Sister Nivedita University

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OBE-RELATED ACADEMIC CURRICULUM

School of Science & Technology
Department of Computer Science

Syllabus
for
Bachelor of Computer Applications (BCA)

Regulations (R24) [NEP]

R24–25 Academic Session

VISION

To be a centre of excellence in computing, AI, and data-driven technologies, recognized for impactful research and innovation, while producing globally competent, ethical professionals and entrepreneurs who lead digital transformation across industries, and advancing interdisciplinary solutions that serve societal needs and support sustainable national and regional development.

MISSION

1. Deliver an outcome-based curriculum that blends strong computing fundamentals with emerging technologies through labs, projects, and real-world problem solving.

2. Foster a culture of research, innovation, and industry collaboration, entrepreneurship support, and modern infrastructure.

3. Nurture professionalism, ethics, inclusivity, effective communication, leadership, and lifelong learning to prepare graduates for responsible societal impact.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1:

Professional Competence: Graduates will demonstrate proficiency in core concepts, principles, and practices of computer science, including programming, algorithms, data structures, database management, and software engineering, enabling them to effectively analyze, design, and develop software solutions.

PEO2:

Career Advancement: Our Bachelor of Computer Application (BCA) program aims to equip students with a strong foundation in computer science and practical skills necessary for their professional growth. Upon graduation, our alumni will demonstrate the ability to adapt to evolving technologies, effectively contribute to multidisciplinary teams, and pursue diverse career opportunities in various sectors including software development, IT consulting, database management, and system analysis.

PEO3:

Lifelong Learning: The BCA program seeks to foster a culture of lifelong learning among graduates, enabling them to stay abreast of emerging trends and advancements in the field of computer applications. Graduates will possess the critical thinking, problem-solving, and self-learning skills necessary to pursue advanced education, professional certifications, and continuous skill development throughout their careers.

PEO4:

Ethical and Social Responsibility: Our BCA program is committed to instilling in students a strong sense of ethical values and social responsibility. Graduates will demonstrate integrity, professionalism, and ethical conduct in their interactions with colleagues, clients, and society. They will also be prepared to contribute positively to the community by leveraging technology for social good, addressing ethical dilemmas, and upholding principles of inclusivity, diversity, and sustainability.

PROGRAM SPECIFIC OBJECTIVES (PSO)

PSO1:

Proficiency in Software Development: Upon completion of the Bachelor of Computer Application program, students should demonstrate proficiency in software development methodologies, tools, and technologies. This includes the ability to analyze, design, implement, and test software solutions for a variety of real-world problems. Students should be capable of applying programming languages, data structures, algorithms, and software engineering principles to develop robust and scalable software applications

PSO2:

Problem-solving Skills in Information Technology: Graduates of the BCA program should possess strong problem-solving skills in the field of information technology. This involves the ability to identify, analyze, and solve complex problems related to software development, database management, networking, and system administration. Students should be adept at applying logical reasoning, critical thinking, and analytical skills to address challenges encountered in the IT domain.

PSO3:

Effective Communication and Teamwork: The BCA program aims to develop students' effective communication and teamwork skills essential for success in the IT industry. Upon completion of the program, students should be able to communicate technical concepts and ideas clearly and concisely, both orally and in writing. They should also demonstrate the ability to work collaboratively in multidisciplinary teams to accomplish common goals and projects, exhibiting professionalism, leadership, and interpersonal skills in diverse team environments.

PROGRAM OUTCOMES (PO)

PO1: Engineering Knowledge

Apply knowledge of mathematics, natural science, computing, engineering fundamentals, and an engineering specialization (as specified in WK1 to WK4) to develop solutions for complex engineering problems.

PO2: Problem Analysis

Identify, formulate, review research literature, and analyze complex engineering problems to reach substantiated conclusions with due consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions

Design creative solutions for complex engineering problems and design or develop systems, components, and processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon goals, cultural context, societal impact, and environmental sustainability. (WK5)

PO4: Conduct Investigations of Complex Problems

Conduct investigations of complex engineering problems using research-based knowledge, including experimental design, modelling, analysis, and interpretation of data, to provide valid conclusions. (WK8)

PO5: Engineering Tool Usage

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools—including prediction and modelling—recognizing their limitations, to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and the World

Analyze and evaluate societal and environmental aspects while solving complex engineering problems, assessing their impact on sustainability in terms of economy, health, safety, legal frameworks, culture, and environment. (WK1, WK5, and WK7)

PO7: Ethics

Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion, adhering to both national and international laws. (WK9)

PO8: Individual and Collaborative Team Work

Function effectively as an individual and as a member or leader in diverse and multidisciplinary teams.

PO9: Communication

Communicate effectively and inclusively within the engineering community and with society at large. Be able to comprehend and write effective reports, prepare design documentation, and make clear, culturally sensitive presentations considering linguistic and learning diversity.

PO10: Project Management and Finance

Apply knowledge and understanding of engineering management principles and economic decision-making to one's own work, functioning as a member and leader in a team, and to manage projects in multidisciplinary environments.

PO11: Life-Long Learning

Recognize the need for, and possess the preparation and ability for:

i) Independent and lifelong learning
ii) Adaptability to new and emerging technologies, and
iii) Critical thinking in the broadest context of technological change. (WK8)

Credit Definition

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

Total Credit Distribution

Semester	Credits										Credits/Semester
	MC	ME	PROJECT	NM	NV	MDC	AEC	SEC	VAC	INT	
1	9	0	0	4	2	4	2	0	2	0	23
2	9	0	0	4	1	4	2	3	2	0	25
3	13	0	0	4	4	4	2	0	0	0	27
4	14	0	0	4	1	0	2	3	0	0	24
5	13	0	0	4	1	0	2	3	0	0	23
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**	**12**	**10**	**9**	**6**	**2**	**169**

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**

FIRST YEAR

SEMESTER-I

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	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	4	3	1	0	0
4	NM Elective I: E-Commerce		NM	4	3	1	0	0
5	Soft Skill Development I		NV	1	0	0	0	2
6	EAA I (Yoga/Sports/NCC/NSS)		NV	1	0	0	0	2
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=23				

SEMESTER-II

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	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	4	3	1	0	0
4	NM Elective II: Principal of Management		NM	4	3	1	0	0
5	Soft Skill Development II		NV	1	0	0	0	2
6	Communicative English II		AEC	2	2	0	0	0
7	SEC1: Introduction to Python		SEC	3	2	0	2	0
8	Environmental Science II		VAC	2	2	0	0	0
Practical								
9	Data Structures Lab		MC	1	0	0	2	0
				Total Credit=25				

SECOND YEAR

SEMESTER-III

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	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 Java		MC	3	2	1	0	0
4	NM Elective III: Business Ethics and Corporate Governance		NM	4	3	1	0	0
5	Mathematics III		MDC	4	3	1	0	0
6	Foreign Language I		AEC	2	2	0	0	0
7	Technical Writing and Presentation		NV	2	0	0	0	4
8	EAA II (Yoga/Sports/NCC/NSS)		NV	1	0	0	0	2
9	Soft Skill Development III		NV	1	0	0	0	2
Practical								
10	Database Management Systems Lab		MC	1	0	0	2	0
11	Object Oriented Programming with Java Lab		MC	1	0	0	2	0
				Total Credit=27				

SEMESTER-IV

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	P	S
1	Computer Graphics		MC	4	3	1	0	0
2	Computer Networks		MC	4	3	1	0	0
3	Web Technology		MC	3	2	1	0	0
4	NM Elective IV: Operation Research		NM	4	3	1	0	0
5	Soft Skill Development IV		NV	1	0	0	0	2
6	Foreign Language II		AEC	2	2	0	0	0
7	SEC2: Entrepreneurship		SEC	3	2	1	0	0
Practical								
8	Computer Graphics Lab		MC	2	0	0	4	0
9	Web Technology Lab		MC	1	0	0	2	0
				Total Credit=24				

THIRD YEAR

SEMESTER-V

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	P	S
1	Unix and Shell Programming		MC	4	3	1	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	0	2
6	SEC3: Logical Ability		SEC	3	2	1	0	0
7	SEC4: Customer Relationship Management using Salesforce		SEC	2	1	0	2	0
Practical								
8	Unix and Shell Programming Lab		MC	1	0	0	2	0
9	PHP with MySQL Lab		MC	1	0	0	2	0
Total Credit=23								

SEMESTER-VI

Sl No	Course Title	Code	Category	Credit	Type			
					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	2	1	0	0
5	Soft Skill Development VI		NV	1	0	0	0	2
6	Ethic Study and IPR		VAC	2	2	0	0	0
Practical								
7	Software Engineering Lab		MC	1	0	0	2	0
Total Credit=19								

FOURTH YEAR

SEMESTER-VII

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	P	S
1	Data Warehousing and Data Mining		MC	3	2	1	0	0
2	Advanced Database and PL-SQL		ME	3	2	1	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	Type			
					L	T	P	S
1	Non-Major Elective VIII: Human Resource Management		NM	4	3	1	0	0
2	Project-II		PROJECT	8	0	0	0	16
Total Credit=12								

FIRST YEAR

SEMESTER-I

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	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	4	3	1	0	0
4	NM Elective I: E-Commerce		NM	4	3	1	0	0
5	Soft Skill Development I		NV	1	0	0	0	2
6	EAA I (Yoga/Sports/NCC/NSS)		NV	1	0	0	0	2
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=23				

INTRODUCTION TO C PROGRAMMING

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Introduction to C Programming	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 1^{st}

➠ 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 / Contact hour	Weightage (%)
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%

➠ Syllabus Outline: .....

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.

➠ Teaching–Learning Methodology:

- ***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.
3. 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.
4. The Complete Reference: C by Herbert Schildt, McGraw Hill Education, 4th Edition.

➠ Course Outcome (CO):

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

CO1: *Identify* data types, operators, and control flow constructs to develop basic C programs.

CO2: *Apply* functions, recursion, and parameter passing techniques to build modular solutions.

CO3: *Analyse* array- and string-based problems to determine suitable program structures.

CO4: *Evaluate* pointer usage and memory-handling approaches to improve program efficiency and reliability.

CO5: *Construct* structure-based and file-handling programs to store, manage, and process data effectively.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	-	-	1	3	1	-
CO2	3	3	3	2	2	-	-	-	-	-	1	3	2	1
CO3	3	3	2	2	3	-	-	-	-	-	1	3	2	1
CO4	3	3	3	2	3	-	-	-	-	-	1	3	3	1
CO5	3	2	3	1	3	-	-	-	-	2	1	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

DIGITAL ELECTRONICS

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Digital Electronics	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 1^{st}

➠ 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 / Contact hour	Weightage (%)
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.

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, Master-slave 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.

➠ Teaching–Learning Methodology: .....

- ***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, 5^{th} 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
3. "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, and Gregory L. Moss

Course Outcome (CO):

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

CO1: *Explain* the principles of number systems, Boolean algebra, and the characteristics of different logic families.

CO2: *Implement* simplified logic functions using Boolean theorems and Karnaugh maps.

CO3: *Analyze* the operation of combinational logic circuits, including multiplexers, decoders, and adders.

CO4: *Differentiate* the functional behavior of various flip-flops, registers, and counters.

CO5: *Design* sequential and combinational logic circuits to perform a specified task.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	1	1	1	-
CO2	3	2	2	1	1	-	-	-	-	-	1	2	2	-
CO3	3	3	1	2	-	-	-	-	-	-	1	2	3	-
CO4	3	3	1	2	-	-	-	-	-	-	1	2	3	1
CO5	3	3	3	2	2	-	-	-	-	-	2	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

MATHEMATICS I

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Mathematics I	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MDC
Code: XXXXXX	**Semester:** 1^{st}

➠ 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 / Contact hour	Weightage (%)
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.

➠ Teaching–Learning Methodology:

- ***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.

Course Outcome (CO):

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

CO1: *Recall* fundamental concepts of sets, relations, mappings, and algebraic structures including groups and subgroups.

CO2: *Explain* the principles of polynomial equations, Descartes' rule of signs, and relationships between roots and coefficients.

CO3: *Apply* propositional logic rules to construct truth tables and determine logical equivalences.

CO4: *Analyze* counting problems using permutations, combinations, generating functions, and recurrence relations.

CO5: *Evaluate* graphs and trees using matrix representations and standard algorithms.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2									2	1	1	
CO2	3	2	1								2		1	
CO3	3	2	1		2						2		2	
CO4	3	3	2	1	2						2	2	3	1
CO5	3	3	2	2	3			1	1	1	2	3	3	1

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

E-COMMERCE

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: E-Commerce	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 1st

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

1. Understand the fundamental concepts of E-Commerce, including value chain management, EDI.
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.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
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 and E-Commerce	8	17%

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.

Teaching–Learning Methodology:

- ***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:

1. 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.

➠ Course Outcome (CO):

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

CO1: *Explain* the fundamental concepts of E-Business and E-Commerce, including value chain management, supply chain structures, and electronic data interchange (EDI).

CO2: *Analyze* various E-Commerce business models and strategies, and evaluate their effectiveness, including the reasons for success or failure in digital environments.

CO3: *Describe* and compare different electronic payment systems such as digital cash, electronic tokens, credit/debit cards, and third-party processors, while identifying associated security issues and standards.

CO4: *Interpret* the legal and ethical issues related to E-Commerce, including privacy, intellectual property rights, regulatory frameworks, and provisions of the IT Act 2000 & Amendment 2008.

CO5: *Apply* internet technologies, network infrastructure components, digital marketing concepts, and website-design principles to develop and evaluate E-Commerce websites and online marketing strategies.

➠ CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	-	-	-	-	1	1	2	-
CO2	2	3	2	2	2	2	-	-	-	-	2	1	3	1
CO3	2	2	1	1	3	1	-	-	-	-	2	2	3	-
CO4	1	2	1	1	1	3	3	-	1	-	1	1	2	2
CO5	2	2	3	2	3	2	-	2	2	2	3	3	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFT SKILL DEVELOPMENT I

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Soft-Skill Development-I	**Course Credit:** 01[0-0-0-2]
Department: Computer Science Engineering	**Category:** NV
Code: MVSSU122T01	**Semester:** 1^{st}

➠ 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.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Essentials of English Grammar	7	30%
Module-II: Spoken English Communication	7	30%
Module-III: Vocabulary	6	20%
Module-IV: Introduction to Written English	2	10%
Module-V: Prose	2	10%

➠ Syllabus Outline: .....

Module I: Essentials of English Grammar: [7L]

- 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: [7L]

- 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: [6L]

- 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: [2L]

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

Activities: Peer editing, writing prompts, sentence expansion

Module V: Prose: [2L]

- "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

Teaching–Learning Methodology:

- ***Pedagogy for Course Delivery:*** Workshop, Group, Discussions, Presentations, Extempore.
- ***Continuous Assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

Course Outcome (CO):

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

CO1: *Identify* the fundamentals of essential English language skills and communication basics, including the key components of core grammar and usage relevant to academic and workplace contexts.

CO2: *Apply* English language skills—covering topic-specific vocabulary, collocations, and clear pronunciation—in everyday, semi-formal, academic, and workplace interactions across diverse professional and social contexts

CO3: *Analyze* written and spoken texts—including short talks and conversations—to determine main ideas, supporting details, and discourse features, thereby strengthening critical reading and listening abilities.

CO4: *Evaluate* grammar rules and foundational language structures for accuracy and effectiveness in context, diagnosing errors and selecting appropriate forms to improve clarity and correctness.

CO5: *Compose* persuasive and effective written and oral communication—such as coherent paragraphs, summaries, and short presentations—aligned with professional standards, integrating information gathered for gist and specific purposes.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	1	-	-	1	-	2	-	1	1	-	1
CO2	-	-	1	-	-	1	-	2	3	1	1	1	-	3
CO3	-	2	1	1	-	-	-	-	2	-	2	1	2	1
CO4	1	1	-	1	-	-	1	-	2	-	1	1	-	1
CO5	-	-	2	-	-	1	-	1	3	2	2	1	1	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

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 Engineering	**Category:** AEC
Code: AECEU041T01	**Semester:** 1st

➠ 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 / Contact hour	Weightage (%)
Module-I: Basics of the Theory of Communication	6	25%
Module-II: Development of Listening and Speaking Skills	6	25%
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.

Teaching–Learning Methodology:

- ***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.
3. 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.

➠ Course Outcome (CO): .....

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

CO1: *Identify*, list, and describe the basics of communicative English and the four core skills (listening, speaking, reading, writing).

CO2: *Apply* stress, rhythm, and intonation patterns to produce clearer, more intelligible speech in short interactions.

CO3: *Explain* essential grammar rules (parts of speech, tense, agreement, punctuation) and construct well-formed simple and compound sentences.

CO4: *Differentiate* among registers and use topic-specific vocabulary and collocations to convey precise meaning across contexts.

CO5: *Compose* and deliver concise, audience-appropriate oral and written messages for academic and professional situations.

➠ CO-PO-PSO Mapping: .....

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	-	-	2	-	1	1	-	1
CO2	-	-	1	-	-	1	-	2	3	1	1	1	-	3
CO3	1	1	-	1	-	-	1	-	2	-	1	1	-	1
CO4	1	-	-	-	-	2	-	-	3	-	1	1	-	2
CO5	-	-	2	-	-	1	-	1	3	2	2	1	1	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

ENVIRONMENTAL SCIENCE I

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Environmental Science I	**Course Credit:** 02[2-0-0]
Department: Computer Science Engineering	**Category:** VAC
Code: XXXXXX	**Semester:** 1^{st}

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 / Contact hour	Weightage (%)
Module-I: Components of Environment and Atmosphere	4	16.67%
Module-II: Water resource	4	16.66%
Module-III: Forest resource and Food resource	4	16.66%
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.

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.

➠ Teaching–Learning Methodology: .....

- ***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)
2. P. K. Gupta – Textbook of Environmental Science, Cengage / Academic Publishers

3. Anubha Kaushik & C. P. Kaushik – Environmental Science and Engineering, New Age International
4. Eldor A. Paul – Soil Microbiology, Ecology, and Biochemistry (for ecosystem and biogeochemical aspects)
5. Benny Joseph – Environmental Studies, McGraw Hill
6. R. Rajagopalan – Environmental Studies: From Crisis to Cure, Oxford University Press

Reference Books:

1. Environmental Science, Dr Biplab Kumar Das, Dr Mofidul Islam, Mahaveer Publications (2023)
2. G. Tyler Miller & Scott Spoolman – Environmental Science, Cengage
3. William Cunningham & Mary Cunningham – Principles of Environmental Science, McGraw Hill
4. Odum & Barrett – Fundamentals of Ecology, Cengage
5. Y. Anjaneyulu – Introduction to Environmental Science, BSP Publications
6. Gilbert M. Masters & Wendell P. Ela – Introduction to Environmental Engineering and Science, Pearson
7. UNEP Reports & IPCC Assessment Reports (for climate change, global warming, ozone depletion)

➠ Course Outcome (CO):

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

CO1: *Categorize* different spheres of environment and their components.

CO2: *Differentiate* among perpetual, renewable and non-renewable resources and clarify the approach towards their preservation.

CO3: *Recognize* the components of atmospheric layers, their specific roles on environment and related problems.

CO4: *Appraise* different resources viz. water, forest, food, land, mineral and energy and their functions for sustaining life on earth.

CO5: *Illustrate* the ways of destruction of specific resources and its prevention in turn.

➠ CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	2	-	3	2	1	1	-	2	-	-	-
CO2	1	2	2	2	-	3	2	1	1	-	2	-	-	-
CO3	1	2	-	2	-	3	1	-	1	-	2	-	-	-
CO4	1	3	2	2	-	3	2	1	2	-	2	2	-	-
CO5	-	2	3	2	-	3	2	1	2	-	2	2	-	-

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

INTRODUCTION TO C PROGRAMMING LAB

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Introduction to C Programming Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 1^{st}

List of Practicals: .....

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 GCD and LCM of two numbers.

SEMESTER-II

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	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	4	3	1	0	0
4	NM Elective II: Principal of Management		NM	4	3	1	0	0
5	Soft Skill Development II		NV	1	0	0	0	2
6	Communicative English II		AEC	2	2	0	0	0
7	SEC1: Introduction to Python		SEC	3	2	0	2	0
8	Environmental Science II		VAC	2	2	0	0	0
Practical								
9	Data Structures Lab		MC	1	0	0	2	0
				Total Credit=25				

COMPUTER ORGANIZATION AND ARCHITECTURE

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Computer Organization and Architecture	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 2^{nd}

➠ Learning Objectives: After completing this course, students will be able to:

1. Understand the internal organization and architecture of modern computer systems.
2. Explain CPU components, instruction formats, addressing modes, and the instruction cycle.
3. Demonstrate knowledge of memory hierarchy, cache mapping, virtual memory, and modern storage technologies.
4. Analyze I/O mechanisms including programmed I/O, interrupt-driven I/O, and DMA.
5. Apply assembly-level concepts to understand low-level program execution and system performance.
6. Recognize modern processor technologies including multi-core CPUs, GPUs, and ARM-based architectures.

➠ Prerequisite: Students should have basic understanding of computers, fundamentals of digital logic (binary number system, logic gates), basic programming skills in any high-level language.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Introduction to Computer Organization	4	8%
Module-II: Central Processing Unit (CPU) Organization	10	21%
Module-III: Memory Organization	12	25%
Module-IV: Input–Output Organization	8	17%
Module-V: Assembly Language and Performance Metrics	8	17%
Module-VI: Modern Computer Architectures and Emerging Hardware Technologies	6	12%

Syllabus Outline:

Module I: Introduction to Computer Organization: [4L]

Overview of computer system components: Hardware, Software, Firmware; Basic Organization of a Computer, Von Neumann and Harvard Architectures, Functional Units: Input Unit, Output Unit, Storage Unit, Control Unit, ALU;

Module II: Central Processing Unit (CPU) Organization: [10L]

CPU Architecture: Registers, ALU, Control Unit; Instruction Formats: Zero-address, One-address, Two-address, Three-address; Instruction Cycle: Fetch–Decode–Execute, Addressing Modes, Interrupts: Types, Priority, Interrupt Handling

Module III: Memory Organization: [12L]

Memory Hierarchy, Memory Basics: RAM, ROM, PROM, EPROM, EEPROM; Bus Organization and Tri-state Buffers, Cache Memory: Organization, L1, L2, L3 caches, Mapping Techniques (Direct, Associative, Set-Associative); Virtual Memory: Paging, Segmentation; Replacement Policies: FIFO, LRU; Modern Storage Technologies: SSD, SSD vs. HDD, RAID

Module IV: Input–Output Organization: [8L]

I/O Interfaces and Types, Programmed I/O, Interrupt-driven I/O; DMA (Direct Memory Access) – Operation and Applications, I/O Processors, Bus Transfer Mechanisms: Synchronous vs Asynchronous, PCI, USB basics

Module V: Assembly Language and Performance Metrics: [8L]

Basics of Assembly Language Programming, Instruction Set Examples (Intel/ARM simplified), Stack Organization, Subroutine calls and parameter passing, Performance Metrics: Clock speed, CPI, MIPS; Introduction to Pipelining

Module VI: Modern Computer Architectures and Emerging Hardware Technologies: [6L]

Multi-Core and Parallel Processing Architectures: Evolution from single-core to multi-core processors, Introduction to Multi-core Processors, Dual-core, Quad-core, Hexa-core, Octa-core and higher-core architectures; Performance benefits: parallelism, throughput improvement, latency reduction; Power efficiency: dynamic frequency scaling (DVFS), thermal design considerations

GPU Architecture: GPU Basics, CPU vs GPU, Basic GPU pipeline, Applications in gaming, ML, crypto-mining

ARM Architecture and its characteristics, RISC vs CISC, ARM vs x86 comparative analysis, Case studies: Snapdragon, Apple Silicon

Teaching–Learning Methodology:

- ***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. C. Hamacher, Z. Vranesic and S. Zaky, Computer Organization, McGraw-Hill Education, 5th Edition.

Course Outcome (CO):

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

CO1: *Explain* the basic organization of computer systems, architectures, and functional units.

CO2: *Describe* and interpret CPU organization, instruction formats, addressing modes, and interrupt mechanisms.

CO3: *Analyze* memory hierarchy, cache structures, virtual memory, and modern storage technologies for system performance.

CO4: *Apply* concepts of I/O organization including programmed I/O, interrupt-driven I/O, and DMA for data transfer handling.

CO5: *Demonstrate* basic assembly programming and evaluate performance metrics while identifying modern processor technologies (multi-core, GPU, ARM).

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	-	2	1	-
CO2	3	3	-	-	1	-	-	-	-	-	-	2	1	-
CO3	3	3	-	-	2	-	-	-	-	-	-	3	2	1
CO4	2	2	-	-	2	-	-	-	-	-	-	2	2	1
CO5	2	2	-	-	2	-	-	-	1	-	1	2	3	1

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

DATA STRUCTURES

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Data Structures	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 2^{nd}

➠ 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 / Contact hour	Weightage (%)
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 Trees- creation, 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.

Teaching–Learning Methodology:

- ***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

Course Outcome (CO):

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

CO1: *Classify* linear and non-linear data structures based on their characteristics and operations.

CO2: *Apply* array-based techniques to implement sparse matrices and polynomial representations.

CO3: *Analyse* linked list variants to determine appropriate representations for dynamic data.

CO4: *Evaluate* stack and queue implementations to recommend solutions for expression handling and problem solving.

CO5: *Design* efficient solutions using trees, searching, sorting, and hashing techniques to optimize data organization and retrieval.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	-	-	1	3	1	-
CO2	3	3	3	2	2	-	-	-	-	-	1	3	2	1
CO3	3	3	2	2	3	-	-	-	-	-	1	3	2	1
CO4	3	3	3	2	3	-	-	-	-	-	1	3	3	1
CO5	3	2	3	2	3	-	-	-	-	2	1	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

MATHEMATICS II

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Mathematics II	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MDC
Code: XXXXXX	**Semester:** 2^{nd}

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 / Contact hour	Weightage (%)
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 Equations	6	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.

➠ Teaching–Learning Methodology: .....

- ***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.

Course Outcome (CO):

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

CO1: *Recall* fundamental concepts of logic, sets, relations, and functions used in discrete mathematical structures.

CO2: *Explain* the reasoning behind mathematical arguments, proof techniques, and structural properties of discrete systems.

CO3: *Solve* problems involving counting principles, recurrence relations, and basic combinatorial methods.

CO4: *Differentiate* various types of relations, graphs, and algebraic structures based on their defining properties.

CO5: *Construct* Boolean expressions, logic circuits, and graph-based models involving real-world computational problems.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	1	1	-	-	1	-	2	2	2	1
CO2	3	3	-	2	1	-	-	-	2	-	3	2	3	2
CO3	3	3	1	2	2	-	-	-	1	-	2	3	3	-
CO4	3	3	1	2	2	-	-	-	2	-	2	2	3	2
CO5	3	2	3	2	3	-	-	2	2	2	2	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

PRINCIPAL OF MANAGEMENT

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Principal of Management	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 2^{nd}

➠ 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.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Management Theories	8	16%
Module-II: Functions of Management	8	17%
Module-III: Organization Behavior	6	12%
Module-IV: Organizational Design	8	17%
Module-V: Motivation & Organizational culture	8	17%
Module-VI: Managerial Ethics and Leadership	10	21%

➠ Syllabus Outline: .....

Module I: Management Theories: [8L]

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: [8L]

Planning, Organizing, Staffing, Directing, Controlling

Module III: Organization Behavior: [6L]

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

Module IV: Organizational Design: [8L]

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: [8L]

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

Module VI: Managerial Ethics and Leadership: [10L]

Ethics and Business, Ethics of Marketing and Advertising, Ethics of Finance and Accounting, Decision-making 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.

➠ Teaching–Learning Methodology: .....

- ***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).

Course Outcome (CO):

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

CO1: *Explain* the fundamental concepts and evolution of management theories and summarize the contributions of major management thinkers.

CO2: *Identify* and *apply* the major functions of management—planning, organizing, staffing, directing, and controlling—in organizational scenarios.

CO3: *Analyze* key elements of organizational behavior, including personality, perception, learning, stress management, and decision-making, to understand individual and group behavior at work.

CO4: *Evaluate* and *compare* various organizational design models and structures to determine suitable designs for different organizational contexts.

CO5: *Demonstrate* an *understanding* of motivation, organizational culture, leadership, and managerial ethics, and assess their impact on effective management and corporate responsibility.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	1	-	1	-	2	1	1	2
CO2	2	2	3	-	1	1	-	2	2	3	2	2	2	3
CO3	1	2	2	-	-	2	1	3	3	2	3	1	2	3
CO4	2	2	3	-	1	2	-	2	2	2	2	1	2	2
CO5	1	1	2	-	-	2	3	3	2	2	2	-	1	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFT SKILL DEVELOPMENT II

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Soft-Skill Development-II	**Course Credit:** 01[0-0-0-2]
Department: Computer Science Engineering	**Category:** NV
Code: MVSSU122T02	**Semester:** 2^{nd}

➠ Learning Objectives:

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

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Fundamentals of Communication	7	30%
Module-II: Verbal Communication	7	30%
Module-III: Non-Verbal Communication	6	20%
Module-IV: Listening Skills	2	10%
Module-V: Prose	2	10%

➠ Syllabus Outline: .....

Module I: Fundamentals of Communication: [7L]

- 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: [7L]

- 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: [6L]

- 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: [2L]

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

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

Module V: Prose: [2L]

- "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

➠ Teaching–Learning Methodology: .....

- ***Pedagogy for Course Delivery:*** Extempore, Presentations
- ***Continuous Assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

➠ Course Outcome (CO): .....

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

CO1: *Deliver* and adapt clear, concise, audience-appropriate oral messages across diverse contexts.

CO2: *Analyze* non-verbal cues (posture, gesture, eye contact, tone) and employ them to enhance clarity and confidence.

CO3: *Discriminate* key information and paraphrase it into structured notes to improve comprehension and engagement.

CO4: *Analyze* complex texts and evaluate claims/evidence to support reasoned understanding.

CO5: *Produce* and revise clear, coherent, and persuasive workplace documents (emails, memos, reports) aligned to professional conventions.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	1	-	-	1	-	2	3	1	1	1	0	3
CO2	-	-	-	-	-	2	2	2	2	-	1	-	0	3
CO3	-	2	1	1	-	-	-	-	2	-	2	1	2	1
CO4	-	2	1	1	-	-	-	-	2	-	2	1	2	1
CO5	-	-	2	-	-	1	-	1	3	2	2	1	1	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

COMMUNICATIVE ENGLISH II

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Communicative English II	**Course Credit:** 02[2-0-0]
Department: Computer Science Engineering	**Category:** AEC
Code: AECEU141T02	**Semester:** 2^{nd}

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.

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 / Contact hour	Weightage (%)
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

Teaching–Learning Methodology:

- ***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

3. 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.
6. "The Discussion Book: 50 Great Ways to Get People Talking" by Stephen D. Brookfield and Stephen Preskill

Course Outcome (CO):

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

CO1: *Explain* key communicative features of contemporary English (register, pragmatics, digital norms) and describe when to use them.

CO2: *Apply* listening, speaking, reading, and writing strategies to produce clear, task-appropriate responses in professional contexts.

CO3: *Analyze* audience, purpose, and context and adapt interpersonal communication for diverse professional and social settings.

CO4: *Evaluate* arguments and information for credibility, bias, and logic, and justify conclusions using evidence.

CO5: *Design* and deliver/compose integrated oral and written messages (emails, briefs, short talks) that synthesize sources and align tone, medium, and audience needs.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	2	-	-	3	-	1	1	0	2
CO2	-	-	2	-	-	1	-	1	3	2	2	1	1	3
CO3	-	-	1	-	-	1	-	2	3	1	1	1	0	3
CO4	-	2	1	1	-	-	-	-	2	-	2	1	2	1
CO5	-	-	2	-	-	1	-	1	3	2	2	1	1	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

INTRODUCTION TO PYTHON

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Introduction to Python	**Course Credit:** 03[2-0-2]
Department: Computer Science Engineering	**Category:** SEC
Code: XXXXXX	**Semester:** 2^{nd}

➠ 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 / Contact hour	Weightage (%)
Module-I: Introduction to Python	4	11%
Module-II: Python Decision-making Statements and Loops	4	11%
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.

➠ Teaching–Learning Methodology:

- ***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.
3. 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.
2. 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.

➠ Course Outcome (CO):

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

CO1: *Recall* Python syntax, keywords, and control structures used in basic programming.

CO2: *Explain* the use of decision-making constructs, loops, and data structures like lists, tuples, and dictionaries in solving problems.

CO3: *Develop* modular Python programs using user-defined and recursive functions for real-world tasks.

CO4: *Analyze* the structure and behavior of programs involving file handling and data visualization using

Matplotlib.

CO5: *Design* and *implement* Python-based applications (e.g., quiz app, file analyzer) that integrate multiple concepts from the course.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	1	-	2	3	2	1
CO2	3	2	2	1	2	-	-	2	2	-	2	3	3	2
CO3	3	2	3	1	3	-	1	2	2	2	2	3	3	2
CO4	2	3	2	3	2	1	1	2	2	1	2	2	3	2
CO5	3	3	3	2	3	2	2	3	3	3	3	3	3	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

ENVIRONMENTAL SCIENCE-II

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Environmental Science-II	**Course Credit:** 02[2-0-0]
Department: Computer Science Engineering	**Category:** VAC
Code: XXXXXX	**Semester:** 2^{nd}

➠ Learning Objectives:

After completing this course, students will be able to:

1. *Understand* the structure, function, and dynamics of ecosystems and explain the importance of biodiversity and its conservation.
2. *Identify* and Analyze major types of environmental pollution, their causes, impacts, and appropriate control measures.
3. *Interpret* key environmental issues, laws, and ethical responsibilities, and evaluate their relevance to sustainable development and public awareness.

➠ Prerequisite:

Basic understanding of environmental concepts from introductory Environmental Science and familiarity with fundamental scientific principles related to ecology, pollution, and environmental protection.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Ecosystem, Biodiversity and its Conservation	8	33%
Module-II: Environmental Pollution	6	25%
Module-III: Environmental Issues, Laws and Ethics	10	42%

➠ Syllabus Outline: .....

Module I: Ecosystem, Biodiversity and its Conservation: [8L]

Concept of Ecosystem, Structure and Function of Ecosystem, Energy flow, Bio-geological cycles, Introduction to Biodiversity, Genetic Biodiversity, Species diversity, Ecological diversity, Bio-geographical

classification of India, Biodiversity Hot-spots, Conservation of biodiversity.

Module II: Environmental Pollution: [6L]
Definition, causes and effects of pollution; control measures of pollution;

Air pollution, Water pollution, Soil pollution, Noise pollution; Solid waste management; Disaster management; role of society in controlling pollution.

Module III: Environmental Issues, Laws and Ethics: [10L]
Water conservation, climate change : cause and effect, global warming, acid rain, ozone layer depletion, hazardous materials industries; Wasteland reclamation; Environment protection act; Air (prevention & control of pollution) act; Water (prevention & control of pollution) act; Wildlife Protection act, Forest conservation act, Issues involved in enforcement of environment legislation, public awareness.

➠ Teaching–Learning Methodology:

- ***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. P. K. Gupta – Textbook of Environmental Science, Cengage / Academic Publishers
2. Anubha Kaushik & C. P. Kaushik – Environmental Science and Engineering, New Age International
3. Eldor A. Paul – Soil Microbiology, Ecology, and Biochemistry (for ecosystem and biogeochemical aspects)
4. Benny Joseph – Environmental Studies, McGraw Hill
5. R. Rajagopalan – Environmental Studies: From Crisis to Cure, Oxford University Press

Reference Books:

1. G. Tyler Miller & Scott Spoolman – Environmental Science, Cengage
2. William Cunningham & Mary Cunningham – Principles of Environmental Science, McGraw Hill
3. Odum & Barrett – Fundamentals of Ecology, Cengage
4. Y. Anjaneyulu – Introduction to Environmental Science, BSP Publications
5. Gilbert M. Masters & Wendell P. Ela – Introduction to Environmental Engineering and Science, Pearson
6. UNEP Reports & IPCC Assessment Reports (for climate change, global warming, ozone depletion)

Course Outcome (CO):

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

CO1: *Construct* the concept of Ecosystem and its importance on the development and well-being of human life on earth

CO2: *Employ* the idea of biodiversity and relevant bio-geochemical phenomena and their impact on the sustainability of life

CO3: *Appraise* the factors responsible for pollution as well as concomitant degradation of natural resources

CO4: *Design* the way-outs to mitigate / moderate / minimize / combat with the effects of pollution and to achieve sustainable development goals (SDG)

CO5: *Design* and Implement Law and Order towards the protection and preservation of Ecosystem, Biodiversity and natural resources.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	3	1	-	1	-	2	-	1	2
CO2	2	3	2	1	1	3	-	-	1	-	2	-	2	1
CO3	1	3	2	2	1	3	2	-	1	-	2	-	3	2
CO4	1	3	3	2	2	3	2	1	2	1	2	1	3	3
CO5	1	2	2	1	-	3	3	1	2	1	2	-	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

DATA STRUCTURES LAB

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Data Structures Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 2^{nd}

➠ List of Practicals: .....

1. **Array**
   a) Write a program to find the largest and smallest elements in an array.
   b) Write a program to insert an element into an array at a specified position.
   c) Write a program to delete an element from an array based on the value entered by the user.
2. **Linked List**
   a) Implement a singly linked list with operations: insertion at beginning and insertion at end.
   b) Write a program to delete a node from a singly linked list based on a given key.
   c) Write a program to count the number of nodes in a linked list.
3. **Stack and Queue**
   a) Implement a stack using an array with push and pop operations.
   b) Implement a queue using an array with enqueue and dequeue operations.
   c) Write a program to check whether a string is a palindrome using a stack.
4. **Tree**
   a) Write a program to create a binary tree and perform preorder traversal.
   b) Write a program to find the height of a binary tree.
5. **Searching**
   a) Write a program to perform linear search on an integer array.
   b) Write a program to perform binary search on an integer array.
6. **Sorting**
   a) Write a program to sort an array using the bubble sort method.
7. **Hashing**
   a) Write a program to implement hashing using linear probing for collision resolution.

SECOND YEAR

SEMESTER-III

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	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 Java		MC	3	2	1	0	0
4	NM Elective III: Business Ethics and Corporate Governance		NM	4	3	1	0	0
5	Mathematics III		MDC	4	3	1	0	0
6	Foreign Language I		AEC	2	2	0	0	0
7	Technical Writing and Presentation		NV	2	0	0	0	4
8	EAA II (Yoga/Sports/NCC/NSS)		NV	1	0	0	0	2
9	Soft Skill Development III		NV	1	0	0	0	2
Practical								
10	Database Management Systems Lab		MC	1	0	0	2	0
11	Object Oriented Programming with Java Lab		MC	1	0	0	2	0
				Total Credit=27				

DATABASE MANAGEMENT SYSTEMS

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Database Management Systems	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 3^{rd}

➠ 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 / Contact hour	Weightage (%)
Module-I: Introduction to DBMS	4	8%
Module-II: Data Modelling	6	12.5%
Module-III: Relational Data Model	12	25%
Module-IV: Database Design	10	21%
Module-V: Query Processing And Optimization	6	12.5%
Module-VI: Transaction	10	21%

➠ Course Content/ Syllabus Table:

Module I: Introduction to DBMS: [4L]

Database concepts: Data, information, metadata; File-based systems vs. DBMS, Advantages of DBMS, Data models: Hierarchical, Network, Relational; DBMS Architecture: 3-schema architecture, Data independence, DBMS users and roles, Overview of relational model (tables, attributes, tuples, domains)

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]

Keys in DBMS: Super Key, Candidate key, Primary key, Foreign key, Alternate key, Composite key; Integrity Constraints: Domain Integrity Constraint, Entity Integrity Constraint, Referential Integrity Constraint, Key Integrity Constraint; 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.

➠ Teaching–Learning Methodology: .....

- ***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:

1. 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.

➠ Course Outcome (CO): .....

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

CO1: *Recall* fundamental concepts of databases, SQL syntax, and normalization rules to establish a strong foundation for advanced database applications.

CO2: *Explain* database design principles, including conceptual modeling and relational schema design, to illustrate efficient data organization in systems.

CO3: *Apply* optimized SQL queries and query processing strategies to retrieve and manipulate data in various database specific applications.

CO4: *Analyze* transaction management and concurrency control mechanisms to ensure reliability and consistency in real-time applications.

CO5: *Evaluate* indexing techniques, join strategies, and query optimization methods to enhance database performance in high-volume environments.

➠ CO-PO-PSO Mapping: .....

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	2	1	-
CO3	-	3	-	2	2	-	-	-	-	-	-	2	2	-
CO4	-	2	-	3	3	2	-	1	-	1	-	3	3	3
CO5	-	3	-	2	3	-	-	-	-	2	-	2	3	-

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

OPERATING SYSTEMS

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Operating Systems	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 3^{rd}

➠ 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 / Contact hour	Weightage (%)
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 Management	8	16%

➠ Syllabus Outline: .....

Module I: Introduction: [2L]

Generations Concept of 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.

Teaching–Learning Methodology:

- ***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. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System 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

Course Outcome (CO):

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

CO1: *Describe* the fundamental principles, components, and functions of modern operating systems.

CO2: *Apply* fundamental operating system principles to address a variety of computing tasks in resource and process management.

CO3: Analyze how operating systems manage system resources and ensure coordination, efficiency, and reliability.

CO4: *Evaluate* various operating system strategies and mechanisms in terms of performance, scalability, and resource utilization.

CO5: *Design* solutions that integrate operating system principles to solve real-world computing challenges.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	1	1	2	2	2	1
CO2	3	3	2	2	3	1	1	2	2	1	2	3	3	1
CO3	3	3	2	3	3	2	1	1	2	1	3	3	3	1
CO4	3	3	3	3	3	2	1	1	2	2	3	3	3	1
CO5	3	3	3	3	3	2	2	3	3	3	3	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

OBJECT ORIENTED PROGRAMMING WITH JAVA

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Object Oriented Programming with Java	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 3^{rd}

➠ 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.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
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%

➠ 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.

Teaching–Learning Methodology:

- ***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

Course Outcome (CO):

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

CO1: *Know* the fundamentals of Java and object-oriented programming.
CO2: *Develop* object-oriented solutions using inheritance, interfaces, and packages.
CO3: *Implement* multithreading and exception handling for efficient coding
CO4: *Design* GUI and web-based applications to simulate real-world problems.
CO5: *Structure* programs using reusable components for scalability and modularity

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	1	1	1	2	1	1
CO2	3	3	3	2	2	1	-	1	1	1	1	3	2	2
CO3	3	3	3	2	2	1	-	1	1	1	1	3	3	1
CO4	2	2	3	3	3	1	1	1	2	2	2	3	3	3
CO5	2	2	3	2	3	2	1	1	3	2	3	3	3	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

BUSINESS ETHICS AND CORPORATE GOVERNANCE

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Business Ethics and Corporate Governance	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 3^{rd}

➠ Learning Objectives:

This course aims to introduce students to the fundamental principles of business ethics and corporate governance. It will equip them with the knowledge and understanding necessary to identify ethical dilemmas in business, make responsible decisions, and appreciate the importance of good governance practices in organizations. Special emphasis will be placed on the relevance of these concepts in the technology and IT sectors.

➠ Prerequisite: Principles of management

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Introduction to Business Ethics	10	21%
Module-II: Ethical Issues in Business	12	25%
Module-III: Corporate Social Responsibility (CSR)	8	17%
Module-IV: Introduction to Corporate Governance	10	21%
Module-V: Corporate Governance Practices and Challenges	5	10%
Module-VI: Emerging Trends in Corporate Governance	3	6%

➠ Syllabus Outline: .....

Module I: Introduction to Business Ethics: [10L]

What is Ethics? Definition of ethics, morals, and values, Distinction between personal and business ethics, Importance of ethics in a globalized business environment. Business Ethics: An Overview,

Definition and scope of business ethics, Arguments for and against business ethics, Evolution of business ethics as a discipline. Ethical Theories-Consequentialist Theories: Utilitarianism, Deontological Theories: Duty-based ethics, Virtue Ethics: Character-based ethics. Ethical Decision-Making Frameworks, Steps in ethical decision-making. Challenges in ethical decision-making, Examples of ethical dilemmas.

Module II: Ethical Issues in Business: [12L]

Workplace Ethics: Discrimination and harassment (gender, caste, religion, disability), Work-life balance and employee well-being, Privacy in the workplace, Whistleblowing: Ethics and protection. Marketing and Advertising Ethics: Truth in advertising, Misleading information and deceptive practices, Ethical issues in online marketing and data privacy. Financial Ethics: Insider trading, Bribery and corruption, Transparency in financial reporting.

Module III: Corporate Social Responsibility (CSR): [8L]

Introduction to CSR: Definition and evolution of CSR, Carroll's Pyramid of CSR (Economic, Legal, Ethical, Philanthropic responsibilities). Arguments for and against CSR. Stakeholder Theory: Identification of stakeholders (employees, customers, suppliers, community, shareholders, government), Balancing stakeholder interests. CSR Initiatives and Reporting: Examples of CSR activities (environmental sustainability, community development, fair labor practices), Introduction to CSR reporting and frameworks (e.g., GRI - Global Reporting Initiative), CSR in the Indian context (Companies Act 2013 provisions for CSR).

Module IV: Introduction to Corporate Governance: [10L]

What is Corporate Governance? Definition and importance of good corporate governance, Objectives and benefits of sound governance. Distinction between management and governance. Key Principles of Corporate Governance: Transparency, accountability, fairness, independence, responsibility. Core Components of Corporate Governance, Board of Directors: Composition, roles, responsibilities, independence, Committees of the Board (Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, CSR Committee), Shareholders and their rights. Governance Models: Anglo-Saxon model (shareholder-centric), Continental European model (stakeholder-centric), Indian context (hybrid approach).

Module V: Corporate Governance Practices and Challenges: [5L]

Regulatory Frameworks in India: SEBI (Securities and Exchange Board of India) Guidelines, Companies Act, 2013 provisions on corporate governance, Role of independent directors. Challenges to Good Governance: Conflict of interest, Fraud and financial scandals (e.g., Satyam, Kingfisher Airlines - brief case studies), Ethical leadership and corporate culture.

Module VI: Emerging Trends in Corporate Governance: [3L]

- ESG (Environmental, Social, Governance) factors.
- Digital governance and cyber resilience.
- Role of technology in enhancing governance.

➠ Teaching–Learning Methodology:

- ***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. Murthy, C. S. V. (2008). Business Ethics and Corporate Governance. Himalaya Publishing House.

Reference Books:

1. Fernando, A. C. (2012). Business Ethics and Corporate Governance. Pearson Education.
2. Bhasin, M. L. (2016). Corporate Governance and Business Ethics. New Age International Publishers.
3. Velasquez, M. G. (2017). Business Ethics: Concepts and Cases. Pearson Education. (For deeper dive into theories and cases)
4. Relevant articles from business magazines, newspapers, and online journals focusing on Indian business ethics and governance.
5. Companies Act, 2013 (relevant sections).
6. SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015 (relevant sections).

➠ Course Outcome (CO):

CO1: *Explain* fundamental concepts of ethics, ethical theories, and ethical decision-making frameworks, and demonstrate their relevance in business and technology-driven environments.

CO2: *Identify* and *evaluate* ethical issues related to workplace practices, marketing, advertising, finance, and data privacy, especially within the IT and digital sectors.

CO3: *Analyze* the role and significance of Corporate Social Responsibility (CSR) and apply stakeholder theory and CSR frameworks, including those relevant to the Indian regulatory context.

CO4: *Describe* and *assess* key principles, models, and components of corporate governance, including board structures, governance committees, and shareholder rights.

CO5: *Critically* examine governance challenges, regulatory frameworks (SEBI, Companies Act 2013),

emerging trends such as ESG and digital governance, and propose ethically sound solutions for responsible corporate conduct.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	-1	1	3	-	1	-	2	1	2	1
CO2	1	3	1	1	1	2	3	-	1	-	2	1	3	1
CO3	1	2	2	1	1	3	2	-	1	1	2	1	2	1
CO4	1	2	2	1	1	2	3	-	1	1	2	1	2	1
CO5	1	3	2	1	2	3	3	-	2	1	3	1	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

MATHEMATICS III

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Mathematics III	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MDC
Code: XXXXXXXX	**Semester:** 3^{rd}

➠ 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 / Contact hour	Weightage (%)
Module-I: Error and Calculus of differences	8	16.66%
Module-II: Interpolation	8	16.66%
Module-III: Numerical integration	8	16.67%
Module-IV: Numerical solution of Algebraic equation	8	16.67%
Module-V: Numerical solution of a system of linear equations	8	16.67%
Module-VI: Numerical solution of ordinary differential equation	8	16.67%

➠ Syllabus Outline: .....

Module I: Error and Calculus of differences: [8L]

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: [8L]

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

Module III: Numerical integration: [8L]

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

Module IV: Numerical solution of Algebraic equation: [8L]

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

Module V: Numerical solution of a system of linear equations: [8L]

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

Module VI: Numerical solution of ordinary differential equation: [8L]

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

➠ Teaching–Learning Methodology:

- ***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. Numerical Analysis and Computational Procedure, S.A.Mollah, Books & Allied Pvt. Ltd

➠ Course Outcome (CO):

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

CO1: *Explain* numerical errors and difference operators with clarity.

CO2: *Apply* interpolation techniques to estimate unknown functional values accurately.

CO3: *Compute* definite integrals using numerical integration rules effectively.

CO4: *Develop* numerical procedures to solve algebraic and linear systems systematically.

CO5: *Evaluate* numerical methods for solving differential equations to determine efficient solutions.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	–	–	–	1	–	1	1	2	1
CO2	3	3	1	1	2	–	–	–	1	–	1	2	3	1
CO3	3	3	2	2	2	–	–	1	1	1	2	2	3	1
CO4	3	3	2	3	2	–	–	1	1	2	2	3	3	1
CO5	3	3	2	3	2	–	–	1	1	2	3	3	3	1

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

TECHNICAL WRITING AND PRESENTATION

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Technical Writing and Presentation	**Course Credit:** 02[0-0-0-4]
Department: Computer Science Engineering	**Category:** NV
Code: XXXXXX	**Semester:** 3^{rd}

➠ Learning Objectives:

On completion of the course, student will:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

➠ Prerequisite: Fundamentals of English Grammar

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Planning and Preparation	4	16
Module-II: Structure of the Paper	4	16
Module-III: Key Skills	4	17
Module-IV: Results and Discussion	4	17
Module-V: Submission	4	17
Module-VI: Guest Lecture from R& D organizations	4	17

➠ Syllabus Outline: .....

Module I: Planning and Preparation: [4L]

Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Module II: Structure of the Paper: [4L]

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Module III: Key Skills: [4L]

Key skills are needed when writing a Title; key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module IV: Results and Discussion: [4L]

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Module V: Submission: [4L]

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Module VI: Guest Lecture from R& D organizations: [4L]

Contemporary Issues.

➠ Teaching–Learning Methodology: .....

- ***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. Goldbort R (2006) Writing for Science, Yale University Press.

Reference Books:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
2. “Technical Communication” by Mike Markel and Stuart A. Selber
3. “Technical Writing for Engineers & Scientists” by Leo Finkelstein
4. “Scientific Writing and Communication: Papers, Proposals, and Presentations” by Angelika H. Hofmann
5. “The Elements of Style” by William Strunk Jr. and E.B. White
6. “The Craft of Scientific Writing” by Michael Alley

7. "The Chicago Manual of Style" by The University of Chicago Press Editorial Staff

Course Outcome (CO):

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

CO1: *Understand* the principles, structure, and ethics of Technical Writing and Presentation.

CO2: *Develop* effective academic documents such as reports, proposals, and research papers.

CO3: *Apply* writing styles, citation formats, and technical vocabulary appropriately.

CO4: *Demonstrate* clarity, precision, and coherence in technical communication.

CO5: *Evaluate* and edit scientific documents for quality and correctness.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	3	2	2	3	3	2	2	1	2
CO2	3	2	2	2	1	3	2	2	3	3	2	2	2	2
CO3	2	2	2	2	1	3	2	2	2	3	2	2	2	2
CO4	2	2	2	2	1	3	2	3	3	3	2	2	2	3
CO5	2	2	2	2	1	3	2	3	3	3	3	2	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFT-SKILL DEVELOPMENT-III

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Soft-Skill Development-III	**Course Credit:** 01[0-0-0-2]
Department: Computer Science Engineering	**Category:** NV
Code: MVSSU122T03	**Semester:** 3^{rd}

➠ Learning Objectives:

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

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Logic & Analytics	5	20%
Module-II: Quantitative Aptitude	5	20%
Module-III: Reasoning Skills	5	20%
Module-IV: Mastering MS Office	7	30%
Module-V: Professional Skills	2	10%

➠ Syllabus Outline: .....

Module I: Logic & Analytics: [5L]

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

Module II: Quantitative Aptitude: [5L]

- 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: [5L]

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

Module IV: Mastering MS Office: [7L]

- MS Word
- MS Excel
- MS PowerPoint

Module V: Professional Skills: [2L]

- Critical Thinking
- Problem Solving
- Leadership
- Work Ethics

➠ Teaching–Learning Methodology:

- ***Pedagogy for Course Delivery:*** Extempore, Presentations
- ***Continuous Assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

➠ Course Outcome (CO):

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

CO1: *Produce* correctly formatted business documents (letters, emails, memos) that conform to block format, netiquette, and basic proofreading norms.

CO2: *Create* organized notes and concise web-based writing (posts/pages) tailored to audience and purpose.

CO3: *Paraphrase* and summarize spoken input to demonstrate active-listening accuracy in brief responses.

CO4: *Adjust* reading strategies (skim/scan/intensive) to extract and evaluate key ideas from assigned texts.

CO5: *Diagnose* and correct common language errors (spelling, agreement, punctuation) to improve clarity.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	-	-	1	1	1	2	3	1	1
CO2	3	2	1	1	2	-	-	1	-	1	2	3	1	1
CO3	-	-	2	1	3	-	-	1	2	2	2	1	3	1
CO4	-	2	2	1	-	2	3	3	2	2	2	1	2	1
CO5	1	2	3	1	1	1	1	2	2	2	3	2	2	1

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

DATABASE MANAGEMENT SYSTEM LAB

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Database Management System Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 3^{rd}

List of Practicals: .....

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, SERIALIZABLE)

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 Science & Technology	**Course Type:** L-T-P
Name: Object Oriented Programming with Java Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 3^{th}

➠ List of Practicals: .....

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` → `Dog` → `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	Type			
					L	T	P	S
1	Computer Graphics		MC	4	3	1	0	0
2	Computer Networks		MC	4	3	1	0	0
3	Web Technology		MC	3	2	1	0	0
4	NM Elective IV: Operation Research		NM	4	3	1	0	0
5	Soft Skill Development IV		NV	1	0	0	0	2
6	Foreign Language II		AEC	2	2	0	0	0
7	SEC2: Entrepreneurship		SEC	3	2	1	0	0
Practical								
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 Science & Technology	**Course Type:** L-T-P
Name: Computer Graphics	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 4^{th}

➠ 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 / Contact hour	Weightage (%)
Module-I: Overview of Graphics Systems	4	10%
Module-II: Output Primitives	8	25%
Module-III: Two Dimensional Geometric Transformations	6	15%
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.

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.

➠ Teaching–Learning Methodology: .....

- ***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.
2. Peter Shirley, Steve Marschner, Fundamentals of Computer Graphics, 5th Edition

Course Outcome (CO):

CO1: *Explain* computer graphics system components, display technologies, and input/output devices used in interactive graphics applications.

CO2: *Apply* fundamental output primitives and drawing algorithms to generate geometric shapes and filled regions in 2D graphics.

CO3: *Apply* 2D geometric transformations and coordinate conversion techniques to manipulate graphical objects in real-life applications such as animations and CAD tools.

CO4: *Analyze* 2D viewing operations, clipping algorithms, and mapping techniques to control visibility and presentation of graphical content.

CO5: *Evaluate* multimedia systems, data compression needs, and standard file formats to support storage, transmission, and rendering of media-rich applications.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	2	1	2	2	2	1
CO2	3	3	2	1	3	1	1	1	1	1	2	3	3	2
CO3	3	3	3	2	3	1	1	1	2	1	2	3	3	2
CO4	2	3	3	2	3	1	1	1	2	1	2	3	3	2
CO5	2	2	2	1	3	1	2	1	2	1	3	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

COMPUTER NETWORKS

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Computer Networks	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 4^{th}

➠ 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 / Contact hour	Weightage (%)
Module-I: Data Transmission Basic Concepts and Terminology	8	16%
Module-II: Computer Network	8	17%
Module-III: Data Line Devices	10	21%
Module-IV: Network Layer	8	17%
Module-V: Local Area Network	8	17%
Module-VI: Network Security	6	12%

Syllabus Outline:

Module I: Data Transmission Basic Concepts and Terminology: [8L]

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: [8L]

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: [10L]

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: [8L]

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: [8L]

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

Module VI: Network Security: [6L]

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

Teaching–Learning Methodology:

- ***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.

Course Outcome (CO):

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

CO1: *Explain* fundamental concepts, components, and principles of computer networks to support efficient data communication..

CO2: *Analyze* networking models, protocols, and standards to evaluate their roles in structured communication environments.

CO3: *Apply* suitable communication techniques and control mechanisms to maintain reliable data transfer across network systems.

CO4: *Evaluate* network performance and operational strategies using appropriate technical parameters and diagnostic approaches.

CO5: *Implement* security measures and protective mechanisms to ensure confidentiality, integrity, and safe operation of networked systems.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	2	-	2	-	2	-
CO2	2	3	-	2	-	-	-	-	2	-	-	-	3	-
CO3	2	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	2	3	-	3	2	2	-	-	-	2	-	-	2	-
CO5	-	-	2	-	2	2	3	-	-	-	2	2	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

WEB TECHNOLOGY

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Web Technology	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** ME
Code: XXXXXX	**Semester:** 4^{th}

➠ 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 / Contact hour	Weightage (%)
Module-I: Introduction	2	5%
Module-II: World Wide Web and TCP/IP	5	14%
Module-III: IP Sub netting, addressing and Internet Routing Protocol	7	19%
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.

➠ Teaching–Learning Methodology: .....

- ***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.
2. Achyut S. Godbole, Atul Kahate, "Web Technologies: TCP/IP Architecture, Web Programming and Cloud Services", McGraw-Hill Education, 3rd Edition, 2020.
3. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 2011.

4. Thomas A. Powell, "The Complete Reference: HTML & CSS", McGraw-Hill, 5th Edition, 2017.

Reference Books:

1. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.
2. Deitel, Deitel & Nieto, "Internet & World Wide Web: How to Program", Pearson Education, 5th Edition, 2018.
3. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
4. William Stallings, "Network Security Essentials: Applications and Standards", Pearson Education, 6th Edition, 2020.

Course Outcome (CO):

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

CO1: *Explain* the foundational concepts of the Internet, WWW, TCP/IP and network protocols relevant to modern web communication.

CO2: *Analyze* IP addressing, subnetting, routing mechanisms and apply them in real network scenarios.

CO3: *Develop* static web pages using HTML and CSS with proper structure, formatting and layout principles.

CO4: *Build* interactive and dynamic client-side applications using JavaScript and applets, and relate them to real-world security threats.

CO5: *Apply* network security techniques such as VPN, SSL, SSH, and firewall configurations for securing web environments.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	2	1	2	2	1	1
CO2	3	3	1	2	2	1	1	1	1	1	2	2	1	1
CO3	2	1	3	1	3	1	1	2	2	1	2	3	3	2
CO4	2	2	2	1	3	1	2	2	2	1	2	2	3	2
CO5	2	2	1	2	3	3	3	1	1	1	3	2	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

OPERATION RESEARCH

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Operation Research	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 4^{th}

Learning Objectives:

After completing this course, students will be able to:

1. Understand the fundamental concepts of optimization and formulate real-life decision-making problems as Linear Programming Problems (LPP).
2. Know graphical and simplex-based techniques to solve LPPs.
3. Solve transportation and assignment problems using standard methods.
4. Know integer programming problems and apply techniques.
5. Know game theory concepts to two-person zero-sum games, compute optimal strategies.
6. Understand and evaluate Markov chains, transition probabilities, and steady-state behavior for real-world stochastic processes.

Prerequisite:

Students should have basic understanding of mathematics, including algebra, matrices, and probability; Fundamental knowledge of problem-solving techniques and logical reasoning, Familiarity with basic graphs, equations, and inequalities used in mathematical modeling.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Linear Programming Problem	12	25%
Module-II: Transportation Problem	8	17%
Module-III: Assignment problem	8	17%
Module-IV: Integer programming problem	6	12%
Module-V: Game Theory	8	17%
Module-VI: Markov Chain	6	12%

Syllabus Outline:

Module I: Linear Programming Problem: [12L]

Introduction to Optimization problem and Linear programming problem (LPP), Formulation of LPP, Graphical methods of solving LPP, Simplex Method of solving LPP, Unboundedness, Multiple optimum solution, Degenracy, Big-M method.

Module II: Transportation Problem: [8L]

Introduction to Transportation Problem, Balanced and unbalanced problems, Basic feasible solution finding methods (N-W corner method, Least cost cell method, VAM), Optimality testing method (MODI method)

Module III: Assignment problem: [8L]

Introduction to Assignment Problem, Balanced and Unbalanced problems, Hungarian method for solving assignment problem, Degeneracy.

Module IV: Integer programming problem: [6L]

Introduction to Integer programming problem (IPP), Formulation, Gomory's Cutting Plane method, Application of IPP.

Module V: Game Theory: [8L]

Introduction to game theory, Two person-zero sum game, saddle point, Pure and Mixed strategies.

Module VI: Markov Chain: [6L]

Concepts of Markov chain, Transition probabilities, Steady-State Probabilities, Applications.

Teaching–Learning Methodology:

- ***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. Taha, H. A. (2017). Operations Research: An Introduction (10th ed.). Pearson Education.
2. Swarup, K., Gupta, P. K., & Mohan, M. (2020). Operations Research. Sultan Chand & Sons.
3. Sharma, J. K. (2017). Operations Research: Theory and Applications (5th ed.). Macmillan Publishers / Laxmi Publications.

4. Hillier, F. S., & Lieberman, G. J. (2021). Introduction to Operations Research (11th ed.). McGraw-Hill Education.
5. Winston, W. L. (2004). Operations Research: Applications and Algorithms (4th ed.). Thomson Learning / Cengage.
6. Hillier, F. S. (2014). Fundamentals of Operations Research. McGraw-Hill Education.

Reference Books:

1. Hamdy Taha, (1999), Operations Research, PHI.
2. Sharma, S. D. (2018). Operations Research. Kedarnath Ramnath Publications.
3. Hira, D. S., & Gupta, P. K. (2016). Problems in Operations Research. S. Chand Publishing.
4. Panneer selvan. R. (2006), Operation Research, Prentice Hall of India Pvt Ltd.

Course Outcome (CO):

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

CO1: *Define* key concepts and terminologies used in operational research models and Decision making problem.

CO2: *Explain* the logical steps involved in optimization methods.

CO3: *Solve* real-world decision problems and optimization problems using appropriate analytical techniques.

CO4: *Differentiate* alternative solution approaches based on structural and operational characteristics of the optimization problem.

CO5: *Verify* the correctness and optimality of computed solutions.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	1	-	-	-	1	1	2	1
CO2	3	3	1	1	2	1	-	-	-	-	2	1	3	1
CO3	3	3	2	1	3	1	-	2	1	1	2	2	3	2
CO4	2	3	1	1	2	1	-	1	-	1	2	2	3	1
CO5	2	3	1	2	3	1	-	-	1	1	2	1	3	1

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFT SKILL DEVELOPMENT IV

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Soft-Skill Development-IV	**Course Credit:** 01[0-0-0-2]
Department: Computer Science Engineering	**Category:** NV
Code: MVSSU122T04	**Semester:** 4^{th}

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.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Advance logic & reasoning	14	65%
Module-II: Aptitude and Reasoning	6	25%
Module-III: Personality Development	2	5%
Module-IV: Professional grooming	2	5%

Syllabus Outline:

Module I: Advance logic & reasoning: [14L]

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

Module II: Aptitude and Reasoning: [6L]

- 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: [2L]

- 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: [2L]

- 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

Teaching–Learning Methodology:

- ***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.

Course Outcome (CO):

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

CO1: *Design* and produce a job portfolio (résumé, cover/application, follow-up) aligned to role requirements.

CO2: *Evaluate* and conduct group discussions using guidelines, roles, and evidence-based contributions.

CO3: *Craft* and deliver structured speeches/presentations demonstrating audience analysis, organization, and delivery control.

CO4: *Apply* small-talk and rapport strategies and analyze informal channels (grapevine/chat) with professional decorum.

CO5: *Analyze* assigned readings and justify takeaways in short written/oral responses.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	-	-	1	-	1	2	1	3	1
CO2	3	2	1	1	2	-	-	1	-	1	2	1	3	1
CO3	-	2	1	1	-	-	-	-	2	-	2	1	2	1
CO4	-	-	2	-	-	1	-	2	3	2	1	1	1	3
CO5	-	-	-	-	-	2	2	2	2	-	1	-	-	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

ENTREPRENEURSHIP

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Entrepreneurship	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** SEC
Code: XXXXXX	**Semester:** 4^{th}

➠ 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 / Contact hour	Weightage (%)
Module-I: Identify qualities of entrepreneurs	6	16%
Module-II: Write project proposal	8	22%
Module-III: Use various entrepreneurship models	6	17%
Module-IV: Understand various schemes supporting entrepreneurship	6	17%
Module-V: Think creative and innovative	6	17%
Module-VI: Future of entrepreneur in India	4	11%

➠ 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

➠ Teaching–Learning Methodology:

- ***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

➠ Course Outcome (CO):

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

CO1: *Identify* and *explain* the fundamental concepts of entrepreneurship and the characteristics, classifications, and environmental factors influencing entrepreneurs.

CO2: *Develop* and *present* structured project proposals by understanding the role of government and non-government agencies in entrepreneurial development.

CO3: *Apply* various entrepreneurship models and feasibility analysis techniques to assess business opportunities and market entry strategies.

CO4: *Prepare* and *evaluate* comprehensive business plans and project reports using appropriate appraisal methods and support schemes for entrepreneurship.

CO5: *Demonstrate* creativity and *innovation* in designing product, pricing, distribution, and promotional strategies while assessing future entrepreneurial opportunities in India

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	2	1	-	1	1	2	1	2	1
CO2	1	2	2	1	1	2	1	1	3	3	2	1	2	3
CO3	2	3	3	2	2	2	1	-	1	2	2	2	3	1
CO4	2	3	3	2	2	2	1	1	3	3	2	2	3	2
CO5	1	2	3	1	2	2	1	1	2	3	3	1	2	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

COMPUTER GRAPHICS LAB

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Computer Graphics Lab	**Course Credit:** 02[0-0-4]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 4^{th}

List of Practicals: .....

1. Write a program to draw a straight line using the DDA line drawing algorithm.
2. Implement Bresenham's Line Drawing Algorithm to draw a line between two points.
3. Write a program to draw a circle using the Midpoint Circle Drawing Algorithm.
4. Implement Bresenham's Circle Drawing Algorithm.
5. Create a program to draw an ellipse using the Midpoint Ellipse Algorithm.
6. Implement Scanline Polygon Fill Algorithm for a given polygon.
7. Implement Boundary-Fill Algorithm using 4-connected and 8-connected approaches.
8. Implement Flood-Fill Algorithm using recursion.
9. Write a program to perform 2D geometric transformations: translation, scaling, and rotation.
10. Implement reflection and shear transformations on a 2D object.
11. Write a program to perform Window-to-Viewport coordinate transformation.
12. Implement Cohen–Sutherland Line Clipping Algorithm.
13. Implement Liang–Barsky Line Clipping Algorithm.
14. Write a program to clip a polygon using Sutherland–Hodgman Polygon Clipping Algorithm.
15. Develop a simple graphics application to draw basic shapes (line, rectangle, circle, triangle) with color-filled options.

WEB TECHNOLOGY LAB

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Web Technology Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 4^{th}

List of Practicals: .....

1. Create a basic HTML webpage using headings, paragraphs, line breaks, and formatting tags.
2. Develop an HTML page using lists, tables, images, and hyperlinks.
3. Create a webpage layout using HTML div, span, and CSS for styling and alignment.
4. Design a student registration form using HTML forms and apply CSS formatting.
5. Write JavaScript code to validate HTML form inputs (name, email, password, etc.).
6. Implement JavaScript functions to demonstrate conditional statements, loops, and arrays.
7. Create a JavaScript program to manipulate DOM elements dynamically.
8. Develop a real-time digital clock using JavaScript.
9. Create a webpage that uses CSS Box Model, Flexbox, and Grid for layout.
10. Write a JavaScript program to set, get, and delete cookies.
11. Develop a simple JavaScript-based calculator for basic arithmetic operations.
12. Build an HTML + CSS + JavaScript mini project using event handling (e.g., image slider).
13. Create a Java Applet that displays shapes and text, and demonstrate applet lifecycle methods.
14. Implement a basic TCP client–server communication program (using Java or Python).
15. Configure simple firewall rules or packet filtering demonstration using a simulation tool.

THIRD YEAR

SEMESTER-V

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	P	S
1	Unix and Shell Programming		MC	4	3	1	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	0	2
6	SEC3: Logical Ability		SEC	3	2	1	0	0
7	SEC4: Customer Relationship Management using Salesforce		SEC	2	1	0	2	0
Practical								
8	Unix and Shell Programming Lab		MC	1	0	0	2	0
9	PHP with MySQL Lab		MC	1	0	0	2	0
				Total Credit=23				

UNIX AND SHELL PROGRAMMING

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Unix and Shell Programming	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 5^{th}

➠ 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 / Contact hour	Weightage (%)
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, /sbin, /usr/sbin, /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)

Teaching–Learning Methodology:

- ***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:

1. “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.
3. “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.

Course Outcome (CO):

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

CO1: *Recall* and *explain* UNIX architecture, basic system utilities, file system concepts, and commonly used UNIX commands.

CO2: *Apply* UNIX commands to navigate directories, manipulate files, manage permissions, and perform routine file system operations.

CO3: *Analyze* command outputs, filter behaviors, regular expressions, and shell utilities to troubleshoot and interpret text-processing tasks.

CO4: *Evaluate* and *compare* different UNIX filters, shell utilities, and process-handling commands to determine the most efficient solution for given problems.

CO5: *Design* and *develop* shell scripts using variables, conditionals, loops, functions, and process control to automate tasks in UNIX.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	1	-	1	1	-	-	1	-	1
CO2	3	3	2	-	2	1	-	1	1	-	-	2	1	1
CO3	3	3	3	2	2	1	-	1	2	-	-	2	1	2
CO4	2	2	-	3	3	2	-	1	1	-	-	1	1	2
CO5	2	3	2	3	3	2	-	1	2	1	-	2	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

CRYPTOGRAPHY AND NETWORK SECURITY

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Cryptography and Network Security	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 5^{th}

➠ 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 / Contact hour	Weightage (%)
Module-I: Introduction	2	6%
Module-II: Conventional Cryptographic Techniques	8	22%
Module-III: Algorithm types & Modes	8	22%
Module-IV: Digital Signature and RSA - Introduction	8	22%
Module-V: Basic Concepts and applications	6	17%
Module-VI: Secure Socket Layer & Transport Layer Security	4	11%

➠ 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.

➠ Teaching–Learning Methodology: .....

- ***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.

Course Outcome (CO):

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

CO1: *Explain* fundamental concepts of security, classical cryptographic techniques, types of attacks, and principles of security.

CO2: *Apply* symmetric and asymmetric cryptographic algorithms (DES, IDEA, RC5, RSA) to secure data and communications in different scenarios.

CO3: *Analyze* digital signature mechanisms, message digest concepts, authentication methods, and evaluate their effectiveness in securing systems.

CO4: *Evaluate* network security protocols like SSL/TLS and security services such as intrusion detection, firewall mechanisms, and trusted systems.

CO5: *Design* and *develop* secure network solutions by integrating cryptographic techniques, authentication models, and security mechanisms for real-world applications.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	3	-	-	-	2	-	-	-	-	2	-	3	-
CO2	3	-	2	-	1	-	-	-	-	-	-	1	3	-
CO3	-	3	-	1	-	1	2	-	-	-	-	-	3	-
CO4	-	2	2	3	2	3	2	-	-	-	-	1	3	-
CO5	3	-	3	-	3	-	-	3	2	1	1	3	-	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

ORGANISATIONAL BEHAVIOUR

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Organisational Behaviour	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 5^{th}

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

1. *Understand* core concepts of organizational behaviour, individual behaviour, group dynamics, leadership, culture, and change.
2. *Analyze* and Apply OB theories to improve individual performance, group effectiveness, and organizational functioning.
3. *Evaluate* leadership, conflict, stress, and cultural factors to propose solutions for real-world organizational challenges.

Prerequisite:

Basic knowledge of management principles and organizational functions; interest in human behaviour in workplace settings.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Introduction to Organizational Behaviour (OB) and Organizational Structure	6	12.5%
Module-II: Individual Behaviour – Personality, Learning, Emotions, Attitudes & Perception	10	21%
Module-III: Group Behaviour, Team Dynamics & Communication	10	20%
Module-IV: Leadership, Power & Conflict Management	8	17%
Module-V: Organizational Culture, Organizational Change & Development	8	17%
Module-VI: Stress Management and Contemporary Issues in OB	6	12.5%

Syllabus Outline:

Module I: Introduction to Organizational Behaviour (OB) and Organizational Structure: [6L]
Definition, scope, and importance of OB; Evolution and historical development, Multidisciplinary nature of OB, Organizations as social systems, Organizational design: meaning, principles; Types of organizational structures: functional, divisional, matrix, network, virtual; Impact of globalization on OB, Contemporary challenges: workforce diversity, technology, ethics.

Module II: Individual Behaviour – Personality, Learning, Emotions, Attitudes & Perception: [10L]
Foundations of individual behaviour, Personality: determinants, traits, Myers-Briggs Type Indicator (MBTI), Big Five Model; Learning: theories (Classical, Operant, Social Learning), Attitudes and job satisfaction, Emotions & Emotional Intelligence (EI), Perception: process, perceptual errors, attribution theory; Motivation: Maslow, Herzberg, McClelland, Vroom, Goal-setting, Reinforcement

Module III: Group Behaviour, Team Dynamics & Communication: [10L]
Group formation: types of groups (formal & informal), Stages of group development, Group cohesiveness and group norms, Team building and team effectiveness, Group decision-making: techniques and pitfalls, Communication: process, barriers, informal communication, improving communication effectiveness, Collaborative problem-solving in organizations

Module IV: Leadership, Power & Conflict Management: [8L]
Leadership: traits and behavioural approaches, Contingency theories: Fiedler, Path–Goal, Hersey-Blanchard, Modern leadership theories: Transformational, Transactional, Servant Leadership, Authentic Leadership; Power and politics in organizations, Sources and types of power, Conflict: nature, causes, types (functional & dysfunctional); Conflict resolution techniques, Negotiation: process and strategies

Module V: Organizational Culture, Organizational Change & Development: [8L]
Organizational culture: definition, levels, types; Creating and sustaining culture, Organizational change: nature, forces, resistance to change; Models of change: Lewin's model, Kotter's 8-step model; Organizational development (OD): objectives and interventions, Managing change in multicultural organizations

Module VI: Stress Management and Contemporary Issues in OB: [6L]
Stress: meaning, types, causes (organizational & personal); Consequences of stress, Stress management techniques: individual and organizational approaches, Work-life balance, Employee empowerment and engagement, Ethics in OB, Role of technology, AI, and remote/hybrid work models; Current trends: diversity inclusion, gig workforce, emotional wellness

Teaching–Learning Methodology:

- ***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. Stephen P. Robbins & Timothy A. Judge – Organizational Behavior, Pearson
2. Keith Davis & John W. Newstrom – Organizational Behavior: Human Behavior at Work, McGraw Hill
3. Udai Pareek – Understanding Organisational Behaviour, Oxford University Press
4. Fred Luthans – Organizational Behavior, McGraw Hill

Reference Books:

1. John R. Schermerhorn, James G. Hunt & Richard Osborn – Organizational Behavior, Wiley
2. Margaret A. Neale & Max H. Bazerman – Negotiation in Organizations
3. Daniel Goleman – Emotional Intelligence (for EI and leadership insights)
4. Debra L. Nelson & James Campbell Quick – Organizational Behavior: Science, The Real World, and You
5. Gary Johns & Alan Saks – Organizational Behaviour: Understanding and Managing Life at Work

Course Outcome (CO):

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

CO1: *Understand* the fundamental concepts of Organizational Behaviour, organizational design, and structure, including their importance, key elements, and relevance in a globalized business environment.

CO2: *Analyze* individual cognitive processes such as learning, personality, emotions, attitudes, motivation, and perception, and apply relevant theories to enhance employee performance and well-being in organizations.

CO3: *Examine* group dynamics, team development, and group decision-making processes, and apply techniques to foster effective teamwork and collaborative problem-solving in organizational settings.

CO4: *Evaluate* leadership styles, power dynamics, and conflict management approaches, and develop strategies to lead effectively and manage organizational conflicts constructively across diverse cultural contexts.

CO5: *Understand* organizational culture, organizational development, and stress management, and apply interventions to promote a positive work environment, manage change, and reduce individual and organizational stress.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	1	2	-	2	2	1	2	2	2	2
CO2	1	2	-	-	-	1	1	2	2	-	2	2	3	2
CO3	-	2	1	-	-	-	1	3	2	2	2	1	2	3
CO4	-	2	1	-	-	1	3	3	2	2	2	1	2	3
CO5	-	1	2	-	-	2	2	2	2	2	2	1	2	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

PHP WITH MYSQL

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: PHP with MySQL	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 5^{th}

➠ 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 / Contact hour	Weightage (%)
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, 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.

Teaching–Learning Methodology:

- ***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

➠ Course Outcome (CO):

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

CO1: *Describe* the fundamental concepts of PHP and MySQL, including syntax, data types, control structures, and basic SQL operations.

CO2: *Apply* PHP form handling, session management, and file upload techniques to create dynamic web pages.

CO3: *Analyze* data processing using arrays, string functions, SQL queries, and normalization principles.

CO4: *Evaluate* the security and efficiency of PHP–MySQL interactions using prepared statements, error handling, and transactions.

CO5: *Design* a complete web application incorporating PHP, MySQL, CRUD operations, AJAX, authentication, and deployment practices.

➠ CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	0	0	1	0	0	0	0	0	0	2	1	0
CO2	1	1	0	0	3	0	0	0	0	0	0	3	2	0
CO3	1	3	1	0	1	0	0	0	0	0	0	2	3	0
CO4	1	1	0	0	1	1	2	0	0	0	0	1	3	0
CO5	1	1	3	1	2	0	0	2	1	2	1	3	2	0

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFT-SKILL DEVELOPMENT V

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Soft-Skill Development-V	**Course Credit:** 01[0-0-0-2]
Department: Computer Science Engineering	**Category:** NV
Code: MVSSU122T05	**Semester:** 5^{th}

➠ Learning Objectives:

To prepare students for various aptitude, logic, and reasoning tests. To familiarize students with the format and types of questions in these tests. To prepare students for group discussions and provide them with an environment to practice.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Mock Tests	12	50%
Module-II: Business Presentation Skills	5	20%
Module-III: Group Discussion	5	20%
Module-IV: Corporate & Social Etiquette	2	10%

➠ Syllabus Outline: .....

Module I: Mock Tests: [12L]

- Aptitude
- Logic and Reasoning

Module II: Business Presentation Skills: [5L]

- Discussing the significance of audio-visual aids, audience, and feedback in presentation skills
- Analyzing the significance of non-verbal communication
- Preparing effective PowerPoint presentations
- Delivering the presentation
- Handling questions

Activities: Time-limited presentations, visual aid designs, impromptu speaking, peer presentations

Module III: Group Discussion: [5L]

- PESTA format
- Do's and Don'ts of group discussions
- Initialization and conclusion
- Tips to stand out

Module IV: Corporate & Social Etiquette: [2L]

- Etiquette
- Netiquettes
- Professional mannerism

➠ Teaching–Learning Methodology:

- ***Pedagogy for Course Delivery:*** Workshop, Group discussions, Presentations, Lectures
- ***List of Professional Skill Development Activities (PSDA):*** Time-limited presentations, visual aid designs, impromptu speaking, peer presentations
- ***Continuous Assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

➠ Teaching–Learning Methodology:

- ***Pedagogy for Course Delivery:*** Workshop, Group discussions, Presentations, Lectures
- ***List of Professional Skill Development Activities (PSDA):*** Time-limited presentations, visual aid designs, impromptu speaking, peer presentations
- ***Continuous Assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

➠ Course Outcome (CO):

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

CO1: *Design* and *deliver* audience-centered presentations using appropriate visuals, timing, and Q&A handling.

CO2: *Analyze* interview types/styles and demonstrate effective responses in simulated panels.

CO3: *Apply* workplace/social etiquette and analyze feedback to improve collaboration and networking (including social media).

CO4: *Evaluate* negotiation scenarios, assess tactics, and justify positions using ethical and persuasive reasoning.

CO5: *Analyze* assigned texts and evaluate implications for professional communication.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	-	-	1	-	1	2	1	3	1
CO2	3	2	1	1	2	-	-	1	-	1	2	1	3	1
CO3	1	2	3	1	1	1	1	2	2	2	3	1	2	2
CO4	-	-	2	-	-	1	-	2	3	2	1	1	1	3
CO5	-	-	-	-	-	2	2	2	2	-	1	-	-	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SEC3: LOGICAL ABILITY

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Logical Ability	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** SEC
Code: XXXXXX	**Semester:** 5^{th}

➠ Learning Objectives:

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

1. *Develop* logical and analytical reasoning skills required for problem-solving in computational and real-life contexts.
2. *Apply* verbal, non-verbal, and quantitative logical techniques to interpret data and solve structured puzzles efficiently.
3. *Enhance* decision-making and critical-thinking abilities for academic, technical, and competitive environments.

➠ Prerequisite:

Basic mathematical ability (class 10 level) and fundamental understanding of English vocabulary and numerical reasoning.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Basics of Logic & Analytical Reasoning	6	16.66%
Module-II: Verbal Reasoning – Classification, Analogy & Series	6	16.66%
Module-III: Non-Verbal Reasoning & Pattern Recognition	6	16.67%
Module-IV: Logical Deduction, Syllogism & Logical Connectives	6	16.67%
Module-V: Analytical Puzzles & Problem Solving	6	16.67%
Module-VI: Quantitative Logic & Data Interpretation Reasoning	6	16.67%

Syllabus Outline:

Module I: Basics of Logic & Analytical Reasoning: [6L]

Introduction to logical thinking and reasoning types, Statements, arguments, assumptions; Deductive & inductive reasoning, Logical puzzles (introductory), Course-of-action reasoning, Data sufficiency (basics)

Module II: Verbal Reasoning – Classification, Analogy & Series: [6L]

Classification (odd-one-out), Analogy (word, number, letter, and meaning-based), Series: alphabetical, alphanumeric, number series; Coding–decoding (letter, number, substitution), Direction sense test

Module III: Non-Verbal Reasoning & Pattern Recognition: [6L]

Pattern completion, Mirror images and water images, Paper folding & paper cutting, Embedded figures, Figure matrix, Dot situation & grouping of identical figures

Module IV: Logical Deduction, Syllogism & Logical Connectives: [6L]

Syllogism (traditional & modern approach), Venn-diagram based logical questions, Implicit statements & conclusions, Logical connectives (AND, OR, IF–THEN, IFF), Truth tables and logical equivalence, Decision making and inference

Module V: Analytical Puzzles & Problem Solving: [6L]

Linear and circular arrangement, Blood relations (direct & coded), Scheduling puzzles, Floor and box puzzles, Ranking and ordering problems, Binary logic puzzles

Module VI: Quantitative Logic & Data Interpretation Reasoning: [6L]

Quantitative logic: ratios, ages, averages (logic-based), Mathematical reasoning (equations, inequalities), Data interpretation (logic-based): tables, graphs, charts; Logical approximation and estimation, Short-cut strategies & exam-oriented techniques

Teaching–Learning Methodology:

- ***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. R. S. Aggarwal – A Modern Approach to Verbal & Non-Verbal Reasoning
2. Arihant Publications – Analytical & Logical Reasoning for CAT

3. K. Kundan – Logical Reasoning and Data Interpretation (BSC Publication)

Reference Books:

1. P. K. Mishra – Logical and Analytical Reasoning
2. Edgar Thorpe – Test of Reasoning, McGraw Hill
3. Nishit Sinha – Logical Reasoning and Data Interpretation
4. Lucent's – Reasoning and Aptitude
5. How to Prepare for Logical Reasoning for CAT – Arun Sharma

Course Outcome (CO):

CO1: *Understand* the foundational concepts of logical reasoning, verbal reasoning, non-verbal reasoning, and analytical thinking.

CO2: *Apply* logical techniques to solve puzzles, series, analogies, deductions, and data-based reasoning problems.

CO3: *Analyze* complex logical situations involving patterns, relationships, and structured problem scenarios to determine accurate solutions.

CO4: *Evaluate* multiple reasoning approaches, identify contradictions or inconsistencies, and choose the most efficient problem-solving strategy.

CO5: *Construct* logical models, represent scenarios using diagrams/tables, and generate unique reasoning patterns for effective decision-making.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	1	1	1	2	1	2	-	-	-
CO2	1	3	1	2	2	1	-	1	2	1	2	1	1	-
CO3	1	3	1	3	2	1	1	1	2	1	2	1	1	1
CO4	1	3	1	3	2	1	2	1	2	2	2	1	1	1
CO5	1	2	1	3	2	1	1	2	3	2	3	1	1	1

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SEC4: CUSTOMER RELATIONSHIP MANAGEMENT USING SALESFORCE

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Customer Relationship Management using Salesforce	**Course Credit:** 02[1-0-2-0]
Department: Computer Science Engineering	**Category:** SEC
Code: XXXXXX	**Semester:** 5^{th}

➠ Learning Objectives:

1. To understand the concepts and importance of Customer Relationship Management (CRM).
2. To familiarize students with Salesforce as a leading cloud-based CRM solution.
3. To provide practical experience in customizing and extending CRM functionality.
4. To enable the development and integration of cloud-based business applications.
5. To introduce cloud architecture and the Salesforce platform for scalable enterprise solutions.

➠ Prerequisite:

Students should have basic knowledge of Web Technologies, Databases, and Software Engineering

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: CRM and Cloud Computing Basics	4	11%
Module-II: Salesforce Platform Overview	4	11%
Module-III: Declarative Development and Automation	6	17%
Module-IV: Programmatic Development with Apex	8	22%
Module-V: Lightning Web Components and App Development	6	17%
Module-VI: Integration and Analytics	8	22%

Syllabus Outline:

Module I: CRM and Cloud Computing Basics : [4L]

- Introduction to CRM: Evolution, types, and business relevance
- CRM components: Operational, Analytical, Collaborative
- Introduction to Cloud Computing: IaaS, PaaS, SaaS
- CRM as SaaS: Overview of market leaders

Module II: : Salesforce Platform Overview : [4L]

- Salesforce architecture and editions
- Navigating Salesforce Lightning interface
- Standard objects and their relationships (Account, Contacts, Leads)
- Custom objects and schema builder

Module III: Declarative Development and Automation: [6L]

- Customizing page layouts and record types
- Validation rules, workflow rules, and process builder
- Flows and approval processes
- Salesforce App Builder and Lightning App setup

Module IV: Programmatic Development with Apex: [8L]

- Apex syntax and data types
- SOQL and SOSL queries
- Writing triggers and classes
- Introduction to asynchronous Apex (future, batch, queueable)

Module V: Lightning Web Components and App Development: [6L]

- Component-driven development with LWC
- Events and data binding
- Creating reusable components
- Deployment using change sets and unmanaged packages

Module VI: Integration and Analytics: [8L]

- REST API and external integrations
- AppExchange and prebuilt integrations
- Reports, dashboards, and Einstein Analytics
- Final project: CRM application for a fictional business

Teaching–Learning Methodology:

- ***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. Paul Battisson, Learning Salesforce Development with Apex, Packt Publishing
2. Salesforce Official Documentation: https://developer.salesforce.com/docs

Reference Books:

1. Siddhesh Kabe, Salesforce Essentials for Administrators, Packt Publishing
2. Michael Wicherski, Advanced Apex Programming, Salesforce Press
3. Trailhead (Salesforce's Official Learning Platform): https://trailhead.salesforce.com

Course Outcome (CO):

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

CO1: *Explain* the fundamentals, architecture, and evolution of Customer Relationship Management (CRM) systems with emphasis on the Salesforce ecosystem.

CO2: *Apply* Salesforce CRM features to manage sales, service, and marketing workflows in real-world business scenarios.

CO3: *Design* and *implement* process automation using validation rules, workflow rules, and Flow Builder to streamline business operations.

CO4: *Analyze* Salesforce reports and dashboards to extract actionable business insights and support decision-making.

CO5: *Able* to develop and *demonstrate* a mini-project simulating a real-world CRM scenario and prepare for Salesforce Administrator (ADM 201) certification.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	1	1	1	1	2	2	2	2
CO2	3	3	3	2	3	1	1	2	2	2	2	2	3	3
CO3	2	3	3	3	3	2	1	2	2	2	3	3	3	3
CO4	2	3	3	3	3	2	1	2	2	2	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

UNIX AND SHELL PROGRAMMING LAB

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Unix and Shell Programming Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 5^{th}

List of Practicals:

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 Science & Technology	**Course Type:** L-T-P
Name: PHP with MySQL Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 5^{th}

List of Practicals: .....

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.
2. **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 MySQL**
   Write 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	Type			
					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	2	1	0	0
5	Soft Skill Development VI		NV	1	0	0	0	2
6	Ethic Study and IPR		VAC	2	2	0	0	0
Practical								
7	Software Engineering Lab		MC	1	0	0	2	0
				Total Credit=19				

FUNDAMENTAL OF DATA SCIENCE

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Fundamental of Data Science	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 6^{th}

➠ 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 / Contact hour	Weightage (%)
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.

➠ Teaching–Learning Methodology: .....

- ***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.
2. 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.

Course Outcome (CO):

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

CO1: *Explain* the foundational concepts of data science, including data science workflow, roles of data scientists, and essential programming components involved in data-driven problem solving.

CO2: *Apply* data manipulation, cleaning, exploratory data analysis, and feature engineering techniques to structured datasets using tools such as pandas, dplyr, and Python/R libraries.

CO3: *Analyze* datasets using probabilistic concepts, statistical inference methods, and regression models to identify patterns, relationships, and evidence-based conclusions.

CO4: *Evaluate* the performance and suitability of machine learning models, including classification, regression, clustering, and neural networks, using appropriate metrics and validation strategies.

CO5: *Design* and *construct* end-to-end data science solutions by integrating data visualisation, distributed processing frameworks (Hadoop/Spark), and ethical/privacy considerations for real-world applications.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	1	1	1	-	1	-	2	1	1
CO2	3	2	2	1	3	-	-	-	-	-	-	2	3	3
CO3	3	3	1	3	2	1	1	-	-	-	-	3	2	3
CO4	2	3	2	3	3	1	1	1	-	-	-	3	3	3
CO5	2	2	3	2	3	3	3	2	2	-	-	3	-	-

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFTWARE ENGINEERING

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Software Engineering	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 6^{th}

➠ 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 / Contact hour	Weightage (%)
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.

Teaching–Learning Methodology:

- ***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 Education, 2021.
3. 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.
2. 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.

➠ Course Outcome (CO):

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

CO1: *Understand* and *compare* different software process models to assess their applicability, and apply requirements engineering techniques to elicit, analyze, and document functional and non-functional requirements.

CO2: *Apply* key design principles such as modularity, abstraction, and cohesion to create architectural, component-level, and user interface designs for software projects.

CO3: *Evaluate* software quality using established models (e.g., McCall's, ISO 9126) and implement quality assurance and risk management strategies to ensure software reliability.

CO4: *Utilize* software sizing techniques (LOC, FP) and estimation models (COCOMO) to estimate cost, effort, and schedule, and create effective project timelines.

CO5: *Apply* various software testing techniques (unit, integration, white-box, black-box) and configuration management practices to validate system performance and ensure maintainability.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	2	-	2	3	-	2	3	2	1
CO2	3	2	3	2	2	1	-	-	2	-	-	3	2	-
CO3	2	3	2	2	2	2	3	-	-	2	2	2	1	3
CO4	2	2	-	-	3	-	-	2	2	3	1	2	1	3
CO5	3	3	2	3	3	-	1	-	-	1	2	3	2	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

NM ELECTIVE VI: DECISION SUPPORT SYSTEM

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Decision Support System	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 6^{th}

Learning Objectives:

1. To equip students with the foundational concepts, architectures, and technologies used in designing and implementing Decision Support Systems.
2. To enable learners to apply analytical models, data-driven tools, and AI techniques for effective decision-making in organizational settings.

Prerequisite:

Basic knowledge of information systems and fundamentals of data management or database concepts.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Introduction to Decision Support Systems	4	8%
Module-II: DSS Architecture and Technologies	8	17%
Module-III: Modeling in DSS	6	13%
Module-IV: Group Decision Support Systems (GDSS)	8	17%
Module-V: AI-Based Decision Support	12	25%
Module-VI: Implementation, Evaluation & Applications of DSS	10	20%

Syllabus Outline:

Module I: Introduction to Decision Support Systems: [4L]

Concept of Decision, Types of Decisions, Decision-Making Process; Need, Characteristics, and Components of DSS; Types of Decision Support Systems; Relationship of DSS with MIS, EIS, and

Knowledge-Based Systems; DSS Models and Modeling Tools

Module II: DSS Architecture and Technologies: [8L]
DSS Architecture: Data Management, Model Management, Knowledge Management; User Interface and Dialog Management, Data Warehousing Concepts and Role in DSS, OLAP and Data Mining for DSS, Business Intelligence Technologies

Module III: Modeling in DSS: [6L]
Decision Models: Mathematical, Statistical, Optimization, and Simulation Models; Sensitivity Analysis, What-if Analysis, Goal Seeking; Heuristic and Predictive Models; Use of Spreadsheets and DSS Tools for Modeling

Module IV: Group Decision Support Systems (GDSS): [8L]
Concept and Need for GDSS, GDSS Components and Applications, Computer-Supported Cooperative Work (CSCW), Groupware Tools, Electronic Meeting Systems, Collaborative Decision-Making Platforms

Module V: AI-Based Decision Support: [12L]
Expert Systems for Decision Support, Machine Learning and AI Integration in DSS, Intelligent Agents and Knowledge-Based DSS, Natural Language Processing for Decision Support, Applications of AI-Driven DSS in Business, Healthcare, Finance

Module VI: Implementation, Evaluation & Applications of DSS: [10L]
DSS Development Process and Methodologies, Ethical and Security Issues in DSS, Cost–Benefit Analysis and Evaluation of DSS, Case Studies: ERP-Based DSS, Supply Chain DSS, Marketing DSS, Financial DSS; Trends: Cloud DSS, Mobile DSS, Real-Time Analytics

➠ Teaching–Learning Methodology:

- ***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. Efraim Turban, Jay E. Aronson, Ting-Peng Liang, “Decision Support Systems and Intelligent Systems”, Pearson.
2. Thomas J. Watson, “Decision Support Systems: Concepts and Applications”, McGraw-Hill.
3. Ralph H. Sprague & Eric D. Carlson, “Building Effective Decision Support Systems”, PHI.

Reference Books:

1. G. Shankar, "Decision Support Systems and Business Intelligence", Pearson.
2. V. S. Janakiraman & K. Sarukesi, "Decision Support Systems", PHI.
3. Marakas G. M., "Decision Support Systems in the 21st Century", Pearson.
4. Daniel J. Power, "Decision Support Systems: Concepts and Resources for Managers", Greenwood Publishing.

Course Outcome (CO):

CO1: *Explain* the concepts, components, and architectures of Decision Support Systems and their role in organizational decision-making.

CO2: *Apply* data management, model management, and BI technologies such as OLAP, data warehousing, and data mining in DSS environments.

CO3: *Build* and *analyze* decision models using mathematical, statistical, optimization, simulation, and spreadsheet-based DSS tools.

CO4: *Evaluate* Group Decision Support Systems and collaborative decision-making technologies for real-world team-based problem scenarios.

CO5: *Assess* AI-driven decision support approaches including expert systems, intelligent agents, and machine learning techniques for business applications.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	2	1	2	1	2	1	2	1
CO2	2	3	2	2	3	1	1	1	2	1	2	3	3	2
CO3	2	3	2	3	3	1	1	1	2	1	2	3	3	2
CO4	1	2	2	1	2	2	1	3	3	2	2	1	2	2
CO5	2	2	2	2	3	1	2	1	2	1	3	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

CLOUD COMPUTING

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Cloud Computing	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** ME
Code: XXXXXX	**Semester:** 6^{th}

➠ 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 / Contact hour	Weightage (%)
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 computing, 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, 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

➠ Teaching–Learning Methodology:

- ***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.

➠ Course Outcome (CO):

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

CO1: *Explain* the fundamental concepts, origins, components, characteristics, service models, and deployment models of cloud computing.

CO2: *Demonstrate* the role of cloud-enabling technologies such as virtualization, grid computing, and high-performance computing, and illustrate how they support cloud architectures.

CO3: *Analyze* various cloud architectures, cloud service models (SaaS, PaaS, IaaS), deployment models, cloud security challenges, and resource management strategies across inter-cloud environments.

CO4: *Evaluate* cloud technologies, including virtualization tools (e.g., VMware), cloud storage mechanisms, SOA-based cloud applications, APIs, and cloud–WSN integration frameworks to assess their effectiveness and limitations.

CO5: *Design* cloud-based solutions using virtualization tools and cloud service APIs for real-world applications involving storage, distributed data access, and cloud-enabled sensor networks.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	1	-	-	1	-	1	2	2	1
CO2	2	2	1	1	3	-	-	-	1	-	2	2	3	1
CO3	2	3	2	1	2	1	1	-	1	-	2	2	3	1
CO4	2	2	3	2	2	1	1	-	1	1	2	2	3	1
CO5	1	2	3	2	3	1	-	2	2	2	2	3	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

CYBER SECURITY

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Cyber Security	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** ME
Code: XXXXXX	**Semester:** 6^{th}

➠ Learning Objectives:

Students will learn core cybersecurity principles, types of cyber-attacks, and foundational cryptographic techniques including symmetric and asymmetric algorithms. They will understand digital signatures, RSA, Internet security protocols, and authentication mechanisms. The course also equips students with knowledge of email security and firewall configuration, enabling them to protect and secure digital information effectively.

➠ 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 / Contact hour	Weightage (%)
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 Signature and RSA	8	22%
Module-V: Internet Security Protocols, User Authentication	4	12%
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.

➠ Teaching–Learning Methodology: .....

- ***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.
2. 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.

4. 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.
2. Forouzan, Behrouz A., and Debdeep Mukhopadhyay. Cryptography and Network Security. McGraw-Hill Education, 2018.

Course Outcome (CO):

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

CO1: *Explain* the need for cybersecurity, various types of attacks, and core security principles used to protect digital systems.

CO2: *Apply* cryptographic concepts including encryption, decryption, symmetric and asymmetric techniques to secure communication.

CO3: *Compare* and *implement* symmetric key algorithms such as DES, IDEA, and RC5 for real-world data protection scenarios.

CO4: *Analyze* asymmetric cryptography, RSA, digital signatures, and hashing concepts to ensure authentication and integrity.

CO5: *Evaluate* user authentication mechanisms, email security protocols, and firewall configurations for designing secure network environments.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	3	3	1	2	1	2	1	2	2
CO2	2	3	1	1	3	1	1	1	1	1	2	3	3	2
CO3	2	3	2	1	3	1	1	1	1	1	2	3	3	2
CO4	2	3	2	1	3	1	2	1	1	1	2	3	3	2
CO5	1	2	2	1	3	1	2	1	2	1	2	2	3	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFT SKILL DEVELOPMENT VI

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P-S
Name: Soft-Skill Development-VI	**Course Credit:** 01[0-0-0-2]
Department: Computer Science Engineering	**Category:** NV
Code: MVSSU122T06	**Semester:** 6^{th}

➠ 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.

➠ 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

➠ Teaching–Learning Methodology: .....

- ***Pedagogy for Course Delivery:*** Workshop, Group Discussions, Presentations, Lectures.
- ***Continuous Assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

➠ Teaching–Learning Methodology: .....

- ***Pedagogy for Course Delivery:*** Workshop, Group Discussions, Presentations, Lectures.
- ***Continuous assessment:*** Quiz/ Assessment/ Presentation/ Problem solving etc.

➠ Course Outcome (CO): .....

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

CO1: *Analyze* etiquette scenarios (image management, events, travel, greetings) and apply appropriate conduct.

CO2: *Plan* and *compose* formal reports that conform to purpose, type, and format with coherent organization.

CO3: *Perform* professional telephonic conversation (receiving/handling/closing), modulate voice, and demonstrate effective listening.

CO4: *Draft* accurate notices, circulars, agendas, and minutes that meet institutional/industry conventions.

CO5: *Evaluate* cross-cultural variables (context, ethnocentrism, stereotyping) and design culturally sensitive communication strategies.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	-	-	1	-	1	2	1	3	1
CO2	2	3	2	2	1	-	-	1	1	1	2	1	3	1
CO3	-	-	2	-	-	1	-	2	3	2	1	1	1	3
CO4	-	1	1	-	-	1	1	3	2	1	1	-	1	3
CO5	-	-	-	-	-	2	2	2	2	-	1	-	-	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

ETHIC STUDY AND IPR

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Ethic Study and IPR	**Course Credit:** 02[2-0-0]
Department: Computer Science Engineering	**Category:** VAC
Code: XXXXXX	**Semester:** 6^{th}

Learning Objectives:

1. To provide foundational understanding of ethical principles and IPR frameworks essential for responsible digital and professional conduct.
2. To enable learners to analyze ethical dilemmas in technology, understand IPR laws, and apply them to protect and manage intellectual creations.

Prerequisite:

Basic understanding of information technology concepts and general awareness of legal and professional practices.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Introduction to Ethics and Ethical Frameworks	4	16.67%
Module-II: Ethics in Information Technology & Digital Environments	4	16.67%
Module-III: Emerging Technology Ethics	6	25%
Module-IV: Introduction to Intellectual Property Rights (IPR)	4	16.67%
Module-V: Legal Frameworks and Procedures of IPR	4	16.67%
Module-VI: Contemporary Issues in Ethics & IPR	2	8.32%

Syllabus Outline:

Module I: Introduction to Ethics and Ethical Frameworks: [4L]

Definition, nature, and scope of ethics; Morality, values, and professional conduct; Ethical theories: Utilitarianism, Deontology, Virtue Ethics; Ethical decision-making models and frameworks, Relevance of ethics in technology and professional practice.

Module II: Ethics in Information Technology & Digital Environments: [4L]

Ethical issues in computing and digital communication, Privacy, data protection, and user consent; Cybersecurity ethics and responsible disclosure, Ethical implications of social media, digital surveillance, and data analytics; Case studies on IT ethics

Module III: Emerging Technology Ethics: [6L]

Ethics of Artificial Intelligence (AI) and automation, Algorithmic bias, fairness, and transparency; Ethical challenges in IoT, Big Data, Blockchain, and Cloud; Digital well-being, digital divide, and societal impacts; Contemporary case studies: AI-generated content, deepfakes, autonomous systems

Module IV: Introduction to Intellectual Property Rights (IPR): [4L]

Nature, purpose, and importance of IPR; Types of IPR: Patents, Copyright, Trademarks, Trade Secrets, Industrial Designs; Distinction among different IPR types, IPR treaties: WIPO, TRIPS Agreement, Global vs. Indian IPR ecosystems

Module V: Legal Frameworks and Procedures of IPR: [4L]

Indian IPR laws: Patents Act, Copyright Act, Trademarks Act, Designs Act; Filing procedures: Patent application, copyright registration, trademark filing; Infringement, remedies, licensing, and technology transfer; Digital rights management (DRM) and open-source licensing, Case studies on IPR disputes

Module VI: Contemporary Issues in Ethics & IPR: [2L]

Ethical & legal issues in digital content creation, AI-generated works and authorship challenges, Plagiarism, online piracy, and infringement, Managing digital rights: Creative Commons, copyleft, fair use; Proposing ethical/legal solutions to modern digital challenges

Teaching–Learning Methodology:

- ***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. Mike W. Martin & Roland Schinzinger, "Ethics in Engineering", McGraw-Hill.
2. Deborah Johnson, "Computer Ethics", Pearson.

Reference Books:

1. R. Subramanian, "Professional Ethics", Oxford University Press.
2. V. Scassa & M. Chung, "Digital Intellectual Property", LexisNexis.
3. T. Ramappa, "Intellectual Property Rights Under WTO: Tasks Before India", PHI.
4. Richard Spinello, "CyberEthics: Morality and Law in Cyberspace", Jones & Bartlett.

Course Outcome (CO):

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

CO1: *Explain* fundamental ethical concepts, theories, and decision-making frameworks relevant to professional and digital environments.

CO2: *Analyze* ethical issues in Information Technology, including privacy, data protection, cybersecurity, and the social impact of emerging technologies.

CO3: *Describe* and differentiate various forms of Intellectual Property Rights (IPR) and interpret the legal frameworks governing IPR in India and globally.

CO4: *Apply* IPR principles—including copyright, patents, trademarks, and trade secrets—to protect digital creations and ensure responsible use of others' intellectual property.

CO5: *Evaluate* contemporary challenges in ethics and IPR—such as AI-generated content, digital rights management, and online infringement—and propose appropriate ethical and legal responses.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	2	3	-	1	-	2	1	1	2
CO2	1	3	2	1	2	3	3	-	1	-	2	1	3	1
CO3	1	2	-	-	-	2	3	-	1	-	1	1	2	1
CO4	1	2	2	1	2	2	3	-	1	-	2	2	3	1
CO5	1	3	2	1	2	3	3	-	2	-	2	1	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SOFTWARE ENGINEERING LAB

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Software Engineering Lab	**Course Credit:** 01[0-0-2]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 6^{th}

List of Practicals: .....

1. Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives, and Infrastructure.
2. Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
3. Data Modeling – SRS Design - Use work products – data dictionary.
4. Software Designing - Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
5. Prototype model – Develop the prototype of the product.
6. The SRS and prototype model should be submitted for end semester examination.
7. Any experiment specially designed by the college (Detailed instructions for Laboratory Manual to be followed for further guidance)

FOURTH YEAR

SEMESTER-VII

Sl No	Course Title	Code	Category	Credit	Type			
					L	T	P	S
1	Data Warehousing and Data Mining		MC	3	2	1	0	0
2	Advanced Database and PL-SQL		ME	3	2	1	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 Science & Technology	**Course Type:** L-T-P
Name: Data Warehousing and Data Mining	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** MC
Code: XXXXXX	**Semester:** 7^{th}

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:

Students should 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 / Contact hour	Weightage (%)
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%

Syllabus Outline:

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.

Teaching–Learning Methodology:

- ***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

Course Outcome (CO):

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

CO1: *Explain* fundamental concepts of data warehousing, OLAP operations, and data preprocessing techniques used in data mining.

CO2: *Apply* classification, clustering, association rule mining, and outlier detection techniques to structured datasets using WEKA.s.

CO3: *Analyze* and *compare* the performance of different clustering algorithms, distance measures, and evaluation metrics.

CO4: *Implement* complete data mining workflows including data cleansing, feature selection, model building, and validation on real-world datasets.

CO5: *Interpret* results, *evaluate* model accuracy, and prepare analytical reports documenting findings and recommended solutions.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	1	2	-	-	-	-	3	1	-
CO2	2	2	3	3	1	1	2	-	-	-	-	3	1	-
CO3	2	1	3	2	1	1	2	-	-	-	-	1	3	-
CO4	1	3	3	3	1	2	3	-	-	-	-	2	3	-
CO5	1	1	3	2	1	3	3	-	-	-	-	2	3	-

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

ADVANCED DATABASE AND PL-SQL

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Advanced Database and PL-SQL	**Course Credit:** 03[2-1-0]
Department: Computer Science Engineering	**Category:** ME
Code: XXXXXX	**Semester:** 7^{th}

➠ Learning Objectives: After completing this course, students will be able to

1. Equip students with a deep understanding of advanced database management concepts and proficient skills in PL/SQL programming.
2. 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.
3. Know 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.

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Functional Dependency and Normalization	8	22%
Module-II: Transaction Processing and Concurrency Control	8	22%
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%

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 rule-based 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.

Teaching–Learning Methodology:

- ***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

Course Outcome (CO):

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

CO1: *Understand* functional dependencies, canonical cover, lossless decomposition, and apply various normalization techniques (1NF–BCNF/4NF) to achieve efficient database design.

CO2: *Explain* transaction concepts, serializability (conflict & view), recoverability, concurrency control techniques, and recovery mechanisms to ensure data integrity in multi-user DBMS.

CO3: *Demonstrate* understanding of query processing stages—parsing, translation, evaluation—and differentiate cost-based and rule-based query optimization techniques.

CO4: *Explain* distributed database concepts, architectures, data fragmentation, replication (sync/async), and recovery techniques for reliable distributed DBMS operation.

CO5: *Develop* PL/SQL programs using variables, control statements, loops, arrays, strings, procedures, functions, recursive routines, cursors, triggers, records, and exception handling to implement robust database applications.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	1	1	3	1	-
CO2	3	3	2	2	3	1	-	2	-	1	1	2	3	-
CO3	3	2	2	3	3	-	-	-	-	1	1	3	2	-
CO4	3	2	2	2	3	1	1	-	-	1	1	2	3	-
CO5	2	2	3	2	3	-	-	2	1	2	1	-	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

NM ELECTIVE VII: DIGITAL MARKETING

Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Digital Marketing	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 7^{th}

Learning Objectives: After completing this course, students will be able to

1. Understand core digital marketing concepts, compare digital vs. traditional methods, and interpret key marketing metrics.
2. Build and optimize websites using CMS platforms while applying UX/UI and performance optimization principles.
3. Apply SEO strategies—including keyword research, on-page, off-page, technical, and local SEO—to improve online visibility.
4. Develop and execute social media and content marketing strategies, including video marketing and paid social advertising.
5. Create, analyze, and optimize digital advertising campaigns using Google Ads, Meta Ads, marketing analytics tools, and AI-driven marketing technologies.

Prerequisite: Students should have

1. Basic computer and internet usage skills.
2. Familiarity with common digital tools (browsers, email, Google Workspace/MS Office).
3. Basic communication skills for content creation and marketing messaging.
4. Interest in marketing, business, or digital technologies
5. Willingness to learn new tools, experiment with platforms, and analyze data.

Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Introduction to Digital Marketing	8	16%
Module-II: Website Development & Optimization	10	21%
Module-III: Search Engine Optimization (SEO)	4	8%
Module-IV: Social Media & Content Marketing	8	17%
Module-V: Paid Advertising & Marketing Analytics	8	17%
Module-VI: Advanced Digital Marketing Technologies	10	21%

Syllabus Outline:

Module I: Introduction to Digital Marketing: [8L]

What is Digital Marketing? Digital vs Traditional Marketing, Key components of digital marketing, Customer journey & digital channels Digital marketing metrics: CPC, CTR, ROI, Conversion Rate. Role of AI, ML & Data Analytics in digital marketing, Case studies of tech-driven marketing

Module II: Website Development & Optimization: [10L]

Basics of websites: domains, hosting, CMS. Building websites using WordPress / Webflow, Website performance optimization: Page speed Mobile responsiveness. Core Web Vitals, Introduction to UX/UI concepts.

Module III: Search Engine Optimization (SEO): [4L]

Keyword research and content optimization, On-page, off-page, and technical SEO, Local SEO strategies

Module IV: Social Media & Content Marketing: [8L]

Social media platforms & audience analysis, Content strategy: types of content, Social media optimization (SMO), Social media advertising basics, Content creation tools, Video marketing & YouTube SEO, Brand storytelling & engagement techniques.

Module V: Paid Advertising & Marketing Analytics: [8L]

Google Ads (Search, Display, Video), Meta Ads (Facebook/Instagram), Targeting & retargeting strategies, Budgeting & bid strategies Introduction to analytics tools, A/B testing, Data-driven marketing.

Module VI: Module Name: [10L]

Email marketing automation & tools, CRM concepts, Marketing automation systems, AI in Digital Marketing: Chatbots, Personalized recommendations. Predictive analytics, Programmatic advertising & ad-tech fundamentals, Growth hacking techniques.

Teaching–Learning Methodology:

- ***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 Marketing for Dummies by Ryan Deiss & Russ Henneberry

2. Digital Marketing: Strategy, Implementation & Practice by Dave Chaffey and Fiona.

Reference Books:

1. Digital Marketing: Strategy, Implementation & Practice" by Dave Chaffey
2. Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth
3. Digital Marketing Analytics by Chuck Hemann & Ken Burbary

Course Outcome (CO):

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

CO1: *Explain* the principles, components, metrics, and technological foundations of digital marketing, including the impact of AI, ML, and data analytics on modern marketing practices.

CO2: *Design* and develop user-friendly, optimized websites and landing pages using CMS tools, applying UX/UI concepts and performance optimization techniques.

CO3: *Apply* SEO techniques—keyword research, on-page, off-page, technical, and local SEO—to improve website visibility and organic search ranking.

CO4: *Create* and *manage* effective social media and content marketing strategies using content creation tools, platform analytics, and engagement techniques.

CO5: *Plan*, *execute*, and *evaluate* paid advertising campaigns and marketing analytics by using Google Ads, Meta Ads, A/B testing, tracking tools, and data-driven decision-making, while integrating advanced technologies like CRM, automation, and AI tools.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	-	-	1	-	2	2	2	1
CO2	2	2	3	1	3	1	-	1	2	2	2	3	2	1
CO3	2	3	2	2	3	1	-	1	1	1	2	2	3	1
CO4	1	2	2	1	2	2	-	2	3	1	2	1	2	3
CO5	2	2	2	2	3	1	1	2	3	3	3	2	3	2

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

SEMESTER-VIII

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

NON-MAJOR ELECTIVE VIII: HUMAN RESOURCE MANAGEMENT

➠ Course Information:

School: School of Science & Technology	**Course Type:** L-T-P
Name: Human Resource Management	**Course Credit:** 04[3-1-0]
Department: Computer Science Engineering	**Category:** NM
Code: XXXXXX	**Semester:** 8^{th}

➠ Learning Objectives:

The course enables students to understand the fundamental principles, functions, and strategic importance of Human Resource Management in organizations. It helps learners develop the ability to apply HRM concepts such as recruitment, training, performance appraisal, compensation, and employee relations in real-world managerial scenarios. Students will also cultivate ethical, analytical, and interpersonal skills essential for effective people management.

➠ Prerequisite:

Basic understanding of business fundamentals, Knowledge of principles of management, Fundamental concepts of economics

➠ Course Content/ Syllabus Table:

Module No.	No. of Lecture / Contact hour	Weightage (%)
Module-I: Foundations of Human Resource Management	8	16.66%
Module-II: Human Resource Systems, HR Accounting, HR Audit & HRIS	8	16.66%
Module-III: Recruitment, Selection & Core HR Functions	8	16.67%
Module-IV: Training, Development, Compensation & Employee Relationse	8	16.67%
Module-V: Human Resource Planning & Strategic HRM	8	16.67%
Module-VI: HRM in the Service Sector & Contemporary HR Issues	8	16.67%

Syllabus Outline:

Module I: Foundations of Human Resource Management: [8L]

Meaning, nature, scope, and importance of HRM. Evolution of HRM: From Personnel Management to Strategic HRM. HR philosophies, policies, procedures, and practices. Functions of HRM: Procurement, Development, Compensation, Integration, Separation. Contemporary challenges in HRM: globalization, technology, workforce diversity, Role of HR professionals and line managers.

Module II: Human Resource Systems, HR Accounting, HR Audit & HRIS: [8L]

HR system: structure, components, and workflow, HR roles and responsibilities in modern organizations, HR Accounting: meaning, objectives, methods; HR Audit: purpose, scope, process, and reporting; Human Resource Information Systems (HRIS): components, features, applications; HR analytics and digital transformation in HR.

Module III: Recruitment, Selection & Core HR Functions: [8L]

Human Resource Planning (HRP): introduction and linkage with recruitment, Job analysis: job description and job specification, Manpower forecasting: qualitative and quantitative techniques, Recruitment: sources, methods, and strategic considerations, Selection: steps, tools, tests, interviews, and decision-making; Orientation, onboarding, and placement; Outsourcing, gig workforce, and flexible staffing

Module IV: Training, Development, Compensation & Employee Relations: [8L]

Training Need Analysis (TNA), Training methods: on-the-job & off-the-job, Management development and succession planning, Performance appraisal: traditional and modern methods, Compensation management: wage structure, incentives, benefits; Employee relations, discipline, grievance handling, HR compliance: legal and regulatory framework, Organizational design and workforce restructuring,

Module V: Human Resource Planning & Strategic HRM: [8L]

HRP in detail: forecasting, staffing plans, redeployment, retention strategies, Career planning and development, Succession planning frameworks, Strategic HRM: concepts, models, and HR's role in strategy formulation, Linking HR strategy with organizational goals, Talent management: acquisition, development, retention; HR scorecard and measuring HR effectiveness.

Module VI: HRM in the Service Sector & Contemporary HR Issues: [8L]

Characteristics of service-sector HRM, Employee–customer interaction and service quality, Empowerment, service recovery, and emotional labor, HR support systems in service organizations, Flexible work practices: remote work, gig model, job sharing, flextime; Ethics in HRM and CSR practices; Current issues: workplace well-being, diversity & inclusion, HR in digital era

Teaching–Learning Methodology:

- ***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. Human Resource Management — Gary Dessler
2. Human Resource Management — V.S. P. Rao
3. Personnel/Human Resource Management — David A. DeCenzo, Stephen P. Robbins & Susan Verhulst
4. Human Resource Management: Text and Cases — K. Aswathappa
5. Strategic Human Resource Management — Charles Greer

Reference Books:

1. Human Resource Management — W. A. Werther & Keith Davis
2. Human Resource Management in Practice — Pravin Durai
3. Managing Human Resources — Bohlander & Snell
4. Strategic Human Resource Management — Jeffrey A. Mello
5. Armstrong's Handbook of Human Resource Management Practice — Michael Armstrong

Course Outcome (CO):

CO1: *Explain* the fundamental concepts, principles, and challenges of Human Resource Management and demonstrate an understanding of HR philosophies, policies, procedures, and practices.

CO2: *Analyze* the structure and functions of the HR system, including the roles of HR professionals and line managers, and evaluate tools such as HR accounting, HR audit, and Human Resource Information Systems (HRIS).

CO3: *Apply* HRM concepts in core functional areas such as recruitment, selection, compensation, employee relations, training and development, organizational design, and HR compliance.

CO4: *Develop* effective Human Resource Planning strategies by forecasting manpower needs and designing action plans related to staffing, retention, redeployment, training, and succession planning.

CO5: *Assess* the strategic role of HRM in achieving competitive advantage and demonstrate an understanding of HR issues in the service sector, including employee–customer interactions, empowerment, service recovery, support services, and flexible work practices.

CO-PO-PSO Mapping:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	1	1	2	1	2	1	2	1	2	3
CO2	2	3	2	2	3	2	1	1	2	2	2	2	3	2
CO3	2	2	3	2	3	2	2	2	3	2	2	2	3	3
CO4	2	3	3	2	2	2	2	2	2	3	2	1	3	3
CO5	2	2	3	2	2	3	2	3	3	3	2	1	2	3

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*