIX commands for system interaction and user management.

CO2: Analyze and manage the UNIX file system, including file types, pathnames, directories, and important system directories, along with the use of commands for file and directory operations.

CO3: Demonstrate the ability to perform file manipulation operations such as creation, deletion, copying, moving, and comparison, and modify file attributes, permissions, and ownership in UNIX.

CO4: Apply various UNIX filters like grep, sed, awk, and regular expressions for text processing, data extraction, and manipulation in a UNIX environment.

CO5: Develop and execute shell scripts using basic programming constructs like variables, conditionals, loops, and functions to automate tasks and handle files in UNIX.

CO6: Understand process management in UNIX, including job control, process creation, and the use of commands like bg, fg, jobs, and kill to manage system processes effectively.



CRYPTOGRAPHY AND NETWORK SECURITY

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Cryptography and Network Security	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 5 th

THEORY

Learning objectives: On completion of the course, student will be able to Learn fundamentals of cryptography and its application to network security, Understand network security threats, security services, and countermeasures, Acquire background on hash functions; authentication; firewalls; intrusion detection techniques, mitigate software security vulnerabilities in existing systems etc.

Prerequisite: Before learning the concepts of Cryptography and Network Security, you should have a basic knowledge prior to fundamentals of cryptography and network security, Basics of areas of knowledge about different mobile platforms and application development etc.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)	
	Contact hour		
Module-I: Introduction	2	3%	
Module-II: Conventional Cryptographic Techniques	8	25%	
Module-III: Algorithm types & Modes	8	25%	
Module-IV: Digital Signature and RSA - Introduction	8	25%	
Module-V: Basic Concepts and applicationse	6	15%	
Module-VI: Secure Socket Layer & Transport Layer	4	70	
Security	4	1 %0	

SYLLABUS OUTLINE:

Module I: Introduction: [2L]

Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.

Module II: Conventional Cryptographic Techniques: [8L]

Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher,



Steganography.

Module III: Algorithm types & Modes: [8L]

Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

Module IV: Digital Signature and RSA - Introduction: [8L]

Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required.

Module V: Basic Concepts and applications: [6L]

Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

Module VI: Secure Socket Layer & Transport Layer Security: [4L]

Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction, Intruders, Intrusion Detection, Password Management, Malicious Software, Firewalls, Trusted Systems.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
- 2) "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
- 3) "Cryptography & Network Security: Atul Kahate, TMH.
- 4) "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.

Reference Books:

- 1) "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
- 2) "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
- 3) "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition,



Oreilly

4) "Cryptography and Network Security", V.K. Jain, Khanna Publishing House, 2017.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
Avg.												

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understand the most common type of cryptographic algorithm and understand the Public-Key Infrastructure.

CO2: Understand security protocols for protecting data on networks.

CO3: Be able to digitally sign emails and files and understand vulnerability assessments and the weakness of using passwords for authentication.

CO4: Be able to perform simple vulnerability assessments and password audits.

CO5: Be able to configure simple firewall architectures.

CO6: Understand Virtual Private Networks.



PHP WITH MYSQL

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: PHP with MySQL	COURSE CREDIT: 03[2-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 5 th

THEORY

Learning objectives: By the end of this course, students will:

- 1) Understand the fundamentals of PHP and its syntax.
- 2) Be able to handle user inputs and form submissions in PHP.
- 3) Manage and manipulate data using arrays and strings in PHP.
- 4) Gain proficiency in basic SQL queries and database management using MySQL.
- 5) Integrate PHP with MySQL to create dynamic and interactive web applications.
- 6) Learn advanced techniques in PHP and MySQL for secure and efficient web development.

Prerequisite: Students enrolling in this course should have a basic understanding of HTML, CSS, and JavaScript to effectively manage front-end development aspects. Familiarity with fundamental programming concepts such as variables, loops, and conditional statements is also required for comprehending PHP and database operations.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to PHP	4	11%
Module-II: Working with Forms and User Input	4	11%
Module-III: Arrays, Strings, and MySQL	8	22%
Module-IV: PHP and MySQL Integration	6	17%
Module-V: Advanced PHP and MySQL	6	17%
Module-VI: Building Web Application	8	22%

SYLLABUS OUTLINE:

Module I: Introduction to PHP: [4L]

Overview of PHP: History and Features, Basic Syntax of PHP, Embedding PHP in HTML, Variables,

BCA-R24



Constants, Data Types, and Operators, Control Structures: Conditional Statements and Loops, PHP Functions: Built-in Functions and User-defined Functions

Module II: Working with Forms and User Input: [4L]

HTML Forms and PHP: Form Handling, Form Validation, and Form Sanitization, Handling GET and POST Methods, Working with Cookies and Sessions, File Uploads: Handling File Uploads in PHP.

Module III: Arrays, Strings, and MySQL: [8L]

Arrays: Types of Arrays, Array Functions, and Array Sorting. String Handling: String Functions, Regular Expressions, and Pattern Matching

Overview of MySQL: Features and Installation

Basic SQL Queries: SELECT, INSERT, UPDATE, DELETE; Database Design and Normalization, Creating and Managing Databases and Tables Data Types in MySQL, Relationships and Joins

Module IV: PHP and MySQL Integration: [6L]

Connecting to MySQL Database using PHP, Executing SQL Queries in PHP, Fetching Data from MySQL Database, Displaying Data in Web Pages, Error Handling in Database Operations, Prepared Statements and Parameterized Queries.

Module V: Advanced PHP and MySQL: [6L]

Working with Stored Procedures and Functions, Managing Transactions, Introduction to Object-Oriented Programming (OOP) in PHP, Security Considerations: SQL Injection, XSS, and Data Sanitization.

Module VI: Building Web Application: [8L]

Project Planning and Design, Implementing User Authentication and Authorization, Developing CRUD Operations, Using AJAX with PHP and MySQL for Asynchronous Web Applications, Testing and Debugging, Deployment and Hosting.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) "PHP and MySQL Web Development" by Luke Welling and Laura Thomson
- 2) "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5" by Robin Nixon



Reference Books:

- 1) "PHP for the Web: Visual QuickStart Guide" by Larry Ullman
- 2) "Murach's PHP and MySQL" by Joel Murach

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
Avg.												

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Comprehend the basic syntax and features of PHP, including variables, data types, control structures, and functions.

CO2: Handle HTML forms in PHP, ensuring proper validation and sanitization of user inputs, and manage session and cookie data securely.

CO3: Utilize PHP's array and string functions to effectively manipulate data, perform operations, and solve complex data handling problems.

CO4: Design and manage MySQL databases, write SQL queries to perform CRUD operations, and integrate PHP with MySQL for dynamic web applications.

CO5: Apply best practices in PHP and MySQL for secure coding, prevent common vulnerabilities like SQL injection and XSS, and ensure robust data management.

CO6: Plan, design, and implement a full-fledged web application using PHP and MySQL, including user authentication, CRUD operations, AJAX integration, and deployment.



UNIX AND SHELL PROGRAMMING LAB

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Unix and Shell Programming Lab	COURSE CREDIT: 01[0-0-2]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 5 th

List of practical:

- 1) Basic Unix Commands:
 - *mkdir*, *rmdir*, *cat*, *ls*, *ls*−*il*, *ls*−*li*, *pwd*, *cp*, *mv*, *rm*, *man*.

2) File Permissions:

- Relative file permission
- Absolute file permission

3) Working with Variables in Shell:

• Write a shell script that defines and uses variables for performing arithmetic operations like addition, subtraction, multiplication, and division.

4) Decision Making in Shell Scripting

- a) Write a script that takes an input number and checks if it is positive number or negative number.
- b) Write a script that takes an input number and checks if it is odd or even.
- c) Write a script that takes an year and checks if it is leap year or not.

5) Loops in Shell:

- a) Write a shell script to print the first 10 natural numbers.
- b) Write a shell script to find sum of first N natural numbers.
- c) Write a shell script to find factorial of a number.
- d) Write a shell script to find sum of digits of a number.
- e) Write a shell script to find reverse of a number.
- f) Write a shell script to check whether a number is palindrome or nor.
- g) Write a shell script to check whether a number is armstrong or not.
- h) Write a shell script to check whether a number is prime or not.
- i) Write a shell script to print a Fibonacci series.

6) File Manipulation and Filters:

- a) File manipulation commands: cat, rm, mv, wc, cp, etc.
- b) UNIX Filters:
 - i) grep: Searching and filtering text based on patterns



- ii) sed: Stream editor for text manipulation and transformation
- iii) awk: Pattern scanning and processing language for text files
- iv) cut: Cutting sections from lines of files
- v) sort: Sorting lines of text files
- vi) uniq: Report or omit repeated lines
- vii) tr: Translating or deleting characters from text
- viii) head and tail: Displaying the first or last lines of a file

7) Array:

- a) Write a shell script to create an array and display its elements
- b) Write a shell script to find the length of an array
- c) Write a shell script to print elements of an array using a loop
- d) Write a shell script to add and remove elements in an array
- e) Write a shell script to sum all numbers in an array
- f) Write a shell script to reverse an array
- g) Write a shell script to find the maximum and minimum values in an array
- h) Write a shell script to check if an element exists in an array
- i) Write a shell script to concatenate two arrays
- j) Write a shell script to find the average of array elements

8) File Handling:

- a) Write a shell script to create and write to a file, then store file contents into disk.
- b) Write a shell script to append content to an existing file.
- c) Write a shell script that copies a file to a new directory and checks whether the file has been successfully copied.
- d) Write a shell script that copies contents of a file to an another file and checks whether the file has been successfully copied.
- e) Write a shell script that searches for a file in a directory and deletes it if found.
- f) Write a shell script to count and display the number of lines, words, and characters in a file.



PHP WITH MYSQL LAB

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: PHP with MySQL Lab	COURSE CREDIT: 01[0-0-2]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 5 th

List of Practical:

Introduction to PHP

- 1) Assignment 1: Basic PHP Syntax
 - a) Create a PHP script to display "Hello, World!" in the browser.
 - b) Modify the script to accept and display a user's name via URL using \$_GET.
- 2) Assignment 2: PHP Variables and Data Types
 - a) Write a PHP script to declare different variables and demonstrate data types (string, integer, float, and boolean).
 - b) Perform arithmetic operations using variables.
- 3) Assignment 3: Conditional Statements and Loops
 - a) Create a PHP script that checks if a number is even or odd.
 - b) Write a loop to display numbers from 1 to 10.

Working with Forms and User Input

- 1) Assignment 1: HTML Forms with PHP
 - a) Create a form to accept user information like name, email, and phone number.
 - b) Capture and display the data using PHP.
- 2) Assignment 2: Form Validation
 - a) Enhance the above form to validate input fields. Check for required fields, valid email format, and display appropriate error messages.
- 3) Assignment 3: Handling GET and POST Requests
 - a) Create a form where user input is sent using both GET and POST methods.
 - b) Display the user input after submission for each method.

Arrays, Strings, and MySQL

1) Assignment 1: Working with Arrays


- a) Write a PHP script to create an array of numbers and perform operations like sorting, reversing, and finding the maximum/minimum value.
- 2) Assignment 2: String Manipulation
 - a) Write a PHP script to demonstrate string functions such as concatenation, length, substring, and searching within a string.
- 3) Assignment 3: MySQL Database Creation
 - a) Using MySQL, create a database students with a table student_info (fields: id, name, age, email).
 - b) Write a PHP script to insert data into the database.

PHP and MySQL Integration

- 1) Assignment 1: Connecting PHP with MySQL
 - a) Write a PHP script to connect to the MySQL database and display a success message on a successful connection.
- Assignment 2: Inserting Data into Database Extend the form created in Module-II to insert user input into a MySQL database using a prepared statement.
- 3) Assignment 3: Retrieving Data from MySQLWrite a PHP script to retrieve and display data from the student_info table on a webpage.

Advanced PHP and MySQL

- 1) Assignment 1: Updating and Deleting Data
 - a) Write a PHP script that allows users to update their data (e.g., email) and delete specific records in the MySQL table.
- 2) Assignment 2: User Authentication
 - a) Create a simple login form and use PHP to validate the user's credentials from a MySQL database.
- 3) Assignment 3: File Upload with PHP
 - a) Write a PHP script that allows users to upload files to the server. Validate file types and sizes.

Building Web Application

- 1) Assignment 1: Building a Student Management System
 - a) Create a simple web application using PHP and MySQL that allows:
 - b) Inserting new student records.
 - c) Viewing, updating, and deleting student records.
 - d) Searching for students by name or ID.
- 2) Assignment 2: Implementing Pagination
 - a) Write a PHP script to display data from the MySQL database with pagination.



- 3) Assignment 3: Basic E-commerce Application
 - a) Build a simple e-commerce site that lists products, allows users to add items to a cart, and check out using session management.



SEMESTER-VI

Sl No	Course Title	Code	Category	Credit		Ту	pe	
					L	T	P	S
1	Fundamental of Data Science		MC	4	3	1	0	0
2	Software Engineering		MC	4	3	1	0	0
3	NM Elective VI: Decision Support System		NM	4	3	1	0	0
4	Cloud Computing/ Cyber Security		ME	3	3	0	0	0
5	Soft Skill Development VI		NV	1	0	0	2	0
6	Ethic Study and IPR		VAC	2	2	0	0	0
7	Software Engineering Lab		MC	1	0	0	2	0



FUNDAMENTAL OF DATA SCIENCE

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Fundamental of Data Science	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 6 th

THEORY

Learning objectives: Apply data science techniques to real-world problems: Students should gain practical experience by working on real-world data science projects. They should be able to identify business or research problems, design and implement data science solutions, and evaluate the effectiveness of their models or algorithms.

Prerequisite: Basic concept of probability statistics

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Fundamental of Data Science Practices	10	21%
Module-II: Probability Theory and Statistical Inference	6	12%
Module-III: Machine Learning Techniques	10	21%
Module-IV: Data Visualization	6	12%
Module-V: Handling Large Datasets	8	17%
Module-VI: Data Privacy and Security	8	17%

SYLLABUS OUTLINE:

Module-I: Fundamental of Data Science Practices: [10L]

Overview of data science, Role of data scientists, Data science workflow, Programming for Data Science, Data Engineering, Data manipulation and cleaning, Grammar of Data using pandas (Python) or dplyr(R), Exploratory data analysis, Data Pre-processing and Feature Engineering, Data cleaning and transformation (handling missing values, dimensionality reduction using PCA), Feature selection and engineering, and dealing with data imbalances.

Module-II: Probability Theory and Statistical Inference: [6L]

Probability and distributions, Bayesian Inference, Hypothesis testing and confidence intervals, Regression



analysis (one variable regression and association).

Module-III: Machine Learning Techniques: [10L]

Supervised learning: classification and regression, Unsupervised learning: clustering (KNN), Deep Learning: Neural Networks, Role of Hidden Layers.

Module-IV: Data Visualization: [6L]

Grammar of Graphics and different kinds of plots using visualization libraries (matplotlib, seaborn, ggplot for Python or ggplot2 for R, etc.), Interactive visualizations with tools like Tableau or PowerBI, D3.js.

Module-V: Handling large Datasets: [8L]

Introduction to Big Data, Distributed computing frameworks (e.g., Hadoop, MapReduce, Spark), Ethical Considerations in Data Science, Bias and Fairness in data analysis.

Module-VI: Data Privacy and Security: [8L]

Introduction to Data Privacy, Application of Data Science, Case studies and real-world applications in various domains.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) VanderPlas, Jake. Python Data Science Handbook: Essential Tools for Working with Data. O'Reilly Media, 2016.
- Provost, Foster, and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking. O'Reilly Media, 2013.
- 3) Grolemund, Garrett, and Hadley Wickham. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media, 2016

Reference Books:

- 1) McKinney, Wes. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media, 2017.
- 2) Deisenroth, Marc Peter, A Aldo Faisal, and Cheng Soon Ong. Mathematics for Machine Learning. Cambridge University Press, 2020.
- 3) Cioara, Jeremy, et al. Python Data Science Essentials. Packt Publishing, 2015.



CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	3								1
CO2	2	2	2	2	3							3
CO3	2	2	2	3								3
CO4	2	1	2	3	3							2
CO5	2	1	2	2	1							1
CO6	2	2	2	2	3							2
Avg.	2	1.9	2	2.3	1.6							2.1

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Students should gain a solid understanding of the fundamental concepts and principles of Data Science, including data collection, cleaning, exploration, visualization, statistical analysis, machine learning, and data-driven decision-making.

CO2: Students should develop proficiency in programming languages commonly used in Data Science, such as Python or R. They should be able to write code to manipulate data, perform statistical analysis, and build machine learning models

CO3: Students should acquire skills to effectively manipulate and analyze large and complex datasets. This includes skills in data pre-processing, feature engineering, data transformation, and data visualization.

CO4: Students should learn various statistical analysis techniques and modeling approaches used in Data Science. This includes understanding of descriptive statistics, inferential statistics, hypothesis testing, regression analysis, time series analysis, and other statistical modeling techniques.

CO5: Students should become familiar with a range of machine learning algorithms and techniques, such as linear regression, logistic regression, decision trees, random forests, support vector machines, clustering, and neural networks. They should understand the principles behind these algorithms and know how to apply them to real-world problems.

CO6: Students should develop skills in visualizing and communicating data insights effectively. This includes creating meaningful visualizations, interpreting and presenting results, and effectively communicating findings to both technical and non-technical audiences.



SOFTWARE ENGINEERING

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Software Engineering	COURSE CREDIT: 04[3-1-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 6 th

THEORY

Learning objectives: On completion of the course, student will be able to:

- 1) Understand Software Development Life cycle.
- 2) Apply Software Engineering Principles and Methodologies.
- 3) Understand software complexity and project estimation.
- 4) Understand Software Testing Techniques.
- 5) Project Management and Collaboration.

Prerequisite: Prior knowledge in computer programming and familiarity with basic data structures and algorithms is essential for learning software engineering. Additionally, understanding fundamental concepts in software development methodologies and processes will provide a solid foundation for comprehending advanced topics in software engineering.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Software Process Models	4	8%
Module-II: Software Requirements	4	8%
Module-III: Software Design	8	17%
Module-IV: Software Quality	10	21%
Module-V: Estimation and Scheduling of Software Projects	10	21%
Module-VI: Software Testing	12	25%

SYLLABUS OUTLINE:

Module I: Software Process Models: [4L]

Software Process, Process Lifecycle, Prescriptive Process Models, Project Management, Component Based



Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models – Extreme Programming (XP), Adptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering.

Module II: Software Requirements: [4L]

Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software Requirment and Specification (SRS) Document.

Module III: Software Design: [8L]

Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Module IV: Software Quality: [10L]

McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM); Software Reliability.

Module V: Estimation and Scheduling of Software Projects: [10L]

Software Sizing, LOC and FP based Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts.

Module VI: Software Testing: [12L]

Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Tesing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.

Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Sommerville, Ian. Software Engineering. 10th ed., Addison-Wesley, 2015.
- 2) Pressman, Roger S. Software Engineering: A Practitioner's Approach. 9th ed., McGraw-Hill Educa-



tion, 2021.

- Pfleeger, Shari Lawrence, Joanne M. Atlee, and Robert L. Glass. Software Engineering: Theory and Practice. 4th ed., Pearson, 2014.
- 4) Ian, Mauro Pezzè, and Michal Young. Software Testing and Analysis: Process, Principles, and Techniques. Wiley, 2007.

Reference Books:

- 1) Ghezzi, Carlo, Mehdi Jazayeri, and Dino Mandrioli. Fundamentals of Software Engineering. 2nd ed., Prentice Hall, 2010.
- Bass, Len, Paul Clements, and Rick Kazman. Software Architecture in Practice. 3rd ed., Addison-Wesley, 2012.
- 3) Shaw, Mary, and David Garlan. Software Architecture: Perspectives on an Emerging Discipline. Prentice Hall, 1996.
- 4) Wazlawick, Raul Sidnei. Object-Oriented Analysis and Design for Information Systems: Modeling with UML, OCL, and IFML. Elsevier, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	-	2	-	-
CO2	3	3	3	2	2	1	1	1	-	2	-	-
CO3	3	3	3	2	3	2	1	1	-	2	1	-
CO4	3	3	3	2	3	1	1	1	-	2	1	-
CO5	3	2	2	2	3	1	1	1	-	1	1	-
CO6	3	3	2	2	3	2	1	1	-	2	1	1
Avg.	3	2.83	2.67	2	2.67	1.33	1	1	-	1.83	1	1

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understand and compare different software process models, including prescriptive, agile, and component-based models, to assess their applicability in diverse project contexts.

CO2: Develop skills in eliciting, analyzing, and documenting functional and non-functional requirements



through use case development and requirement modeling.

CO3: Apply key design principles such as modularity, abstraction, and cohesion, and demonstrate the ability to perform architectural, component-level, and interface design in software projects.

CO4: Evaluate software quality using established quality models like McCall's and ISO 9126, and implement quality assurance and risk management strategies in software development.

CO5: Utilize software sizing techniques (LOC, FP) and estimation models (COCOMO) to estimate cost, effort, and schedule, and create effective project timelines.

CO6: Understand and apply various software testing techniques (unit, integration, white-box, black-box) and configuration management practices to ensure the reliability and maintainability of software systems.



CLOUD COMPUTING

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Cloud Computing	COURSE CREDIT: 03[3-0-0]
DEPARTMENT: Computer Science	CATEGORY: ME
CODE: XXXXXX	SEMESTER: 6 th

THEORY

Learning objectives: This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.

Prerequisite: Familiarity with Operating Systems. Understanding of Virtualization, Basics of Networking. Basic Understanding of Different Types of Cloud.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction	4	11%
Module-II: Cloud enabling technologies	6	17%
Module-III: Cloud architecture, services and storage	8	22%
Module-IV: Resource management and security in cloud	6	17%
Module-V: Cloud technologies and advancements	4	11%
Module-VI: Concepts of Services and Applications	8	22%

SYLLABUS OUTLINE:

Module I: Introduction: [4L]

Cloud Computing Overview Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling ,Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

Module II: Cloud enabling technologies: [6L]

Cloud Insights Architectural influences- High-performance computing, Utility and Enterprise grid com-



puting, Cloud scenarios– Benefits: scalability, simplicity, vendors, security, Basics of Virtualization– Types of Virtualization, Virtualization Structures– Tools and Mechanisms, Virtualization of CPU– Memory, Limitations– Sensitive information- Application development- security level of third party- security benefits, Virtualization Support and Disaster Recovery. Regularity issues: Government policies.

Module III: Cloud architecture, services and storage: [6L]

Cloud Architecture- Layers and Models Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds– Private clouds– Community clouds- Hybrid clouds - Advantages of Cloud computing.

Module IV: Resource management and security in cloud: [6L]

Inter Cloud Resource Management, Resource Provisioning and Resource Provisioning, Global Exchange of Cloud Resources, Security Overview – Cloud Security Challenges, Software-as-a-Service, Software-as-a-Service, Software-as-a-Service, Software-as-a-Service, Security Governance, Virtual Machine Security, IAM – Security Standards.

Module V: Cloud technologies and advancements: [4L]

Introduction to VMWare Simulator Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Module VI: Concepts of Services and Applications: [8L]

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, workflow and Co-ordination of Multiple components.

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs

Cloud-based Storage: Customer-facing data, Distributed-access data, Data backups, Sensitive data, Synchronized data, Large databases, Public and private Cloud Storage, Cloud Storage Service, Utility Storage, Storage Virtualization, Cooperative Storage Cloud.

Integration of cloud with Wireless Sensor Network, A framework of Cloud and WSN. Different Applications in WSN in cloud infrastructure.

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services



- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
- 2) Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons.
- 3) Cloud Computing Solutions: Architecture, Data Storage, Implementation and Security, S. Pal, Dac-Nhuong Le, P. K. Pattnaik, John Wiley & Sons Inc, 2020

Reference Books:

- 1) Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, 2013.
- 2) Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	1	-	1	-	-
CO2	3	3	3	2	3	2	1	1	-	1	-	-
CO3	3	3	3	2	3	1	-	1	-	1	-	1
CO4	3	3	3	2	3	2	1	1	-	1	-	1
CO5	3	2	2	2	3	1	1	1	-	1	1	1
CO6	3	3	2	2	3	2	1	1	-	2	1	1
Avg.	3	2.83	2.5	2	2.83	1.5	1	1	-	1.17	1	1

CO-PO Mapping:

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understand the fundamental characteristics and components of cloud computing, and compare the advantages of cloud providers with traditional IT service models.

CO2: Analyze the architectural influences and benefits of cloud computing, with a focus on virtualization technologies and disaster recovery strategies, while addressing security and regulatory issues.



CO3: Explore the layers of cloud architecture and the models of cloud services (SaaS, PaaS, IaaS), and evaluate their advantages, challenges, and risks in cloud adoption.

CO4: Demonstrate understanding of cloud resource management, provisioning strategies, and cloud security challenges, with a focus on virtual machine security and identity and access management (IAM).

CO5: Utilize VMware technologies to create, clone, and manage virtual machines, and understand their role in cloud environments.

CO6: Gain proficiency in service-oriented architecture (SOA), cloud-based applications, and cloud storage concepts, including data management, system abstraction, and integration with wireless sensor networks.



CYBER SECURITY

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Cyber Security	COURSE CREDIT: 03[3-0-0]
DEPARTMENT: Computer Science	CATEGORY: ME
CODE: XXXXXX	SEMESTER: 6 th

THEORY

Learning objectives: This course aims to provide a comprehensive understanding of cyber security principles and practices. Students will explore various types of attacks on computers and the fundamental concepts of cryptography, including both symmetric and asymmetric key algorithms. The course will cover advanced topics such as digital signatures, RSA, and Internet security protocols. Additionally, students will learn about user authentication methods, electronic mail security, and the implementation and management of firewalls, equipping them with the necessary skills to protect and secure digital information.

Prerequisite: Students in this course should have a foundational knowledge of computer science and networking concepts. Familiarity with basic programming, data structures, and algorithms is essential, as well as an understanding of operating systems and network protocols.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Attacks on Computers & Computer Security	4	11%
Module-II: Cryptography: Concepts & Techniques	8	22%
Module-III: Symmetric Key Algorithm	8	22%
Module-IV: Asymmetric Key Algorithm, Digital	8	220%
Signature and RSA	0	
Module-V: Internet Security Protocols, User	1	120%
Authentication	+	1270
Module-VI: Electronic Mail Security and Firewall	4	11 %

SYLLABUS OUTLINE:

Module I: Attacks on Computers & Computer Security: [4L]

Introduction, Need for Security, Security approaches, Principles of Security, Types of attack



Module II: Cryptography: Concepts & Techniques: [8L]

Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques.

Module III: Symmetric Key Algorithm: [8L]

Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) Algorithm.

Module IV: Asymmetric Key Algorithm, Digital Signature and RSA: [8L]

Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required)

Module V: Internet Security Protocols, User Authentication: [4L]

Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

Module VI: Electronic Mail Security and Firewall: [4L]

Basics of mail security, Pretty Good Privacy, S/MIME, Introduction to Firewall, Types of firewall, Firewall Configurations, DMZ Network.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.

Text & Reference books:

Text Books:

- 1) Stallings, William. Cryptography and Network Security: Principles and Practice. 7th ed., Pearson, 2017.
- Paar, Christof, and Jan Pelzl. Understanding Cryptography: A Textbook for Students and Practitioners.
 2nd ed., Springer, 2010.
- 3) Kaufman, Charlie, Radia Perlman, and Mike Speciner. Network Security: Private Communication in a Public World. 2nd ed., Prentice Hall, 2002.
- Schneier, Bruce. Applied Cryptography: Protocols, Algorithms, and Source Code in C. 2nd ed., Wiley, 1996



Reference Books:

- 1) Ferguson, Niels, Bruce Schneier, and Tadayoshi Kohno. Cryptography Engineering: Design Principles and Practical Applications. Wiley, 2010.
- Forouzan, Behrouz A., and Debdeep Mukhopadhyay. Cryptography and Network Security. McGraw-Hill Education, 2018.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	1	-	1	-	1
CO2	3	3	3	2	3	-	-	1	-	1	-	1
CO3	3	3	3	2	3	-	-	1	-	1	-	1
CO4	3	3	3	2	3	-	-	1	-	1	-	1
CO5	3	3	2	2	3	1	-	1	-	1	1	1
CO6	3	3	2	2	3	1	-	1	-	2	1	1
Avg.	3	3	2.5	2	2.67	1	1	1	-	1.17	1	1

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Understand the need for computer security, security principles, and various types of attacks that can compromise system integrity.

CO2: Demonstrate knowledge of cryptographic techniques, including symmetric and asymmetric encryption, and apply substitution and transposition methods to secure data.

CO3: Analyze symmetric key algorithms such as DES, IDEA, and RC5, understanding their structure, modes, and applications in securing communication.

CO4: Explore asymmetric key cryptography, RSA algorithm, and the use of digital signatures to secure data exchanges, along with basic concepts of message digests and hash functions.

CO5: Gain proficiency in internet security protocols like SSL and various user authentication mechanisms, including passwords, certificates, and biometric authentication.

CO6: Understand electronic mail security through protocols like PGP and S/MIME, and examine the types, configurations, and roles of firewalls in network security.



SOFT SKILL DEVELOPMENT VI

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P-S
NAME: Soft Skill Development VI	COURSE CREDIT: 01[0-0-2-0]
DEPARTMENT: Computer Science	CATEGORY: NV
CODE: MVSSU122T06	SEMESTER: 6 th

THEORY

Learning objectives: To equip participants with essential skills required in professional settings, focusing on aptitude, logic, and reasoning. To practice creating and delivering effective business presentations. To engage in mock group discussions and gain a comprehensive understanding of corporate and social etiquette.

Prerequisite: Nil

Course content/ Syllabus table:

Module No.	No of lecture/Contact hour	Weightage (%)
Module-I: Mock Test and Practice Sessions	6	25%
Module-II: Social Etiquette	5	20%
Module-III: Business Presentation	6	25%
Module-IV: Group Discussions	7	30%

SYLLABUS OUTLINE:

Module I: Mock Test and Practice Sessions: [6L]

• Aptitude, Logic, and Reasoning

Module II: Social Etiquette: [5L]

- Power Dressing
- Fine Dining
- Office Party Etiquette
- Business Travel Etiquette

Workplace and Business Etiquette

Proper Greetings



- Thank You Notes
- Voice mail Etiquette
- Business Salutation Etiquette
- Guest Etiquette
- Cubicle Etiquette
- Business Card Etiquette

Different Cultural Etiquette & Protocol

Module III: Business Presentation: [6L]

- **777** Rule
- Audio & Visual
- Know Your Audience
- Body Language During Presentations
- How to Handle Questions

Module IV: Group Discussions: [7L]

- Practice sessions
- Pedagogy for Course Delivery: Workshop, Group Discussions, Presentations, Lectures.
- Continuous assessment: Quiz/assessment/presentation/problem solving etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	2	3
CO2	-	-	-	-	-	-	-	-	2	3	2	3
CO3	-	-	-	-	-	-	-	-	1	3	2	3
CO4	-	-	-	-	-	-	-	-	2	3	2	3
CO5	-	-	-	-	-	-	-	-	1	3	1	3
CO6	-	-	-	-	-	-	-	-	2	3	2	3
Avg.	-	-	-	-	-	-	-	-	1.33	3	1.83	3

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**



Course Learning Outcome: (CO)

CO1: To equip participants with essential skills in aptitude, logic, and reasoning for professional settings.

CO2: To practice creating and delivering impactful business presentations effectively.

CO3: To engage in mock group discussions to refine communication and teamwork skills.

CO4: To gain a comprehensive understanding of corporate and social etiquette.

CO5: To develop strong logical and analytical reasoning skills for problem-solving.

CO6: To improve overall professional communication skills, including presentations and group interactions.



FOURTH YEAR

SEMESTER-VII

Sl No	Course Title	Code	Category	Credit		Ту	ре			
1	Data Warehousing and Data Mining		MC	3	3	0	0	0		
2	Advanced Database and PL-SQL		ME	3	3	0	0	0		
3	NM Elective VII: Digital Marketing		NM	4	3	1	0	0		
4	Internship		INT	2	0	0	0	4		
5	Project-I		Project	4	0	0	0	8		
	Total Credit=16									



DATA WAREHOUSING AND DATA MINING

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Data Warehousing and Data Mining	COURSE CREDIT: 03[3-0-0]
DEPARTMENT: Computer Science	CATEGORY: MC
CODE: XXXXXX	SEMESTER: 7 th

THEORY

Learning objectives: On completion of the course, student will be able to:

- 1) To understand the principles of Data warehousing and Data Mining.
- 2) To be familiar with the Data warehouse architecture and its Implementation.
- 3) To know the Architecture of a Data Mining system.
- 4) To understand the various Data preprocessing Methods.
- 5) To perform classification and prediction of data.

Prerequisite: Before learning about Data Warehouse, you must have the fundamental knowledge of basic database concepts such as schema, ER model, structured query language, etc. Before learning the concepts of Data Mining, you must have a basic understanding of Statistics, Database Knowledge, and Basic programming language.

Course content/ Syllabus table:

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Introduction to Data Warehousing	4	11%
Module-II: Data Mining	8	22%
Module-III: Classification and Prediction	12	33%
Module-IV: Clustering	8	22%
Module-V: Association Rules	2	6%
Module-VI: Data Mining Cases	2	6%

BCA-R24



Module I: Introduction to Data Warehousing: [4L]

Definition, Characteristics, Needs, Components and Benefits of Data Warehouse. Difference between Database and Data Warehouse. Differences between OLTP and OLAP, Data warehouse architecture, Types of Data Warehouses. Data Warehouse Modeling, ETL process, Data staging, cleaning, and loading, Data Warehouse Design, Data Warehouse Implementation.

Module II: Data Mining: [8L]

Data Mining Techniques, Data Mining Functionalities, Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation, Architecture of a Typical Data Mining Systems. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods –Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis –Constraint-Based Association Mining.

Module III: Classification and Prediction: [12L]

Definition of Classification, Classification techniques: Decision trees, Naive Bayes Classifier, K-Nearest Neighbors, SVM. Model evaluation metrics: Accuracy, Precision, Recall, F1 Score, ROC, AUC, Cross-validation techniques, Handling imbalanced data, Model tuning and optimization. Definition of Prediction, Difference between classification and prediction.

Module IV: Clustering: [8L]

Definition, Applications of Clustering in different fields, Types of Clustering: Partitioning Method, Hierarchical method, Density-Based Method, Model-Based Clustering Method. Clustering algorithms: K-means clustering, Hierarchical clustering.

Module V: Association Rules: [2L]

Concept of Association Rule Learning, How does Association Rule Learning work, Applications of Association Rule Learning in different fields, Types of Association Rule: Apriori Algorithm, Eclat Algorithm, F-P Growth Algorithm.

Module VI: Data Mining Cases: [2L]

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.



Text & Reference books:

Text Books:

- 1) Modern Data Warehousing, Mining and Visualization: Core Concepts by George M. Marakas, Pearson Education
- 2) Data Warehousing, Data Mining & OLAP by Alex Berson & Stephen J. Smith Tata McGraw-Hill

Reference Books:

- 1) Data Mining: Concepts & Techniques by Jiawei Han & Micheline Kamber, Second Edition, Morgan Kaufmann Publishers
- 2) Data Warehousing in the real World by Sam Anahory, Dennis Murray, Pearson Education
- 3) Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber
- 4) Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach, Vipin Kumar
- 5) Pattern Recognition and Machine Learning by Christopher Bishop
- 6) Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten, Eibe Frank

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	1	-	1
CO2	3	3	3	3	2	-	-	-	-	1	-	1
CO3	3	3	3	3	3	-	-	-	-	2	-	1
CO4	3	3	3	3	3	2	2	-	-	2	-	2
CO5	3	3	2	2	3	2	-	-	-	1	1	3
CO6	2	2	2	2	3	2	-	-	-	2	2	3
Avg.	2.83	2.83	2.5	2.5	2.67	2	2	-	-	1.5	1	1.83

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Student will understand the components, architecture, and benefits of data warehouses, and differentiate between databases, OLTP, OLAP, and data warehouse types and design.

CO2: Gain knowledge of data mining techniques, functionalities, and preprocessing methods, with a focus on association rule mining and its applications.



CO3: Apply classification techniques such as decision trees, Naive Bayes, KNN, and SVM, and evaluate models using performance metrics and optimization techniques for real-world predictions.

CO4: Analyze different clustering methods, including partitioning, hierarchical, and density-based approaches, and implement clustering algorithms like K-means and hierarchical clustering.

CO5: Explore association rule learning algorithms such as Apriori, Eclat, and F-P Growth, and understand their applications in various domains.

CO6: Demonstrate the ability to mine complex data objects such as spatial, multimedia, text, and web data through multidimensional analysis and descriptive mining techniques.



ADVANCED DATABASE AND PL-SQL

COURSE INFORMATION:

SCHOOL: School of Engineering	COURSE TYPE: L-T-P
NAME: Advanced Database and PL-SQL	COURSE CREDIT: 03[3-0-0]
DEPARTMENT: Computer Science	CATEGORY: ME
CODE: XXXXXX	SEMESTER: 7 th

THEORY

Learning objectives: The primary objective of this course is to equip students with a deep understanding of advanced database management concepts and proficient skills in PL/SQL programming. Students will learn to apply advanced data modeling techniques, optimize SQL queries for enhanced performance, and implement complex database schemas using enhanced ER models and Object-Relational Mapping. Additionally, the course will cover the development of modular PL/SQL code through stored procedures, functions, packages, and triggers, as well as best practices for database security, including user authentication, authorization, and data encryption, along with robust backup and recovery strategies to ensure data integrity and system reliability.

Prerequisite: Before learning Advanced Database and PLSQL you must have a solid foundation in basic database concepts, including relational database principles and fundamental SQL query writing skills. Apart from these, you should have basic programming knowledge.

Module No.	No. of lecture /	Weightage (%)
	Contact hour	
Module-I: Functional Dependency and Normalization	8	22%
Module-II: Transaction Processing and Concurrency	Q	220%
Control	0	2270
Module-III: Query Processing and Optimization	4	11%
Module-IV: Distributed Database	4	11%
Module-V: Introduction to PL/SQL	7	20%
Module-VI: Advanced PL/SQL	5	14%

Course content/ Syllabus table:



SYLLABUS OUTLINE:

Module I: Functional Dependency and Normalization: [8L]

Functional dependency: Definition, Types, Armstrong Axioms, Closure, Determining Candidate Keys, Equivalence of Functional Dependency, Canonical Cover, Database Decomposition: Lossless and Lossy.

Normalization: Types of normalization (1NF, 2NF, 3NF, BCNF, 4NF), Advantages and Disadvantages of Normalization.

Module II: Transaction Processing and Concurrency Control: [8L]

Transaction: Transaction Concept, Operations of Transaction, Properties of Transaction, States of Transaction, Schedules, Serializability: Conflict Serializable Schedule, View Serializable Schedule; Recoverability of Schedule: Recoverable schedules, Irrecoverable Schedules, Cascade less Schedules, and Strict Schedules;

Concurrency Control: Problems of Concurrency Control, Concurrency Control Techniques, Database Recovery Techniques, checkpoint, concept of phantom deadlock.

Module III: Query Processing and Optimization: [4L]

Query Processing: Parsing and Translation, Evaluation, Optimization; Cost-based optimization vs rulebased optimization.

Module IV: Distributed Database: [4L]

Distributed Database: Definition, Goals, Types, Architectures; Data fragmentation in Distributed System: horizontal, vertical, and hybrid fragmentation; Data Replication in Distributed System: synchronous and asynchronous replication; Recovery in Distributed Databases.

Module V: Introduction to PL/SQL: [7L]

PL/SQL: Features, Data Types, Variable declaration, syntax and structure, Operators, Control statements, Loops, Arrays, Strings, Procedures, Functions, Recursive Functions, Advantages.

Module VI: Advanced PL/SQL: [5L]

Cursors: Implicit cursors, Explicit cursors; Triggers: Creating Triggers, DDL, DML Operations; Records, Exceptions, and Advantages of Triggers.

- Pedagogy for Course Delivery: Hybrid Mode (Offline Class/ Presentation/ Video/ MOOC)
- Continuous Assessment: Quiz/ Assessment/ Presentation/ Problem solving etc.



Text & Reference books:

Text Books:

- 1) Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan.
- 2) Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe.
- 3) Oracle PL/SQL Programming by Steven Feuerstein.

Reference Books:

- 1) Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan
- 2) Oracle PL/SQL Programming by Steven Feuerstein
- 3) SQL Performance Tuning by Peter Gulutzan, Trudy Pelzer
- 4) Advanced Oracle PL/SQL Developer's Guide by Saurabh Gupta

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	1	-	1
CO2	3	3	3	2	2	-	-	-	-	1	-	1
CO3	3	3	3	3	3	-	-	-	-	2	-	1
CO4	3	2	3	3	3	2	2	-	-	2	-	2
CO5	3	3	2	2	3	2	-	-	-	1	1	3
CO6	2	2	2	2	3	2	-	-	-	2	2	3
Avg.	2.83	2.67	2.5	2.33	2.67	2	2	-	-	1.5	1	1.83

Highly Correlated: **3** Moderately Correlated: **2** Slightly Correlated: **1**

Course Learning Outcome: (CO)

CO1: Students will understand the concepts of functional dependency, database decomposition, and normalization, learning how to achieve efficient database design by applying normalization techniques and recognizing their advantages and disadvantages.

CO2: Understand the fundamentals of transaction processing, serializability, and various concurrency control techniques, enabling them to ensure data integrity and consistency in multi-user database environments.



CO3: Acquire knowledge of query processing, including parsing, evaluation, and optimization, and will differentiate between cost-based and rule-based optimization methods to enhance query performance.

CO4: Explore the principles of distributed databases, including data fragmentation, replication, and recovery techniques, understanding how to manage and maintain distributed database systems effectively.

CO5: Develop skills in PL/SQL programming, including variable declaration, control statements, loops, arrays, strings, and creating procedures and functions, recognizing the advantages of PL/SQL in database management.

CO6: Develop advanced PL/SQL skills by learning about cursors, triggers, records, and exception handling, enabling them to implement complex database operations and automate tasks within PL/SQL environments.



SEMESTER-VIII

Sl No	Course Title	Code	Category	Credit	Туре			
					L	T	P	S
1	Non-Major Elective VIII: Human		NM	4	3	1	0	0
	Resource Management							
2	Project-II		Project	8	0	0	0	16
Total Credit=12								