



**School of Engineering**  
**Department of Computer Science and Application**  
**Bachelor of Computer Application**

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**SISTER NIVEDITA UNIVERSITY**

**SYLLABUS**

**FOR**

**THREE YEARS BACHELOR DEGREE COURSE**

**IN**

**COMPUTER APPLICATION (BCA)**

**UNDER**

**UGC-CBCS SYSTEM**



2023-26

**School of Engineering**  
**Department of Computer Science and Application**  
**Bachelor of Computer Application**

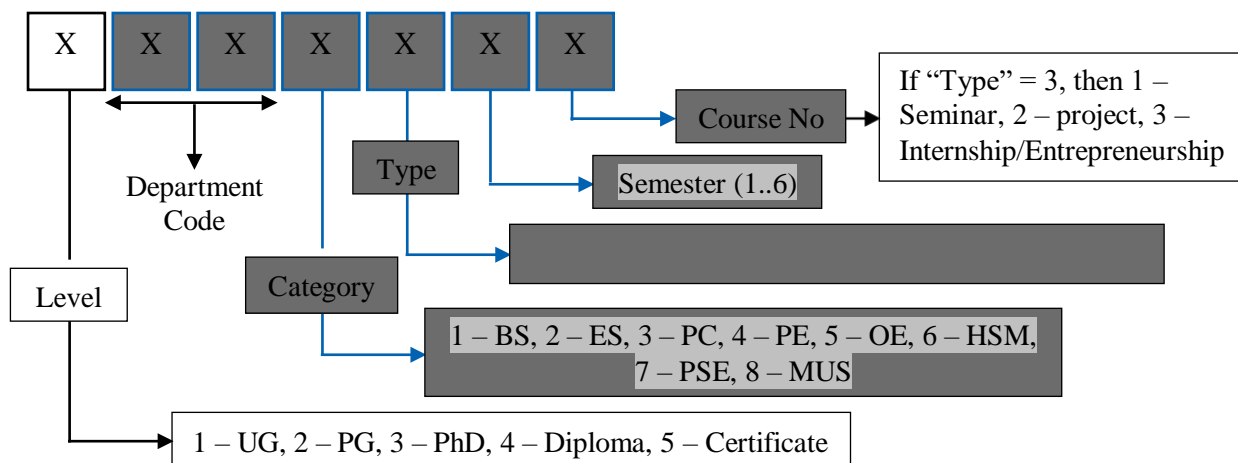
**Credit Definition**

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

**Category Codification with Credit Break up**

Definition of Category	Code	No	Credit
Major Program Specific Course	MC	15	51
Major Program Specific Course-Elective	ME	3	09
Non-Major Specific Subject Course	NM	6	12
Non-Major Vocational Education and Training	NV	10	12
Multidisciplinary Courses	MDC	3	09
Ability Enhancement Courses	AEC	4	08
Skill Enhancement Courses	SEC	3	09
Value Added Courses	VAC	3	06
Internship	INT	1	04
Project	PROJECT	2	10
<b>Total</b>			<b>130</b>

**Subject Codification Nomenclature**





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**SEMESTER: I**

**Mandatory Induction Program – Duration 3 weeks**

- Physical Activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to Local Areas
- Familiarization to Department/Branch & Innovations

**SEMESTER: I**

Sl. No	Sub Category	Course Title	Code	Credit	Type		
					L	T	P
<b>Theory</b>							
1	MC	Mathematics- I		4	3	1	0
2	MC	Fundamental of Computer Science and Introduction to C Programming		4	3	1	0
3	MC	Digital Electronics		4	4	0	0
4	NV	Vocational-Soft Skill Development I		1			
5	AEC	Communicative English I		2			
6	VAC	Environmental Science I		2			
<b>Practical</b>							
8	MC	Introduction to C-Programming Lab		1	0	0	2
9	NV	Vocational- Mentored Seminar 1		2			
10	NV	Vocational- EAA I (yoga/Sports/NCC/NSS)		1			
<b>Total Credit</b>				<b>21</b>			

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**SEMESTER: II**

Sl. No	Sub Category	Course Title	Code	Credit	Type		
					L	T	P
<b>Theory</b>							
1	MC	Computer Organization and Architecture		4	3	1	0
2	MC	Data Structure		4	3	1	0
3	MC	Mathematics II		4	3	1	0
4	MC	Programming with JAVA		4	4	0	0
5	NV	Vocational-Soft Skill Development II		1			
6	AEC	Communicative English II		2			
7	VAC	Environmental Science II		2			
<b>Practical</b>							
8	MC	Data Structure Lab		2	0	0	4
9	MC	Programming with JAVA Lab		2	0	0	4
<b>Total Credit</b>				<b>25</b>			

**SEMESTER: III**

Sl. No	Sub Category	Course Title	Code	Credit	Type		
					L	T	P
<b>Theory</b>							
1	MC	Database Management Systems		4	3	1	0
2	MC	Operating Systems		4	3	1	0
3	NM	Non-Major Elective		3			
4	MDC	Multidisciplinary Elective		3			
5	AEC	Foreign Language I		2			
6	SEC	SEC1		3			
<b>Practical</b>							
7	MC	Database Management Systems Lab		2	0	0	4
8	NM	Non-Major Elective Lab		1			
9	NV	Vocational- Mentored Seminar II		2			
10	NV	Vocational- EAA II (yoga/Sports/NCC/NSS)		1			
11	NV	Vocational-Soft Skill Development III		1			
<b>Total Credit</b>				<b>26</b>			

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**SEMESTER: IV**

Sl. No	Sub Category	Course Title	Code	Credit	Type		
					L	T	P
<b>Theory</b>							
1	MC	Computer Graphics & Multimedia Systems		4	4	0	0
2	MC	Computer Networks		4	3	1	0
3	NM	Non-Major Elective		3			
4	NV	Vocational-Soft Skill Development IV		1			
5	MDC	Multidisciplinary Elective		3			
6	AEC	Logical Ability II/Foreign Language II		2			
7	SEC	SEC2		3			
<b>Practical</b>							
8	ME	Python Programming Lab		3	0	0	3
		Web Application					
9	NM	Non-Major Elective Lab		1			
<b>Total Credit</b>				<b>24</b>			

**SEMESTER: V**

Sl. No	Sub Category	Course Title	Code	Credit	Type		
					L	T	P
<b>Theory</b>							
1	ME	Fundamental of AI		3	3	0	0
		Web Technology					
2	NM	Non-Major Elective		4			
3	NV	Vocational-Soft Skill Development V		1			
4	MDC	Multidisciplinary Elective		3			
5	VAC	Ethic Study and IPR		2			
6	SEC	SEC3		3			
7	PROJECT	Project-1		4	0	0	4
<b>Total Credit</b>				<b>20</b>			



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**SEMESTER: VI**

Sl. No	Sub Category	Course Title	Code	Credit	Type		
					L	T	P
1	ME	Mobile Computing		3	3	0	0
		Cryptography and Network Security					
2	NV	Vocational-Soft Skill Development V		1			
3	INT	Internship		4			
4	PROJECT	Project-2		6	0	0	6
<b>Total Credit</b>				<b>14</b>			

**Total Credit: 130**

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**Semester I**  
**SYLLABUS OUTLINE:**  
**PAPER NAME: Mathematics-I**  
**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	3	1	0	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory//Mid-Term Assessment/ End Semester Assessment**

**THEORY**

**Learning objectives:** On completion of the course, student will be able to: recall and remember basics of matrices, complex numbers, and differential calculus. Understand the concepts of basic mathematical methods for matrices, complex numbers and differential calculus. This course is intended to teach how to apply methods to solve engineering problems and how to analyse engineering problems and evaluate.

**Prerequisite:** Before learning the concepts of Mathematics, you should have a basic knowledge prior to basic fundamental Mathematical calculation, basic idea to solve and evaluate the Mathematical problems.

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Permutation and Combination</b>	4	15%
<b>Module-II: Determinants and Matrices</b>	4	15%
<b>Module-III: Arithmetic Progression (AP) &amp; Geometric Progression (GP)</b>	8	20%
<b>Module-IV: Logarithms</b>	4	15%
<b>Module-V: Infinite Series</b>	8	15%
<b>Module-VI: Linear Equations and Calculus</b>	8	20%



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***SYLLABUS OUTLINE:***

**Module-I: Basic Permutation and Combination: [4L]**

Fundamental counting principle, Permutations of objects, Combinations of objects, Applications of permutation and combination

**Module-II: Determinants and Matrices: [4L]**

Introduction to matrices, Types of matrices, Determinants of 2x2 and 3x3 matrices, Matrix operations: addition, subtraction, and multiplication

**Module-III: Arithmetic Progression (AP) & Geometric Progression (GP): [8L]**

Arithmetic progression: terms, common difference, sum of the series Geometric progression: terms, Common ratio, and sum of the series, Applications of AP and GP in real-life scenarios

**Module-IV: Logarithms: [4L]**

Introduction to logarithms, Properties of logarithms, Solving equations involving logarithms, Applications of logarithms

**Module-V: Infinite Series: [8L]**

Infinite geometric series, Exponential series, Trigonometric series, Convergence and divergence of series.

**Module-VI: Linear Equations and Calculus : [8L]**

Linear equations and their solutions, Differentiation: basic rules and techniques, Applications of differentiation: maxima and minima problems, Optimal values and optimization problems

*Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)*

*List of Professional Skill Development Activities (PSDA):NA*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

**Text & Reference books:**

**Text Books:**

1. Advanced Engineering Mathematics – Kreyiszg
2. Engineering Mathematics I – Das and Pal
3. Engineering Mathematics II – Das and Pal

**Reference Books:**

4. Higher Algebra – Ghosh and Chankravorty
5. Real Analysis (Differential Calculus) – Maity and Ghosh



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*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Apply the principles of permutation and combination to solve problems related to counting, arranging, and selecting objects. (Application/Analysis).
CO2	Solve problems involving determinants and matrices, including matrix operations and finding determinants of matrices. (Application/Analysis).
CO3	Analyze and solve problems related to arithmetic progression (AP) and geometric progression (GP), including finding terms, sums, and common differences or ratios. (Application/Analysis).
CO4	Apply logarithmic properties and solve equations involving logarithms to real-life scenarios and mathematical problems. (Application/Analysis).
CO5	Evaluate and analyze infinite series, including exponential and trigonometric series, and determine their convergence or divergence. (Analysis/Evaluation).
CO6	Apply linear equations and differentiation techniques to solve optimization problems, including finding maxima and minima values. (Application/Analysis).

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2	2	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	2	1	-	-	-	-	-	-	-	-
<b>CO3</b>	2	3	1	1	-	-	-	-	-	-	-	-
<b>CO4</b>	2	2	2	-	-	-	-	-	-	-	-	-
<b>CO5</b>	1	1	1	1	-	-	-	-	-	-	-	-
<b>CO6</b>	2	1	1	2	-	-	-	-	-	-	-	1

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**PAPER NAME: Fundamental of Computer Science and  
Introduction to C-Programming**

**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	3	1	1	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

**Course content/Syllabus:**

Module no.	No of lecture/Cont act hour	Weightage (%)
<b>Module-I: Introduction to Computer Fundamentals</b>	4	15%
<b>Module-II: Digital Logic and Boolean Algebra</b>	6	15%
<b>Module-III: Introduction to C Programming</b>	4	15%
<b>Module-IV: Control Flow in C Programming</b>	6	15%
<b>Module-V: Functions in C Programming</b>	6	20%
<b>Module-VI: Structures in C Programming</b>	10	20%



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***SYLLABUS OUTLINE:***

**Module-I: Introduction to Computer Fundamentals: [4L]**

Computer architecture and components, Operating systems and software, Data representation and storage

**Module-II: Digital Logic and Boolean Algebra: [6L]**

Boolean logic and Boolean operators, Truth tables and logic gates, Boolean algebra and simplification techniques.

**Module-III: Introduction to C Programming: [4L]**

Basics of programming and algorithm development, Data types, variables, and constants, Input/output operations

**Module-IV: Control Flow in C Programming: [6L]**

Decision-making structures (if-else, switch), Looping structures (for, while, do-while), Flow control statements (break, continue).

**Module-V: Functions in C Programming: [6L]**

Function definition and declaration, Passing arguments to functions, Return values and function prototypes.

**Module-VI: Structures in C Programming: [10L]**

Structure declaration and initialization, Accessing structure members, Array of structures and nested structures.

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**Text & Reference books:**

**Text Books:**

6. Fundamental Of Computer – V.Rajaraman,Neeharaika, Adabala,PHI.
7. Programming In ANSI C, 8<sup>th</sup> Edition - E Balagurusamy,TMH.

**Reference Books:**

8. Let us C- Yashwant Kanetkar.

*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Explain the fundamental concepts of computer architecture, operating systems, and data representation, and apply them to analyze and solve basic computing problems. (Knowledge/Comprehension).
CO2	Apply Boolean algebra techniques to simplify logical expressions, design digital circuits using logic gates, and analyze and evaluate truth tables. (Application/Analysis)
CO3	Write C programs using appropriate syntax, data types, variables, and constants to solve simple computational problems. (Application/Analysis).
CO4	Utilize control flow structures in C programming, including decision-making and looping constructs, to implement logic and control the flow of program execution. (Application/Analysis).
CO5	Design and implement functions in C programming, including passing arguments, returning values, and using function prototypes, to modularize and organize code. (Application/Analysis).
CO6	Create and manipulate structures in C programming, including accessing structure members, using arrays of structures, and working with nested structures, to manage complex data. (Application/Analysis).

**CO-PO Mapping**

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

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**PAPER NAME: Digital Electronics**

**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC	1203212	4	4	0	0	0	0	0	48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

**Learning objectives:** *On completion of the course, student will be able to: Understand basics knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. Understand the laws involved in the Boolean algebra and logic families and digital circuits and familiarize with the different number systems, logic gates, and combinational and sequential circuits utilized in the different digital circuits and systems. This course is intended to prepare students to perform the analysis and design of various digital electronic circuits.*

**Prerequisite:** *Before learning the concepts of Digital Electronics, you should have a basic knowledge of working of computer fundamental.*

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Number Systems &amp; Codes</b>	8	20%
<b>Module-II: Logic Gates</b>	8	20%
<b>Module-III: Multilevel Gate Network</b>	8	20%
<b>Module-IV: Combinational Circuits</b>	6	15%
<b>Module-V: Sequential Circuits</b>	4	15%
<b>Module-VI: Basics of Counters</b>	2	10%

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***SYLLABUS OUTLINE:***

**Module-I: Number Systems & Codes: [8L]**

Decimal Number, Binary Number, Octal Number, Hexadecimal Number, Conversion – Decimal to Binary, Binary to Decimal, Octal to Binary, Binary to Octal, Hexadecimal to Binary, Binary to Hexadecimal, Octal to Binary to Hexadecimal, Hexadecimal to Binary to Octal; Floating Point Number Representation, Conversion of Floating Point Numbers, Binary Arithmetic, 1's and 2's Complement, 9's and 10's Complement, Complement Arithmetic, BCD, BCD addition, BCD subtraction, Weighted Binary codes, Non-weighted codes, Parity checker and generator, Alphanumeric codes

**Module-II: Logic Gates: [8L]**

OR, AND, NOT, NAND, NOR, Exclusive – OR, Exclusive – NOR, Mixed logic. Boolean Algebra: Boolean Logic Operations, Basic Law of Boolean Algebra, Demorgan's Theorem, Principle of Duality. Minimization Techniques: Sum of Products, Product of Sums, Karnaugh Map (up to 4 variables).

**Module-III: Multilevel Gate Network: [8L]**

Implementation of Multilevel Gate Network, Conversion to NAND-NAND and NOR-NOR Gate Networks, Arithmetic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Carry Look Ahead Adder, 4-Bit Parallel Adder

**Module-IV: Combinational Circuits: [6L]**

Basic 2-input and 4-input multiplexer, Demultiplexer, Basic binary decoder, BCD to binary converters, Binary to Gray code converters, Gray code to binary converters, Encoder.

**Module-V: Sequential Circuits: [4L]**

Introduction to sequential circuit, Latch, SR Flip Flop, D Flip Flop, T Flip Flop, JK Flip Flop, Master Slave Flip Flop.

**Module-VI: Basics of Counters: [2L]**

Asynchronous (Ripple or serial) counter, Synchronous (parallel) counter. Basics of Registers: SISO, SIPO, PISO, PIPO, Universal Registers.

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**Text & Reference books:**

**Text Books:**

1. Digital Circuit & Design, Salivahan, VIKAS
2. Digital Design, M. Morris. Mano & Michael D. Ciletti, PEARSON
3. Fundamentals of Digital Circuits; Anand Kumar; PHI

**Reference Books:**

4. Digital Electronics; Tokheim; TMH
5. Digital Electronics; S. Rangnekar; ISTE/EXCEL

**Course learning outcome: (CO)**

CO#	Course Outcomes
CO1	Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
CO2	To understand and examine the structure of various number systems and its application in digital design.
CO3	The ability to understand, analyse and design various combinational and sequential circuits.
CO4	Ability to identify basic requirements for a design application and propose a cost effective solution.
CO5	The ability to identify and prevent various hazards and timing problems in a digital design.
CO6	To develop skill to build, and troubleshoot digital circuits.

**CO PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	3	3		-	-				3
<b>CO2</b>	3	3	3	3	3	2	-	-	2	2		3
<b>CO3</b>	3	3	3	3	3	2	-	-	2	2		3
<b>CO4</b>	3	3	3	3	3	2	-	-	2	2		3
<b>CO5</b>	3	3	3	3	3	2	-	-	2	2		3
<b>CO6</b>	3	3	3	3	3	2	-	-	2	2		3
<b>Avg</b>	3	3	3	3	3	2	-	-	2	2	-	3

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**SEMESTER: II**

**SYLLABUS OUTLINE**

**PAPER NAME: Computer Organization and Architecture**

**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	3	1	0	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Principles of Computer design</b>	6	15%
<b>Module-II: Machine language instructions</b>	6	15%
<b>Module-III: Control unit, Data path and control path design</b>	8	20%
<b>Module-IV: Memory system and Storage technologies</b>	8	20%
<b>Module-V: Input-output devices and characteristics</b>	4	15%
<b>Module-VI: Performance evaluation</b>	4	15%





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***SYLLABUS OUTLINE:***

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

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

**Module-II: Machine language instructions: [6L]**

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

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

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

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

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

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

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

**Module-VI: Performance evaluation: [4L]**

SPEC marks, Transaction Processing benchmarks

*Pedagogy for Course Delivery: Hybrid Mode (Offline  
Class/Presentation/Video/MOODLE/NPTEL)*

*List of Professional Skill Development Activities (PSDA):NA*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

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**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:**

4. Stallings. W, "Computer Organization and Architecture, (2<sup>nd</sup> edition) Prentice Hall of India, New Delhi

*Course learning outcome: (CO)*

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

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	1	2	1	1	1	1		1	1
<b>CO2</b>	3	3	3	1	3	1			1		1	1
<b>CO3</b>	2	2	2	1	3	1			1		1	1
<b>CO4</b>	2	2	2	1	1	1			1		1	1
<b>CO5</b>	2	2	2	1	1	1			1		1	1
<b>CO6</b>	2	2	1	1								

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**PAPER NAME: Data Structure**  
**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC	1201222	4	3	1	1	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

***Learning objectives:** On completion of the course, student will be able to: Design and implement various data structures and algorithms. Understand algorithms and analyze algorithms performance. This course is intended to teach how to apply data structures and algorithms to solve complex problems.*

***Prerequisite:** Before learning the concepts of Data Structure, you should have a basic knowledge of programming to implement different data structure.*

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Introduction to Python</b>	6	15%
<b>Module-II: Conditions &amp; Iterations</b>	6	15%
<b>Module-III: Recursion, Strings, List, Dictionaries, Tuples</b>	6	20%
<b>Module-IV: Data Structure using Array</b>	6	20%
<b>Module-V: Linked List and Tree Data Structure</b>	6	15%
<b>Module-VI: Graphs and Hashing</b>	6	15%

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***SYLLABUS OUTLINE:***

**Module-I: Introduction to Python: [6L]**

Python variables, expressions, statements: Variables, Keywords, Operators & operands, Expressions, Statements, Order of operations, String operations, Comments, Keyboard input, Example programs. Functions: Type conversion function, Math functions, Composition of functions, Defining own function, parameters, arguments, Importing functions, Example programs

**Module-II: Conditions & Iterations: [6L]**

Conditions: Modulus operator, Boolean expression, Logical operators, if, if-else, if-if-else, Nested conditions, Example programs.

Iteration: while, for, break, continue, Nested loop, Example programs

**Module-III: Recursion, Strings, List, Dictionaries, Tuples: [6L]**

Recursion: Python recursion, Examples of recursive functions, Recursion error, Advantages & disadvantages of recursion,

Strings: Accessing values in string, Updating strings, Slicing strings, String methods – upper(), find(), lower(), capitalize(), count(), join(), len(), isalnum(), isalpha(), isdigit(), islower(), isnumeric(), isspace(), isupper() max(), min(), replace(), split(), Example programs.

List: Introduction, Traversal, Operations, Slice, Methods, Delete element, Difference between lists and strings. Dictionaries: Introduction, Brief idea of dictionaries & lists. Tuples:

Introduction, Brief idea of lists & tuples, Brief idea of dictionaries & tuples.

**Module-IV: Data Structure using Array: [6L]**

Stack, queue, circular queue, priority queue, dequeue and their operations and applications.

Searching and Sorting:

Searching: linear search, Binary search, their comparison,

Sorting: insertion sort, Selection sort. Quick sort, Bubble sort Heap sort, Comparison of sorting methods , Analysis of algorithm, complexity using big 'O' notation

**Module-V: Linked List and Tree Data Structure:[6L]**

Linked List: Linear link lists, doubly linked lists, stack using linked list, queue using linked list, circular linked list and their operations and applications.

Trees: Binary trees, binary search trees, representations and operations, thread representations, sequential representations, B tree , B+ tree

**Module-VI: Graphs and Hashing: [6L]**

Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal: Depth first search and Breadth-first search.

Spanning Trees, minimum spanning Tree, Shortest path algorithm.

Hashing: Definition, Hashing functions, Load factor and collision, open addressing (linear probing) and chaining method to avoid collision

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*Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)*

*List of Professional Skill Development Activities (PSDA):NA*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

**Text & Reference books:**

**Text Books:**

1. Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser
2. Data Structures and Algorithmic Thinking with Python, Narasimha Karumanchi

**Reference Books:**

3. Python Data Structures and Algorithms: Benjamin Baka

*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Select appropriate data structures as applied to the specified problem definition.
CO2	Implement operations like searching, insertion, deletion, traversing mechanism, etc. on various data structures.
CO3	Compare Linear and Non-Linear data structures.
CO4	Apply appropriate sorting/searching techniques for the given problems.
CO5	Design advanced data structure using Non-Linear data structure.
CO6	Determine and analyse the complexity of given Algorithms

**CO PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	1	1	1	1	1	2	3	3
CO2	3	3	2	2	2	1	1	1	1	1	1	2	3	3
CO3	3	3	2	3	2	1	1	1	1	1	1	2	3	3
CO4	3	3	2	3	2	2	1	1	1	1	1	2	3	3
CO5	3	3	3	3	2	2	1	1	2	2	2	3	3	3
CO6	2	2	1	1							1			

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**



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**PAPER NAME: Mathematics II**  
**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	3	1		0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

**Learning objectives:** On completion of the course, student will be able to: Understand the concept of sets, relations and functions, familiar with propositional logic and basic of lattices and graphs. This course is intended to teach wide range of important mathematical concepts which forms the main fundamentals for higher-level studies

**Prerequisite:** Before learning the concepts of Mathematics, you should have a basic knowledge prior to basic fundamental Mathematical calculation, basic idea to solve and evaluate the Mathematical problems.

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Logic</b>	6	15%
<b>Module-II: Sets</b>	6	15%
<b>Module-III: Relations &amp; Functions</b>	8	20%
<b>Module-IV: Graphs</b>	8	20%
<b>Module-V: Boolean Algebra &amp; Computer Logic</b>	4	15%
<b>Module-VI: Counting</b>	4	15%

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***SYLLABUS OUTLINE:***

**Module-I: Logic: [6L]**

Statements and logical connectives; truth tables. Predicates logic and Quantifiers Proof techniques, the nature of mathematical theorems and proofs; direct proof, proof by contraposition, by contradiction. Use of counter examples; the principle of mathematical induction programs

**Module-II: Sets: [6L]**

The notation of set theory - Subsets and the power set; binary and unary operations on a set; set operations of union, intersection, complementation, difference, and Cartesian product. Demonstration of the denumerability of some sets and the use of Cantor diagonalization method to prove the uncountability, partition of a set.

**Module-III: Relations & Functions: [8L]**

Binary relations as ordered pairs and verbal description; the reflexive, symmetric, transitive and anti-symmetric properties of binary relations; the definition and terminology about partial orderings; graphs of partially ordered finite sets; the definition of equivalence relation and equivalence class. Functions; definition and examples; properties of functions one-to-one, onto, bijective; function composition, inverse function

**Module-IV: Graphs: [8L]**

Graph terminology; undirected graphs, simple, complete, path, cycle, adjacency matrix, connectivity; Euler's path and Hamiltonian circuit; graph representation, trees. Digraphs and connectivity problems - Reachability matrix analysis; Warshall's algorithm

**Module-V: Boolean Algebra & Computer Logic: [4L]**

Discussion and Definition; similarities between propositional logic and set theory; mathematical structures as models or abstractions incorporating common properties found in different contexts. Logic circuits; basic logic elements of AND gate, OR gate and inverter; representation of a Boolean expression as a combinational network and vice versa; procedure to find a canonical sum-of-product Boolean expressions using Karnaugh map or Boolean algebra properties.

**Module-VI: Counting: [4L]**

The basics of counting, the pigeonhole principle, permutations and combinations, recurrence relations, solving recurrence relations, generating functions, inclusion-exclusion principle, application of inclusion-exclusion.

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*Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)*

*List of Professional Skill Development Activities (PSDA):NA*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

**Text & Reference books:**

**Text Books:**

1. “Discrete Mathematical Structures” : Tremblay and Manohar, Tata McGraw Hill
2. “Discrete Mathematics” : 1st edition by Maggard Thomson
3. “Discrete Mathematics ” : Semyour Lipschutz, VarshaPatil II and Edition Schaum’s Series, TMH
4. Graph Theory – N. Deo
5. “Discrete Mathematical Structures” : Kolman, Busby and Ross, Prentice Hall India

**Reference Books:**

6. Discrete Mathematics and its application” – Mott Kendle
7. “Discrete Mathematical Structure” : G. Shankar Rao, New Age Publisher.
8. “Fundamental Approach to Discrete Mathematics” : Acharjaya D. P. Sreekumar, New Age.

*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Learn and design how logic gates are used in carrying out computation
CO2	Understand and identify set, inclusive, element, object, and roster notation and elements of a given set.
CO3	Learn about different types of relations and equivalence relations, composition of functions, invertible functions, and binary operations
CO4	Understand and application of the fundamental concepts in graph theory and tree.
CO5	To solve applied problems by using principles of Boolean algebra properties.
CO6	Learn basic counting and solve application of inclusion-exclusion problems.





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	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	2	1	1	-	-	-	-	-	-	-	1
<b>CO2</b>	2	2	2	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	3	1	1	-	-	-	-	-	-	-	1
<b>CO4</b>	2	3	3	2	3	-	-	-	-	-	-	2
<b>CO5</b>	1	1	3	3	1	-	-	-	-	-	-	1
<b>CO6</b>	2	1	1	2	-	-	-	-	-	-	-	1

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**PAPER NAMR: Programming with JAVA**  
**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	4	0	1	0	0	0	48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

***Learning objectives:** On completion of the course, student will be able to: understand the basic concepts and fundamentals of platform independent object oriented language. This course is intended to teach how to writing programs using exception handling techniques and multithreading.*

***Prerequisite:** Before learning the concepts of JAVA, you should have a basic knowledge of introduction to programming concept and basic computer skills.*

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Java Evolution and Overview of Java Language</b>	4	15%
<b>Module-II: Constants, Variables, and Data Types</b>	6	15%
<b>Module-III: Operators and Expressions</b>	6	15%
<b>Module-IV: Decision Making and Looping</b>	6	15%
<b>Module-V: Arrays, String and Vectors</b>	6	20%
<b>Module-VI: Multithreaded Programming</b>	8	20%



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***SYLLABUS OUTLINE:***

**Module-I: Java Evolution and Overview of Java Language: [4L]**

How Java differs from C and C++, Java and Internet, Java and World Wide Web, Introduction, Simple Java Program, More of Java, An Application with Two Classes, Java Program Structure, Java Tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style.

**Module-II: Constants, Variables, and Data Types: [6L]**

Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Values of Variables, Scope of Variables, Symbolic Constants, Type Casting, Getting Values of Variables, Standard Default Values.

**Module-III: Operators and Expressions: [6L]**

Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evolution of Expressions, Precedence of Arithmetic Operators, Type Conversion in Expressions, Operator Precedence and Associativity, Mathematical Functions. Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, The if... else Statement, Nesting of if ... else Statements, The else if Ladder, The switch Statement, The ?: Operator.

**Module-IV: Decision Making and Looping: [6L]**

Introduction, The while Statement, The do Statement, The for Statement, Jumps in Loops, Labelled Loops. Classes, Objects and Methods: Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance: Extending a Class, Overriding Methods, final Variables and Methods, Final Classes, Finalizer Methods, Abstract Methods and Classes, Visibility Control.

**Module-V: Arrays, String and Vectors: [6L]**

Arrays, One-Dimensional Arrays, Creating an Array, Two-Dimensional Arrays, Strings, Vectors, Wrapper Classes. Interfaces: Multiple Inheritance: Introduction, Defining Interfaces, Extending Interfaces, implementing Interfaces, Accessing Interface Variables. Packages: Putting Classes Together: Introduction, Java API Packages, Using system Packages, Naming Conventions, Creating Packages, Accessing a Packages, Using a Package, Adding a Class to a Package, Hiding Classes.

**Module-VI: Multithreaded Programming: [8L]**

Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, and Synchronization. Managing Errors and Exceptions: Introduction, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging. Applet Programming: Introduction, How Applets Differ from Application, Preparing to Write

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Applets, Building Applet Code, Applet Life Cycle, Creating an Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, More About Applet Tag, Passing Parameters to Applets..

**Pedagogy for Course Delivery:** Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)

**List of Professional Skill Development Activities (PSDA):** NA

**Continuous assessment:** Quiz/assessment/presentation/problem solving etc.

**Continuous assessment:** Quiz/assessment/presentation/problem solving etc.

**Text & Reference books:**

**Text Books:**

1. Programming with JAVA 5th Edition, E Balagurusamy, TMH
2. Java - The Complete Reference, Herbert Schildt

**Reference Books:**

1. Let Us JAVA 2 Edition, Yashavant `Kanetkar, BPB Publications

**Course learning outcome: (CO)**

CO#	Course Outcomes
CO1	Use the syntax and semantics of java programming language and basic concepts of OOP.
CO2	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
CO3	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
CO4	Design event driven GUI and web related applications which mimic the real word scenarios.
CO5	Demonstrate on the multi-tasking by using multiple threads
CO6	Able to implement object oriented programming concepts using java and able to develop interactive programs using applets and swings.

**CO PO Mapping**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
<b>CO1</b>	3	2	1	-	2	-	-	-	-	-	-	2
<b>CO2</b>	3	2	2	-	3	-	-	-	-	-	-	3
<b>CO3</b>	3	2	1	-	2	-	-	-	-	-	-	2

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<b>CO4</b>	3	3	3	-	3	-	-	-	-	-	-	3
<b>CO5</b>	3	3	3	-	3	-	-	-	-	-	-	3
<b>CO6</b>	2	2	1	1						1	1	

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

**SEMESTER: III**

**SYLLABUS OUTLINE:**

**PAPER NAME: Database Management System**  
**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	3	1	1	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

<b>Total contact hour</b>	<b>Contact hour/week</b>
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

**Course content/Syllabus:**

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Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Database System Concepts &amp; Architecture</b>	4	15%
<b>Module-II: Data Modelling</b>	4	15%
<b>Module-III: Relational Data Model</b>	8	20%
<b>Module-IV: Database Design</b>	8	20%
<b>Module-V: Query Processing And Optimization</b>	6	15%
<b>Module-VI: Transaction</b>	6	15%

***SYLLABUS OUTLINE:***

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

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

**Module-II: Data Modelling:[4L]**

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: [8L]**

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

**Module-IV: Database Design: [8L]**

Functional dependencies, irreducible sets of dependencies, loss less decomposition, 1st, 2<sup>nd</sup> & 3<sup>rd</sup> NF, dependency preservation, Boyce Codd NF, Multivalued Dependency & 4th 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: [6L]**

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

**Pedagogy for Course Delivery:** Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)

**List of Professional Skill Development Activities (PSDA):** NA

**Continuous assessment:** Quiz/assessment/presentation/problem solving etc.

**Continuous assessment:** Quiz/assessment/presentation/problem solving etc.

**Text & Reference books:**

**Text Books:**

1. Fundamental of Database Systems- ElmasriNavathe- Pearson Education Asia
2. Database- Principles, Programming and Performance- Parick O' Neil Elizabeth O'Neil, Harcourt Asia PTE Limited
3. Database System Concepts- Abraham Silberschat, Henry F. Korth, S.Sudarshan, Tata McGraw Hill.

**Reference Books:**

1. An Introduction to Database Systems - C.J.Date, Addison Wesley, Pearson EducationPress

**Course learning outcome: (CO)**

CO#	Course Outcomes
CO1	Explain DBMS architecture, physical and logical database designs, database modelling, relational, hierarchical and network models
CO2	Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing
CO3	Learn and apply Structured Query Language (SQL) for database definition and database manipulation
CO4	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database
CO5	Understand various transaction processing, concurrency control mechanisms and database protection mechanisms
CO6	Improve the database design by applying normalization techniques

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**CO PO Mapping**

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

 Highly Correlated: **3**

 Moderately Correlated: **2**

 Slightly Correlated: **1**

**PAPER NAME: Operating Systems**

**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC		4	3	1	0	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

<b>Total contact hour</b>	<b>Contact hour/week</b>
48	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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



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**Course content/Syllabus:**

Module no.	No of lecture/Cont act hour	Weightage (%)
<b>Module-I: Introduction</b>	2	10%
<b>Module-II: Process Management</b>	10	20%
<b>Module-III: Process Synchronization</b>	8	20%
<b>Module-IV: Deadlocks</b>	4	15%
<b>Module-V: Memory Management</b>	8	20%
<b>Module-VI: I/O Hardware, File Management and Disk Management</b>	4	15%

**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, Dining Philosopher Problem etc.

**Module-IV: Deadlocks: [4L]**

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

**Module-V: Memory Management: [8L]**

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,

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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: [4L]**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O

Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

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

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

*Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)*

*List of Professional Skill Development Activities (PSDA): NA*

*Continuous assessment: Quiz/assessment/presentation/problem solving etc.*

*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:**

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

*Course learning outcome: (CO)*



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CO#	Course Outcomes
CO1	Understands the different services provided by Operating System at different level
CO2	They learn real life applications of Operating System in every field
CO3	Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock
CO4	They will learn different memory management techniques like paging, segmentation and demand paging, etc
CO5	Compare file naming in Linux and Windows.
CO6	Awareness of Android Operating System

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3		-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	2	3	-	-	-	-	-	-	-	
CO4	3	2	-	3	-	-	-	-	-	-	-	2
CO 5	3	2	-	-	-	-	-	-	-	-	-	
CO6	2	2						1	1	1		

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**SEMESTER: IV**

**SYLLABUS OUTLINE:**

**PAPER NAME: Computer Graphics & Multimedia Systems**  
**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC	1201241	4	4	0	0	0	0	0	48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	4

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Overview of Graphics Systems</b>	4	10%
<b>Module-II: Output Primitives</b>	8	25%
<b>Module-III: Two Dimensional Geometric Transformations</b>	6	15%
<b>Module-IV: Two-Dimensional Viewing</b>	8	25%
<b>Module-V: Multimedia Systems Design</b>	6	15%
<b>Module-VI: Data &amp; File Format Standards</b>	4	10%

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***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.

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.



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**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:**

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

*Course learning outcome: (CO)*

CO#	COURSE OUTCOMES
CO1	Have a knowledge and understanding of the structure of an interactive computer graphics system, and the separation of system components.
CO2	Have a knowledge and understanding of geometrical transformations and 3D viewing.
CO3	Have a knowledge and understanding of techniques for representing 3D geometrical objects.
CO4	Have a knowledge and understanding of interaction techniques.
CO5	Be able to create interactive graphics applications and use C++ builds functions or equivalent graphics tools (Java, Pascal) to perform item (3), above.
CO6	Perform simple 2D graphics with lines, curves and can implement algorithms to rasterizing simple shapes, fill and clip polygons and have a basic grasp of anti-aliasing techniques.



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CO PO Mapping

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

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**



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**PAPER NAME: Computer Networks**

**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
MC	1201243	4	3	1	0	0	0	0	36+12=48

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
48	4

**Component: Theory/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

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

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Data Transmission Basic Concepts and Terminology</b>	6	15%
<b>Module-II: Computer Network</b>	6	15%
<b>Module-III: Data Line Devices</b>	8	30%
<b>Module-IV: Network Layer</b>	6	15%
<b>Module-V: Local Area Network</b>	6	15%
<b>Module-VI: Network Security</b>	4	10%



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***SYLLABUS OUTLINE:***

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

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

**Module-II: Computer Network: [6L]**

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

**Module-III: Data Line Devices: [8L]**

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

**Module-IV: Network Layer: [6L]**

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

**Module-V: Local Area Network: [6L]**

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

**Module-VI: Network Security: [4L]**

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

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**Text & Reference books:**

**Text Books:**

- 1.B. Fourauzan, “Data Communications and Networking”, 4th Edition, Tata McGraw-Hill
2. William Stallings- Data & Communications, 6th Edition, Pearson Education
- 3.Tanenbaum- Computer Networks, 3rd Edition, PHI, New Delhi.

**Course learning outcome: (CO)**

CO#	Course Outcomes
C01	To develop an understanding of Various IEEE standards for computer networks
CO2	Understanding the Internet protocol in multicasting routing protocols and routing algorithms.
CO3	To learn mechanisms for overlay networks and various routing protocols
CO4	To know the multicasting and routing algorithms.
CO5	To acquire the basic network security principle including encryption algorithms
CO6	Examine the issues related to security in computer networks

**CO PO Mapping**

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

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**PAPER NAME: Python Programming**  
**Paper Code:**

Type	Code	Credit	Credit division					No. of PSDA	Total no of lecture
			L	T	P	SW	FW		
ME		3	0	0	3	0	0	0	36

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
36	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.
3. To learn how to use lists, tuples, and dictionaries in Python programs.
4. To learn how to identify Python object types.
5. To learn how to use indexing and slicing to access data in Python programs.
6. To define the structure and components of a Python program.
7. To learn how to write loops and decision statements in Python.

**Prerequisite:** Before learning the concepts of Python programming, you should have a basic knowledge prior to basics scripting language, Basic of structure and components, Basics of areas of loops and decision statements etc.

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Introduction to Python</b>	8	30%
<b>Module-II: Conditional Blocks and Flow of control structure</b>	6	15%
<b>Module-III: Functions</b>	6	15%
<b>Module-IV: Complex data types</b>	6	15%
<b>Module-V: File Operations</b>	6	15%
<b>Module-VI: Use of Libraries</b>	4	10%



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***SYLLABUS OUTLINE:***

**Module-I: Introduction to Python: [8L]**

Python keywords and variables, Python basic Operators, Understanding python blocks. Python Data Types, Mutable and Immutable types, Declaring and using Numeric data types.

**Module-II: Conditional Blocks and Flow of control structure: [6L]**

Condition: if, else and nested if, Loops: For loops, while loops, Nested loops, Enumerate, Loop manipulation: Pass, Break, Continue Statement, Programming using conditional and loop blocks

**Module-III: Functions: [6L]**

Def Statements with Parameters, Return Values, and return Statements, None and print, adding new function, parameters and argument, recursion, and its use, Local and Global Scope, The global Statement, Exception Handling.

**Module-IV: Complex data types: [6L]**

String data type and string operations, list and list slicing, Use of Tuple data type. String, List and Dictionary, string manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list.

**Module-V: File Operations: [6L]**

Reading files, different read functions. Writing files in python using write functions. File handling and organization.

**Module-VI: Use of Libraries: [4L]**

Numpy, Pandas, matplotlib, Introduction to different framework in python.

***Pedagogy for Course Delivery: Hybrid Mode (Offline***

***Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment: Quiz/assessment/presentation/problem solving etc.***

***Continuous assessment: Quiz/assessment/presentation/problem solving etc.***



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**Text & Reference books:**

**Text Books:**

1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson Education.
2. Martin C Brown, "Python the Complete Reference", Tata McGraw Hill, India
3. Wesley J. Chun, "Core Python Applications Programming", Pearson Education.

**Reference Books:**

4. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India.

**Course learning outcome: (CO)**

CO#	Course Outcomes
CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements
CO2	Express proficiency in the handling of strings and functions.
CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
CO4	Identify the commonly used operations involving file systems and regular expressions.
CO5	Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.
CO6	Implement Conditionals and Loops for Python Programs knowledge/skill development and Use functions and represent Compound data using Lists, Tuples and Dictionaries

**CO PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	2	3				3	3
CO2	3	2	3	3	2	3	2				3	3
CO3	3	2	3	2	3	3	3				3	2
CO4	3	2	3	2	2	2	2				2	3
CO5	3	2	3		3	3	2				2	3
CO 6	2	2	1									

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**



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**PAPER NAME: Web Application**

**Paper Code:**

Type	Code	Credit	Credit division						Total no of lecture
			L	T	P	SW	FW	No. of PSDA	
ME		3	0	0	3	0	0	0	36

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
36	6

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

8. To define the web development Strategies and Protocols governing Web.
9. To learn how to design web pages using HTML, XML, CSS and JavaScript.
10. To define the creation of client-server environment using socket programming.
11. To learn how to write Java programs for window/web-based applications.

**Prerequisite:** Before learning the concepts of web programming, you should have a basic knowledge prior to basics Strategies and Protocols governing Web, Basic structure design of web pages, Basics of areas of web databases etc.

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Internet Basics</b>	3	5%
<b>Module-II: HTML</b>	8	20%
<b>Module-III: Cascading Style Sheet – CSS</b>	5	15%
<b>Module-IV: JavaScript &amp; Document Object Model</b>	5	15%
<b>Module-V: PHP Hypertext Pre-processor (PHP)</b>	5	15%
<b>Module-VI: Introduction to SQL &amp; MySQL</b>	10	30%



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***SYLLABUS OUTLINE:***

**Module-I: Internet Basics: [3L]**

Protocols, Servers and their Functions, Internet Clients, Network Security, Internet Development, Design Functional Internet site & Business Concepts.

**Module-II: HTML: [8L]**

Fundamentals/ Basic HTML, Text formatting on Web Pages, incorporate images, formatting fonts, creating hyperlinks, complex image maps (iMap), tables and nested tables, Div and span, Forms and various form fields such as text box, text area, radio button, combo box and check box.

**Module-III: Cascading Style Sheet – CSS: [5L]**

Introduction, Designing with Style Sheets, Types of style sheet, style Sheet Syntax, ID, Class Contextual Selectors, Cascading Order, Properties, Absolute and Relative Positioning

**Module-IV: JavaScript & Document Object Model: [5L]**

Introduction to JavaScript, Variables and Objects, Decision Making Statement, Loops, Arrays, Functions. Form validation using JavaScript functions.

**Module-V: PHP Hypertext Preprocessor (PHP) : [5L]**

Introduction, PHP Document, Language Fundamentals, Decision Making Statement, Loops, Statements, Operators, PHP functions, Server-Side Processing, Processing Forms via GET/POST.

**Module-VI: Introduction to SQL & MySQL: [10L]**

Introduction to SQL & MySQL & its Versions, Creating Databases & Tables, using keys, Types of tables in MySQL, Data Types, deleting databases and tables, Inserting, Retrieving, Updating & Deleting data, PHP interfacing with MySQL, connecting to MySQL, executing SQL, Retrieving the data set & refining the fetch using Forms.

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**Text & Reference books:**

Text Books:

2. Pankaj Sharma “Introduction to Web Technology “, Paperback
3. Chris Martin The Wolf in Their Pockets: 13 Ways the Social Internet Threatens the People You Lead Kindle Edition

**Reference Books:**

*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Understand the fundamentals of the Internet, including its architecture, protocols, and key components, enabling effective communication and data transfer between clients and servers.
CO2	Demonstrate proficiency in HTML, utilizing tags, attributes, and elements to create structured web pages and effectively present content.
CO3	Apply Cascading Style Sheets (CSS) to enhance the appearance and layout of web pages, employing selectors, properties, and values to achieve desired design outcomes.
CO4	Implement JavaScript and the Document Object Model (DOM) to create interactive and dynamic web pages, manipulating elements, handling events, and accessing and modifying content dynamically.
CO5	Develop server-side scripting skills using PHP, enabling the creation of dynamic web applications, handling form data, and interacting with databases for data storage and retrieval.
CO6	Utilize PHP to interface with MySQL, effectively performing database operations such as querying, inserting, updating, and deleting data, and integrating it seamlessly with PHP-based web applications.

CO PO Mapping





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

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**SEMESTER: V**

**SYLLABUS OUTLINE:**

**PAPER NAME: Fundamentals of AI**

**Paper Code:**

Type	Code	Credit	Credit division					Total no of lecture	
			L	T	P	SW	FW		No. of PSDA
ME		3	3	0	0	0	0	0	36

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
36	3

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

***Learning objectives:** On completion of the course, student will be able to basic concepts of artificial intelligence, and analyze different problem-solving techniques employed by intelligent agents, Implement natural language processing techniques, design and implement knowledge representation and reasoning systems using logic, semantic networks, and rule-based approaches*

***Prerequisite:** Before learning the concepts of AI, you should have a basic knowledge prior to basics Strategies and logic, Basic structure design of algorithms, Basics of areas of rule based approaches etc.*

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Introduction to Artificial Intelligence</b>	6	5%
<b>Module-II: Machine Learning</b>	6	20%
<b>Module-III: Natural Language Processing</b>	6	15%
<b>Module-IV: Computer Vision</b>	6	15%
<b>Module-V: Knowledge Representation and Reasoning</b>	8	15%
<b>Module-VI: Ethical and Social Implications of AI</b>	4	30%

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***SYLLABUS OUTLINE:***

**Module-I: Introduction to Artificial Intelligence: [6L]**

History and evolution of AI, different Problem-solving techniques, Intelligent agents and environments,, good behaviour, the nature of environments, structure of agents, the nature of environments, structure of agents, problem solving agents.

**Module-II: Machine Learning: [6L]**

Fundamentals of ML, basic learning approaches, types of learning, suitability of different learning approaches, basics of Supervised learning, Unsupervised learning, advantages of semi-supervised learning, needs of Reinforcement learning and its usage.

**Module-III: Natural Language Processing: [6L]**

Fundamental concepts of Natural Language Processing (NLP), Techniques of NLP, Text processing, segmentation, tokenization, removing stop words, stemming, lemmatization. Parts of speech tagging, Language modelling, Sentiment analysis, applications of AI to NLP

**Module-IV: Computer Vision: [6L]**

Image acquisition process, Image processing and different Image preprocessing approaches, Object detection techniques, Object recognition, Image segmentation, types of segmentation, various segmentation techniques and their applications in Computer vision, Object identification, Region of Interest.

**Module-V: Knowledge Representation and Reasoning : [8L]**

Logic and knowledge representation, First order logic representation, Syntax, and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic, forward chaining, backward chaining, Knowledge representation, Categories and objects, Actions, Simulation and events, Semantic networks, Rule-based systems.

**Module-VI: Ethical and Social Implications of AI: [4L]**

Socio-ethical impacts of AI, Bias and fairness in AI systems, vulnerabilities and security aspects, Privacy and data protection, utility of different AI based tools, AI and job displacement.

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**Text & Reference books:**

**Text Books:**

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, 2nd Edition, Pearson Education / Prentice Hall of India.
2. Artificial Intelligence, Elaine Rich, Kevin Knight, S.B. Nair, Tata McGraw Hill. Stallings. W, "Computer Organization and Architecture, Prentice Hall of India, New Delhi.

*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Define the history and basic concepts of artificial intelligence, and analyse different problem-solving techniques employed by intelligent agents. (Knowledge/Comprehension).
CO2	Apply machine learning algorithms, including supervised, unsupervised, and reinforcement learning, to solve real-world problems. (Application/Analysis).
CO3	Implement natural language processing techniques, such as text processing, language modelling, and sentiment analysis, to analyse and generate human-like language. (Application/Analysis).
CO4	Utilize computer vision algorithms, including image pre-processing, object detection, and segmentation, to extract meaningful information from visual data. (Application/Analysis).
CO5	Design and implement knowledge representation and reasoning systems using logic, semantic networks, and rule-based approaches. (Application/Analysis).
CO6	Evaluate the ethical and social implications of AI, including issues of bias, privacy, and job displacement, and propose solutions to address these challenges. (Evaluation/Synthesis).

**CO PO Mapping**

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

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

**PAPER NAME: Web Technology**  
**Paper Code:**

Type	Code	Credit	Credit division					No. of PSDA	Total no of lecture
			L	T	P	SW	FW		
ME		<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	36

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
36	3

**Component: Theory/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Introduction</b>	2	5%
<b>Module-II: World Wide Web and TCP/IP</b>	5	20%
<b>Module-III: IP Sub netting, addressing and Internet Routing Protocol</b>	7	15%
<b>Module-IV: HTML</b>	5	15%
<b>Module-V: JavaScript and Applets</b>	10	15%
<b>Module-VI: Network security techniques and Firewall</b>	7	30%



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***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 Subnetting, addressing and Internet Routing Protocol: [7L]**

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

**Module-IV: HTML: [5L]**

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

**Module-V: JavaScript and Applets: [10L]**

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

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

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

***Pedagogy for Course Delivery: Hybrid Mode (Offline***

***Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment: Quiz/assessment/presentation/problem solving etc.***

***Continuous assessment: Quiz/assessment/presentation/problem solving etc.***



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**Text & Reference books:**

**Text Books:**

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

**Reference Books:**

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

**Course learning outcome: (CO)**

CO#	Course Outcomes
CO1	Understand the foundational concepts of networking and apply them to analyze and troubleshoot basic network connectivity issues. (Knowledge/Comprehension)
CO2	Explain the principles and protocols of the World Wide Web and TCP/IP, and demonstrate the ability to design and implement basic web applications. (Application/Analysis)
CO3	Analyse and design IP sub netting schemes, address allocation strategies, and internet routing protocols to optimize network performance and scalability. (Analysis/Evaluation)
CO4	Create well-structured HTML documents with appropriate tags and attributes, and effectively use stylesheets and multimedia elements to enhance web page presentation. (Application/Analysis)
CO5	Develop interactive web applications using JavaScript and applets, incorporating event handling, DOM manipulation, and form validation to enhance user experience. (Application/Analysis)
CO6	Identify common network security threats, implement security measures such as encryption and authentication, and configure firewalls to protect web applications and network infrastructure. (Evaluation/Synthesis)



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**CO PO Mapping**

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

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**



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**SEMESTER: VI**

**SYLLABUS OUTLINE:**

**PAPER NAME: Mobile Computing**  
**Paper Code:**

Type	Code	Credit	Credit division					No. of PSDA	Total no of lecture
			L	T	P	SW	FW		
ME		3	3	0	0	0	0	0	36

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
36	3

**Component: Theory/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

***Learning objectives:** On completion of the course, student will be able to the understand the basic concepts of mobile computing. And able to be familiar with the network layer protocols and Ad-Hoc networks. To know the basis of transport and application layer protocols etc.*

***Prerequisite:** Before learning the concepts of Web Technology, you should have a basic knowledge prior to network layer protocols and Ad-Hoc networks, Basics of areas of knowledge about different mobile platforms and application development etc.*

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Introduction</b>	4	10%
<b>Module-II: Mobile telecommunication system</b>	6	15%
<b>Module-III: Mobile network layer</b>	6	15%
<b>Module-IV: Mobile transport and application layer</b>	8	25%
<b>Module-V: Mobile platforms and applications</b>	8	25%
<b>Module-VI: MCommerce</b>	4	10%



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***SYLLABUS OUTLINE:***

**Module-I: Introduction: [4L]**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

**Module-II: Mobile telecommunication system: [6L]**

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS/UMTS – Architecture – Handover - Security

**Module-III: Mobile network layer: [6L]**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing – ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

**Module-IV: Mobile transport and application layer: [8L]**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

**Module-V: Mobile platforms and applications: [8L]**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone

**Module-VI: M Commerce: [4L]**

M Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**Text & Reference books:**

**Text Books:**

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012.

*Course learning outcome: (CO)*

CO#	Course Outcomes
CO1	Define mobile technologies in terms of hardware, software, and communications.
CO2	Utilize mobile computing nomenclature to describe and analyse existing mobile computing frameworks and architectures.
CO3	Evaluate the effectiveness of different mobile computing frameworks.
CO4	Describe how mobile technology functions to enable other computing technologies.
CO5	Know basis of transport and application layer protocols
CO6	Describe different mobile platforms and application development

**CO PO Mapping**

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

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

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**PAPER NAME: Cryptography and Network Security**  
**Paper Code:**

Type	Code	Credit	Credit division					Total no of lecture	
			L	T	P	SW	FW		No. of PSDA
ME		3	3	0	0	0	0	0	36

*SW = Self work, FW = Field work, Professional Skill Development Activities (PSDA)*

Total contact hour	Contact hour/week
36	3

**Component: Theory/Practical/Mid-Term Assessment/ End Semester Assessment**

**THEORY**

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

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

**Course content/Syllabus:**

Module no.	No of lecture/Contact hour	Weightage (%)
<b>Module-I: Introduction</b>	2	3%
<b>Module-II: Conventional Cryptographic Techniques</b>	8	25%
<b>Module-III: Algorithm types &amp; Modes</b>	8	25%
<b>Module-IV: Digital Signature and RSA - Introduction</b>	8	25%
<b>Module-V: Basic Concepts and applications</b>	6	15%
<b>Module-VI: Secure Socket Layer &amp; Transport Layer Security</b>	4	7%



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***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 and Transport Layer Security: [4L]**

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

***Pedagogy for Course Delivery: Hybrid Mode (Offline Class/Presentation/Video/MOODLE/NPTEL)***

***List of Professional Skill Development Activities (PSDA):NA***

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

***Continuous assessment:*** Quiz/assessment/presentation/problem solving etc.

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**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:**

5. “Designing Network Security”, Merike Kaeo, 2nd Edition, Pearson Books
6. “Building Internet Firewalls”, Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
7. “Practical Unix & Internet Security”, Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly
8. “Cryptography and Network Security”, V.K. Jain, Khanna Publishing House, 2017.

**Course learning outcome: (CO)**

CO#	Course Outcomes
CO1	Understand the most common type of cryptographic algorithm and understand the Public-Key Infrastructure
CO2	Understand security protocols for protecting data on networks
CO3	Be able to digitally sign emails and files and understand vulnerability assessments and the weakness of using passwords for authentication
CO4	Be able to perform simple vulnerability assessments and password audits
CO5	Be able to configure simple firewall architectures
CO6	Understand Virtual Private Networks

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**CO PO Mapping**

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	2	2	-	-	-	-	-	-	-	-	-	-
CO2.	2	2	-	1	-	-	-	-	-	-	-	1
CO3.	2	2	-	-	-	-	-	-	-	-	-	1
CO4.	2	1	-	-	-	-	-	-	-	-	-	1
CO5.	2	1	-	-	-	1	-	-	-	-	-	1
CO6	2	2	1	1								

Highly Correlated: **3**

Moderately Correlated: **2**

Slightly Correlated: **1**

Programme Objectives:

Programme Objectives (POs)	Description
PO1	Understand the fundamental concepts of computers, software hardware and peripheral devices and evolution of computer technologies.
PO2	Familiarized with business environment and information technology and its applications in different domains.
PO3	Gain knowledge to identify, explain and apply functional programming and object-oriented programming techniques and use of databases to develop computer programs.
PO4	Analyze, design, implement and evaluate computerized solutions to real life problems, using appropriate computing methods including web applications.



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PO5	Understand the front end and backend of software applications.
PO6	Gain expertise in at least one emerging technology.
PO7	Acquire knowledge about computer networks, network devices and their configuration protocols, security concepts at various level etc.
PO8	Apply techniques of software validation and reliability analysis to the development of computer programs.
PO9	Acquire technical, communication and management skills to convey or present information, applications, instructions, policies, procedures, decisions, documentations etc. verbally as well as in writing.
PO10	Recognize the various issues related to society, environment, health and vivid cultures and understand the responsibilities to contribute in providing the solutions.
PO11	Acquire technical skills to lead a productive life in the society as a professional or as an entrepreneur
PO12	Contribute to progressive community and society in comprehending computing activities by writing effective reports, designing documentation, making effective presentation, and understand instructions.