

Curriculum for UG Degree
in
Bachelor in Computer Applications
BCA
2026-29



Department of Computer Application
Ravenshaw University, Kataka-753014



ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
NEWDELHI-110070

www.aicte-india.org

PREFACE

This is the curriculum for the Bachelor of Computer Application (BCA) programs at the undergraduate level, as prescribed by AICTE. This curriculum has been designed keeping in mind the following objectives:

1. Align the curriculum with the current and future needs of the industry, ensuring that graduates are not only well-equipped with foundational knowledge in computer science but also possess essential communication skills. This alignment ensures our graduates are prepared to excel in their careers and adapt to the evolving industry landscape.
2. Incorporate best practices in computer education from leading institutions across the globe, while adapting them to the Indian context. This includes the integration of an Induction Program aimed at instilling core values and ethics in students, setting a precedent for a holistic educational journey that mirrors global standards.
3. Develop a comprehensive framework that includes updated course descriptions, learning outcomes and assessment methods, ensuring a holistic approach to computer education. This framework now also emphasizes the importance of hands-on learning through courses like 'Artificial Intelligence and' Data Science, which are designed to provide students with practical skills and knowledge critical for the business world.

Key features of the BCA Curriculum:

1. **Flexible Duration and Structure:** The curriculum offers a flexible duration of three to four years, divided into 6 or 8 semesters, with multiple entry and exit points.
2. **Comprehensive Credit Distribution:** The curriculum encompasses a total of 120 credits for the 3-year program and 160 credits for the 4-year (Honours and Honours with Research) programs.
3. **Innovative Course Structure:** The course structure introduces an Induction Program, mandatory visits/workshops, and expert lectures to foster a holistic educational experience. The curriculum envisages connect of core subjects with NEP.
4. **Diverse Specializations and Practical Exposure:** Students will have the opportunity to specialize in emerging areas through Open Electives and gain practical experience through structured internships and project work.
5. **Assessment and Grading:** A detailed and transparent assessment mechanism ensures that students' performances are evaluated fairly, focusing on continuous learning and improvement.

GENERAL COURSE STRUCTURE

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
CC	Core Courses
AEC	Ability Enhancement Courses
MDE	Multi-Disciplinary Elective course
VAC	Value added Courses
SEC	Skill Enhancement courses
DSE	Discipline Specific Elective
OE	Open Elective

Course Name: Bachelor in Computer Application (Honours with Research)

Course Level/Duration/System:

Undergraduate Four years 8 Semesters with multiple entry and exit. The following option will be made available to the students joining BCA Program:

- One year:** Under Graduate Certificate in Computer Application
- Two years:** Under Graduate Diploma in Computer Application
- Three years:** Bachelor in Computer Application (BCA)
- Four years:** Bachelor in Computer Application with Research: BCA (Honours with Research)

Minimum Eligibility Criteria:

Minimum eligibility criteria for opting the course in the fourth year will be as follows:

BCA (Honours with Research): BCA Degree

SEMESTER WISE CREDIT DISTRIBUTION:

Semester	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective Course	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
I	8	2	2	2	5	-	19
II	12	-	-	2	7	-	21
III	11	0	0	2	4	3	20
IV	15	0	0	0	2	3	20
V	0	0	0	0	6	15	21
VI	4	1	0	0	4	10	19
BCA (Honours with Research)							
VII	12	---	---	---	---	8	20
VIII	20	---	---	---	---	----	20

Category-wise distribution*

Description	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective Courses	Value Added Courses	Skill Enhancement Courses	Discipline Specific Elective	Total
BCA	50	3	2	6	28	31	120
BCA (Honours with Research)	82	3	2	6	28	39	160
3 Years BCA Program					Total Credits = 120		
4 Years BCA (Honours with Research)					Total Credits = 160		

Note: Students can take extra credit course from their own department or from other departments as per the University Norms/Govt Guidelines.

INDUCTION PROGRAM

Induction Program	
Induction Program for students to be offered right at the start of the first year.	• Physical Activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to Local Areas • Familiarization to Department/Branch & Innovations

Mandatory Visits/Workshop/Expert Lectures:

1. It is mandatory to arrange one industrial visit for the students.
2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
3. It is mandatory to organize at least one expert lecture per semester by inviting resource persons from domain specific industry.

For Summer Internship/Projects/Seminars, etc.

1. There is an Internship Program in 5th Semester of BCA with 4 Credits under Skill Enhancement Course (SEC 302).
2. During the Summer Vacation following 4th Semester, students are required to undergo the said Internship Program (SEC 302) for 120 hours.
3. Evaluation is based on work done, quality of report, performance viva-voce, presentation etc. as per the University/Department Guidelines.

ACADEMIC EVALUATION & EXAMINATION SCHEME

Comprehensive Breakdown of Course Assessment Structure, Marks Allocation, and Question Paper Pattern

1. Marks Distribution & Evaluation Structure

Course Type	Total Marks	MIDTERM		Attendance	Surprise Test / Quiz	Assignment / Presentation	END TERM	
		Theory	Practical				Theory	Practical
Without Practical	100	20	0	5	10	5	60	0
Practical	100	10	10	5	5	0	50	20

Attendance Weightage Criteria: Above 95% → 5 Marks | 85% to 94% → 4 Marks | 75% to 84% → 3 Marks

Note: The term-end theory examination shall be of 100 marks with a 3-hour duration. The effective weightage shall be 50 marks for courses with practicals and 60 marks for courses without practicals.

2. End-Term Theory Question Paper Pattern

SL. NO	Question Pattern & Instructions	With Practical	Without Practical
1	Part I - Objective Answer in MCQ / One Word Sentence (All are compulsory)	$1 \times 10 = 10$	$1 \times 10 = 10$
2	Part II - Very Short Type Answer in maximum 50 words (All are compulsory)	$2 \times 9 = 18$	$2 \times 9 = 18$
3	Part III - Short Type Answer in maximum 250 words (Answer any 8 out of 10 questions)	$5 \times 8 = 40$	$5 \times 8 = 40$
4	Part IV - Long Type Answer in maximum 800 words (Answer any 4 out of 5 questions)	$8 \times 4 = 32$	$8 \times 4 = 32$
TOTAL MARKS		100	100

PRACTICAL PAPER EVALUATION BREAKDOWN: One Major Experiment (10 Marks) | Record (05 Marks) | Viva Voce (05 Marks)

Semester wise Structure and Curriculum for BCA

SEMESTER I

Sl. No.	Code	Course Title	L	T	P	Credit	Total Marks (TH)	Total Marks (P)
1	CC 101	Mathematics - I	3	0	0	3	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
2	SEC 101	Programming in C	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
3	CC 102	Computer Architecture	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
4	AEC 101	General English	2	0	0	2	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
5	MDE 101	Indian Knowledge System (IKS-IV: Indian Science, Engineering and Technology (Past, Present and Future))	2	0	0	2	(100 End)	NA
6	VAC 101	Environmental Science and Sustainability	2	0	0	2	(100 End)	NA
TOTAL						19		

SEMESTER II

Sl. No.	Code	Course Title	L	T	P	Credit	Total Marks (TH)	Total Marks (P)
1	CC 103	Mathematics - II	3	0	0	3	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
2	CC 104	Data Structure Using C	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
3	CC 105	Operating Systems	3	1	0	4	100 (20 Mid+5 ATT+ 10 ASS	NA

							+ 5 ST+60 End)	
4	SEC 102	Object Oriented Programming using Java	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
5	SEC 103	Web Technologies	1	0	2	2	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
6	VAC 102	Indian Constitution	2	0	0	2	(100 End)	NA
		TOTAL				21		

Exit Criteria after First Year of BCA Programme

Students will have the option to exit the Bachelor of Computer Application (BCA) Program after successfully completing the first year. Upon exit, they will be awarded a **UG Certificate in Computer Application**. To be eligible for this certificate, students must complete an additional 04 credits in one of the following areas:

1. **Skill-Based Subject:** A course designed to enhance practical and technical skills in the field of computer applications.
2. **Work-Based Vocational Course:** A vocational course offered during the summer term that emphasizes hands-on training and workplace readiness.
3. **Internship/Apprenticeship:** A professional internship or apprenticeship program in a relevant field, with a minimum duration of 08 weeks, which will take place after the second semester.
4. **Social Responsibility & Community Engagement:** Active engagement with an NGO or community organization for a minimum duration of 08 weeks, focusing on real-world problem-solving, social responsibility, and community service.

The mode and specifics of these additional credits will be determined by the University/Department.

Re-entry Criteria in to Second Year (Third Semester)

The student who takes an exit after one year with an award of certificate may be allowed to re-enter in to Third Semester for completion of the BCA Program as per the Department Schedule after earning requisite credits in the First Year.

SEMESTER III

Sl. No.	Code	Course Title	L	T	P	Credit	Total Marks (TH)	Total Marks (P)
1	CC 201	Mathematics - III	3	0	0	3	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA

2	CC 202	Data Base Management System	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
3	SEC 201	Python Programming	2	0	4	4	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
4	CC 203	Software Engineering	3	0	0	3	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
5	DSE 201	Basics of Data Analytics	1	0	4	3	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
6	VAC 201	Disaster Management	2	0	0	2	(100 End)	NA
TOTAL						20		

SEMESTER IV

S. No.	Course Code	Course Title	L	T	P	Credit	Total Marks (TH)	Total Marks (P)
1	CC 204	Entrepreneurship and Startup Ecosystem	2	0	0	2	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
2	CC 205	Computer Networks	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
3	CC 206	Design and Analysis of Algorithm	3	0	0	3	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
4	CC 207	Artificial Intelligence	3	1	0	4	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
5	DSE 202	Basics of R Programming	2	0	4	4	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
6	SEC 202	Design Thinking and Innovation	2	0	0	2	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
TOTAL						20		

Exit Criteria after Second Year of BCA Programme

Students will have the option to exit the Bachelor of Computer Application (BCA) Program after successfully completing the second year. Upon exit, they will be awarded a **UG Diploma in**

Computer Application. To be eligible for this diploma, students must complete an additional 04 credits in one of the following areas:

1. **Skill-Based Subject:** A specialized course aimed at enhancing technical and practical expertise in computer applications.
2. **Work-Based Vocational Course:** A vocational course offered during the summer term, focused on building practical, industry-relevant skills.
3. **Internship/Apprenticeship:** A professional internship or apprenticeship with a minimum duration of 08 weeks, conducted after the fourth semester, offering hands on experience in a relevant field.
4. **Social Responsibility & Community Engagement:** Involvement with an NGO or community-based organization for a minimum of 08 weeks, contributing to social initiatives and applying computer application knowledge to solve real-world challenges.
5. **Capstone Project:** Completion of a capstone project integrating the skills and knowledge gained during the first two years of the program, which can be an independent or group project.

The mode and specifics of these additional credits will be determined by the University/Department.

Students opting for this exit will also be required to **submit an Internship/Apprenticeship Report** or complete the Capstone Project as per the schedule outlined by the University/Department before they are awarded the UG Diploma.

Re-entry Criteria in to Third Year (Fifth Semester)

The student who takes an exit after second year with an award of Diploma may be allowed to re-enter into fifth Semester for completion of the BCA Program as per the respective University/Department Schedule after earning requisite credits in the Second year.

SEMESTER V

Sl. No.	Code	Course Title	L	T	P	Credit	Total Marks (TH)	Total Marks (P)
1	DSE 301	Web Development using PHP	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
2	DSE 302	Internet of Things	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
3	DSE 303	Digital Image Processing	3	0	4	5	70 (10 Mid+5 ATT + 5 ST+50 End)	30 (10 Mid+20 End)
4	SEC 301	Quantitative Techniques	2	0	0	2	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
5	SEC 302	Internship/Capstone Project	0	0	8	4	(100 End)	
TOTAL						21		

SEMESTER VI

Sl. No.	Code	Course Title	L	T	P	Credit	Total Marks (TH)	Total Marks (P)
1	CC 301	Mathematics - IV	3	0	0	3	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
2	DSE 304	Data Mining	3	2	0	5	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
3	DSE 305	Cyber Security	3	2	0	5	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
4	AEC 301	Soft Skills	2	0	0	2	100 (20 Mid+5 ATT+ 10 ASS + 5 ST+60 End)	NA
5	SEC 304	Major Project	0	0	8	4	(100 End)	
TOTAL						19		

Exit Criteria after Third Year of BCA Programme

The students shall have an option to exit after 3rd year of Computer Application Program and will be awarded with a Bachelor's in Computer Application.

Re-entry Criteria in to Fourth Year (Seventh Semester)

The student who takes an exit after third year with an award of BCA may be allowed to re-enter in to Seventh Semester for completion of the BCA (Honours with Research) Program as per the respective University/Department Schedule after earning requisite credits in the Third year.

Streams with Discipline-Specific Electives (DSE)

1. Data Science

Sl. No	Semester	Course Code	Professional Elective
1	III	DSE 201	Basics of Data Analytics
2	IV	DSE 202	Basics of R Programming
3	VI	DSE 304	Data Mining
4	VI	DSE 305	Cyber Security

2. Artificial Intelligent and Internet Technology

Sl. No	Semester	Course Code	Professional Elective
1	V	DSE 301	Web Development using PHP
2	V	DSE 302	Internet of Things
3	V	DSE 303	Digital Image Processing

SEMESTER – I

CC 101	Mathematics - I	3L : 0T : 0P	3 Credits
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Course Objectives

- CO1: Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.
- CO2: This course enables the students to use mathematical models and techniques to analyze and understand problems in computer science.
- CO3: This course demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.

UNIT I:

Set, Relation and Function:

Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products.

Relations on a Set, Properties of Relations, Types of Relations, Equivalence Relation, Closures of Relations, Warshall's algorithm.

Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions.

UNIT II:

Counting and Recurrence Relation:

Basics of counting, Permutation, combination, Binomial coefficients, Binomial theorem. Recurrence relations, solving linear recurrence relation with constant coefficients using characteristic equation roots method.

UNIT III:

Elementary Graph Theory:

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, planar graph, digraphs, weighted graphs, Euler and Hamiltonian graphs.

Trees, properties of trees, concept of spanning tree.

UNIT IV:

Matrix Algebra:

Types of matrices, multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen vector, eigen values, Caley-Hamilton Theorem.

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2023.
3. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
5. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

SEC 101	Programming in C	3L : 0T : 4P	5 Credits
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Course Objectives:

- To learn the C programming language to solve different scientific and business problems
- To learn how to design and write effectively codes using various programming constructs available in the C programming language

Unit I:

Introduction: Introduction to Programming Language, Introduction to C Programming, Keywords & Identifiers, Constants, Variables, Input and Output Operations, Compilation and pre-processing,

Data types: Different data types, Data types qualifier, modifiers, Memory representation, size and range,

Operators: Operators (Arithmetic, Relational, Logical, Bitwise, Assignment & compound assignment, Increment & Decrement, Conditional), Operator types (unary, binary, ternary). Expressions, Order of expression (Precedence and associativity)

Unit II:

Decision Control structures & Loops: Decision Making and Branching statements (Simple IF, IF...ELSE, Nested IF... ELSE, ELSE ... IF ladder), Selection control structure (Switch Statement). Looping statements (FOR, WHILE, DO...WHILE), break and continue.

Array: Concept of Array, Array Declaration, types of arrays (one and two dimension), Character Arrays and Strings, limitation of array.

Unit III:

Pointers: Concept of Pointer (NULL pointer, wild pointer, dangling pointer, generic pointer), Pointer Expressions, Accessing the Address of a Variable, Declaring Pointer Variables, Initializations of Pointer Variable, accessing a Variable through its Pointer, Pointer arithmetic, Pointer representation of array, Accessing Sting using Pointer.

Function: Types of Function, Function Declaration, Function Definition, Function Call, Recursive Function, String handling function (strlen, strcmp, strcpy, strncpy, strcat, strstr). Storage class: Types (auto, register, static, extern), scope rules, declaration and definition.

Unit IV:

Structure and Union: Defining, Declaring, Accessing, Initialization Structure, nested structure, self-referential structure, structures and pointers.

Unions, difference between structure and union, structure within union.

File: File Management in C, Defining and Opening a File, File opening modes (read, write, append), Closing a File, File operations, Command line arguments.

Text Books:

- ✓ *Programming in ANSI C* by E. Balagurusamy, TMH
- ✓ *Let us C* by Yashavant Kanetkar, BPB Pubs.
- ✓ *The C Programming Language* by B. Kernighan & Dennis Ritchie, PHI.

Reference Books:

- ✓ *C: How to Program* by Paul Deitel, Harvey Deitel, Prentice Hall.
- ✓ *Programming using C* by P.C. Sethi & P.K. Behera, Kalyani Publisher.

Lab: C Programming

- Q1. To input two numbers and perform addition, subtraction, multiplication, division, and modulus operations.
- Q2. To check whether a number is greater than 10 and less than 50 using relational and logical operators.
- Q3. To demonstrate pre-increment, post-increment, pre-decrement, post-decrement, and compound assignment operators.
- Q4. To find the largest of two numbers using the conditional operator.
- Q5. To check whether a number is even or odd using bitwise AND (&) operator.
- Q6. To swap two numbers using bitwise XOR (^) without using a third variable.
- Q7. To check whether a given string is Palindrome or not.
- Q8. To read an alphabet from user and check if it is vowel or consonant using switch case.
- Q9. To check if a given number is a prime number or not.
- Q10. To check if a given positive number Armstrong number or not.
- Q11. To read an array of 10 integers and find sum of all numbers.
- Q12. To accept 'n' numbers and store all prime numbers in an array and display.
- Q13. To swap two numbers using pointers.
- Q14. To accept 'n' numbers, store them in array and find out the smallest number using pointer.
- Q15. To read two integer numbers and find their sum, difference, product and division using separate function.
- Q16. To calculate factorial of given number by using recursion.
- Q17. To accept the details of employee and display them using structure and union. Details consist of Employee ID, Name, Designation, Department, Salary.
- Q18. To read data from a text file and display the data on the screen. If file does not exist, create a file.

CC 102	Computer Architecture	3L : 0T : 4P	5 Credits
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Course Objectives

CO1: To understand the basics of Digital Electronics and Binary Number System

CO2: To learn the implementation of Combinational Circuit.

CO3: To Learn the implementation of Sequential Circuit.

CO4: To Understand the Organization of basic computers.

CO5: To Understand the concept of Parallel Processing.

CO6: To understand the concept of memory organization.

UNIT-I

Digital Principles: Definition for Digital signals, Digital logic, Digital computers.

Number Systems: Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic
Binary Codes, Decimal Codes, Error detecting and correcting codes, Excess3 Code, The Gray Code. Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS.

UNIT-II

Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer

Sequential Circuits: Flip-Flops- SR Flip-Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop.

Shift Registers- Bidirectional shift register with parallel load

Binary Counters-4 bit synchronous and Asynchronous binary counter.

UNIT-III

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC), RISC Vs CISC.

UNIT-IV

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor(IOP). Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Books:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha- “Digital Principles & Applications” , Tata McGraw Hill Education Private Limited, 2011 Edition.
2. M. Morris Mano- “Computer System Architecture”, Pearson/Phi, Third Edition.

Reference Books:

- 1 William Stallings- “Computer Organization and Architecture”, Pearson/PHI, Sixth Edition,
- 2 Andrew S. Tanenbaum- “Structured Computer Organization”, PHI /Pearson 4th Edition,

Lab: Computer Architecture

1. Verify logic behaviour of AND, OR, NAND, NOR, EX-OR gates.
2. To study and verify NAND as a Universal Gate
3. To verify De- Morgan’s theorem for 2 variables.
4. Implement Boolean function using logic gates in SOP.
5. Design and verify operation of half adder and full adder.
6. Design and verify operation of half subtractor.
7. To Convert Binary to Grey Code.
8. Realize Decoder and Encoder circuit using Basic Gates.
9. Design and implement the 4:1 MUX and 1:4 DE-MUX.
10. Design and test of an S-R flip-flop using NAND/NOR gate.
11. Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate.
12. Design and implement a 4-bit shift register using Flip flops.

Hardware

1. Familiarize the computer system layout: marking positions of SMPS, motherboard, FDD, HDD, CD, DVD and add on cards.
2. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)
3. Demonstrate the assembly of a PC.
4. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio.
5. Install and configure windows OS.

AEC 101	General English	2L : 0T : 0P	2 Credits
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Course Objective:

- To provide learning environment to practice listening, speaking, reading and writing skills.
- To assist the students to carry on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

UNIT- I:

Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

UNIT-II:

Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

UNIT- III:

Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies

Nature and Style of sensible Writing

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing

UNIT-IV:

Oral Communication (This Module involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday

Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Oral Communication (This Module involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday

Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Text/Reference Books:

- AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.
- Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
- Practical English Usage. Michael Swan. OUP. 1995.
- Remedial English Grammar. F.T. Wood. Macmillan. 2007
- On Writing Well. William Zinsser. Harper Resource Book. 2001
- Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011. 8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Alternative NPTEL/SWAYAM Course:

S.No.	NPTEL/SWAYAM Course Name	Instructor	Host Institute
1	English language for competitive exams	Prof. Aysha iqbal	IIT MADRAS
2	Technical English for engineers	Prof. Aysha iqbal	IITM

MDE 101	Indian Knowledge System	2L : 0T : 0P	2 Credits
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Indian Science, Engineering and Technology Past, Present and Future (IKS-IV)

Course Objectives

- To familiarize learners with major sequential development in Indian science, engineering and technology.
- To review & strengthen the ancient discovery and research in physics, chemistry, maths, metallurgy, astronomy, architecture, textile, transport, agriculture and Ayurveda etc.
- To help students to trace, identify and develop the ancient knowledge systems to make meaningful contribution to development of science today
- To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the scientific, technological and holistic development of physical, mental and spiritual wellbeing.

Module 1: Indian Traditional Knowledge; Science and Practices

Introduction to the Science and way of doing science and research in India, Ancient Science in Intra & Inter Culture Dialogue & coevolution.

Traditional agricultural practices, Traditional water-harvesting practices, Traditional Livestock and veterinary Sciences Traditional Houses & villages, Traditional Forecasting, Traditional Ayurveda & plant based medicine, Traditional writing Technology

Module 2: Ancient Indian Science (Physics, Chemistry, Maths)

Physics in India: Vaisheshika darshan Atomic theory & law of motion, theory of panchmahabhoota, Brihath Shathaka (divisions of the time, unit of distance), bhaskaracharya (theory of gravity, surya siddhanta & sidhanta shriomani), Lilavati (gurutvakashan Shakti).

Chemistry in India Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhaṭa – building of the ras-shala (laboratory), working arrangements of ras-shala, material and equipment, Yaśodhara Bhaṭṭa-process of distillation, apparatus, saranasamskara, saranataila

Mathematics in India: Baudhayana's Sulbasutras, Aryabhaṭa, Bhaskaracharya-I, Severus Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyeṣṭhadeva

Module 3: Ancient Indian Science (metallurgy, Astronomy, Architecture)

Metallurgy in India: Survarṇa(gold) and its different types, prosperities, Rajata(silver), Tamra(copper), Loha(iron), Vanga(tin), Naga / sisa(lead), Pittala(brass)
Astronomy in India Vedang Jyotish, aryabhatta siddhanta, Mahabhaskariya, Laghubhaskariya, vatesvarasiddhanta, Sisyaḍhivṛddhida, Grahashyaya, Goladhyaya, Karabakutuhala (Aryabhaṭa, Varahamihira, Brahmagupta, Vaṭesvara, Bhaskara, Paramesvara, NilakaṇṭhaSomayaji, Jyeṣṭhadeva, ŚankaraVarman)

Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple style, cave architecture, rock cut architecture, kalinga architecture, chandela architecture, rajput architecture, jain architecture, sikh architecture, Maratha architecture Indo-Islamic architectural, Indo-Saracenic revival architecture, Greco Buddhist style.

Module 4: Ancient Indian Science (Textile, Agriculture, Transport)

Textile Technology in India: Cotton (natural cellulose fiber), silk, wool (natural protein fibers), bast and leaf fibers, mridhudhautadhupitamaram (meaning a practice of fumigating the fabric with incense smoke before use as a part of the finishing process), sitadhautavasanayugala (bleached white—a finishing process); suchhastah, sutradharah (needle and thread – tools for stitching). dyeing, washing spinning and weaving technology, Agriculture in India: kishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- devamatruka, nadimatruka, use of animals in warfare, animal husbandry, Animals for medicines. Ancient transport in India

Module 5: Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health regimen for wellbeing, introduction to yoga (raja yoga, astanga yoga, gyan yoga), understanding of Indian psychological concept, consciousness, tridosha & triguna.

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A.K (Eds) (2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
4. SK Das, The education system of Ancient hindus, Gyan publication house, India
5. R P Kulkarni, Glimpse of Indian Engineering and Technology (Ancient & Medieval period, Munshiram Manoharlal Publishers Pvt. Ltd. 2018
6. AK Pathak, Science and Technology in India, Anshika prakashan pratapgarh, 2016
7. PB Sharma, S. Narain, Doctors Scientists and Engineers of Ancient India, Kalpaz Publications 2017
8. NVP, Unithiri, Indian Scientific Traditions (Professor K.N. Neelakantan Elayath Felicitation Volume), publication division unieristy of Calicut, 2006
9. Anonyms, History of Science in India- Volume-I Part-I (Physics, Mathematics and Statistics), the national academy of science, India & the ramkrishna mission institute of culture, 2014
10. R N Basu, T K Bose, CS, Cakraborty History of Science in India - Agricultural Science (Volume V), the national academy of science, India & the ramkrishna mission institute of culture 2014

11. A Gosh, History of Science in India (Volume-I Part-II Astronomy), the national academy of science, India & the ramkrishna mission institute of culture, 2014
12. Dharmpal, Indian science and technology in the eighteen century, rashtrotahana sahitya, 1983
13. S Biswal, B L ray, vedic Science and technology, DK Print world, 2009
14. A.K Bag, Histroy of technology in Indian (Set 3 vol), Indian Nation Science Academy, 1997.
15. AR vasudev Murty, Science and Technology in Ancient India as Reflected in the Mahabharata, Sanskrit bharati, 2019

VAC 101	Environmental Science and Sustainability	2L : 0T : 0P	2 Credits
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Course Objective(s):

1. This course aims to familiarize students with basic environmental concepts, their relevance to business operations, and forthcoming sustainability challenges.
2. This course will equip students to make decisions that consider environmental consequences.
3. This course will enable future business graduates to become environmentally sensitive and responsible managers.

UNIT 1:

Understanding Environment, Natural Resources, and Sustainability

Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. The conservation and equitable use of resources, considering both intergenerational and intergenerational equity, and the importance of public awareness and education.

UNIT 2:

Ecosystems, Biodiversity, and Sustainable Practices

Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation.

UNIT 3:

Environmental Pollution, Waste Management, and Sustainable Development

Various types of environmental pollution, including air, water, noise, soil, and marine pollution, and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts.

UNIT 4:

Social Issues, Legislation, and Practical Applications

Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.

Text Books (Latest Editions):

- Poonia, M.P. *Environmental Studies* (3rd ed.), Khanna Book Publishing Co.
- Bharucha, E. *Textbook of Environmental Studies* (3rd ed.) Orient Blackswan Private Ltd.
- Dave, D., & Katewa, S. S. *Text Book of Environmental Studies*. Cengage Learning India Pvt Ltd.
- Rajagopalan, R. *Environmental studies: from crisis to cure* (4th ed.). Oxford University Press. ● Miller, G.T. & Spoolman S. *Living in the Environment*. (20th ed.). Cengage.
- Basu, M., & Xavier Savarimuthu, S. J. *Fundamentals of environmental studies*. Cambridge University Press.
- Roy, M. G. *Sustainable Development: Environment, Energy and Water Resources*. Ane Books.
- Pritwani, K. *Sustainability of business in the context of environmental management*. CRC Press.
- Wright, R.T. & Boorse, D.F. *Environmental Science: Toward A Sustainable Future* (13th ed.). Pearson.

Web links:

- <https://www.ourplanet.com>
- <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>
- www.myfootprint.org
- <https://www.globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html>

SEMESTER – II

CC 103	Mathematics - II	3L : 0T : 0P	3 Credits
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Course Objectives

CO1: This course helps the students to understand correct lines of arguments and proofs.

CO2: This course introduces mathematical techniques that are foundations for understanding advanced computational methods, including numerical methods and optimization.

CO3: This course helps the students to understand various problem-solving strategies and methods to tackle both theoretical and practical challenges in computer science.

UNIT I:

Logic and Methods of Proofs:

Propositions, logical operations (basic connectives), compound statements, construction of truth table, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF). Rules of inference for propositional logic, Mathematical Induction.

UNIT II:

Algebraic Structures:

Binary Operation, Fundamental Properties of Binary Operations, Semi-group, Monoid, Introduction to Group, Addition Modulo, Multiplication Modulo, General properties of Group, Questions based on properties of group, Abelian Group, Order of an element of a group, Subgroup, Theorems of Sub-group, Cyclic group, Theorems of cyclic group, Related questions based on the above theorems.

UNIT III:

Numerical Methods:

Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods.

Numerical Interpolation: Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula.

Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule, Simpson's 3/8 rule.

UNIT IV:

Optimization Techniques:

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Simplex Method, Duality

Transportation problem: North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution.

Text Books

1. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 2022.
3. Taha Hamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
4. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

Reference Books

1. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
2. Chakravorty J. G. and Ghosh P. R., Linear Programming and Game Theory, Moulik Library, 2017.
3. Sharma J. K., Operations Research: Theory and Applications, Fourth Edition, Macmillan Publishers, 2007.

CC 104	Data Structures Using C	3L : 0T : 4P	5 Credits
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Course Objectives

- To introduce the fundamental concepts, terminology, classification, and importance of data structures in computer science.
- To develop an understanding of linear data structures such as arrays, linked lists, stacks, and queues and their associated operations.
- To develop the ability to implement searching and sorting techniques and analyze their basic characteristics.
- To introduce non-linear data structures such as trees and graphs and their representations and traversal techniques.
- To develop practical skills in selecting and implementing appropriate data structures for solving computational problems.
- To provide hands-on experience in implementing data structures using an appropriate programming language.

Unit I: Introduction to Data Structures, Arrays, Searching and Sorting

Introduction to Data Structures: Definition and Concepts of Data Structures, Need and Importance of Data Structures, Classification of Data Structures, Linear and Non-Linear Data Structures, Static and Dynamic Data Structures, Basic Operations on Data Structures.

Arrays: Introduction to Arrays, One-Dimensional Arrays, Memory Representation of One-Dimensional Arrays, Operations on Arrays: Traversing, Searching, Insertion, Deletion and Merging, Two-Dimensional Arrays and Their Memory Representation, Multidimensional Arrays.

Searching: Linear Search, Binary Search, Comparison of Linear Search and Binary Search, Applications of Searching Techniques.

Sorting: Introduction to Sorting, Selection Sort, Bubble Sort, Insertion Sort

Unit II: Linked Lists

Introduction to Linked Lists: Definition and Concepts of Linked Lists, Need for Dynamic Data Structures, Advantages and Limitations of Linked Lists, Memory Representation of Linked Lists.

Singly Linked List: Creation and Initialization of Singly Linked Lists, Traversing a Linked List, Searching, Insertion, Deletion and Merging Operations.

Doubly Linked List: Structure and Memory Representation of Doubly Linked Lists, Forward and Backward Traversal, Insertion and Deletion Operations.

Circular Linked Lists: Circular Singly Linked List, Circular Doubly Linked List, Structure and Memory Representation, Traversal and Insertion Operations.

Unit III: Stacks and Queues

Stacks: Definition and Concepts of Stack, Stack Representation using Arrays and Linked Lists, Stack Operations: PUSH, POP and STATUS, Overflow and Underflow Conditions.

Applications of Stacks: Arithmetic Expression Notations, Infix, Prefix and Postfix Expressions, Infix to Postfix Conversion, Evaluation of Postfix Expressions.

Queues: Definition and Concepts of Queue, Array and Linked List Representations, Queue Operations: Enqueue and Dequeue, Overflow and Underflow Conditions.

Types of Queues: Circular Queue, Double-Ended Queue (Deque), Priority Queue, Basic Operations and Applications of Different Types of Queues.

Unit IV: Trees and Graphs

Trees: Definition and Terminology of Trees, Root, Node, Edge, Parent, Child, Sibling, Leaf, Degree, Level and Height, Binary Trees, Properties of Binary Trees.

Binary Tree Representation and Operations: Representation of Binary Trees using Arrays and Linked Structures, Tree Traversal Techniques: Inorder, Preorder and Postorder, Searching in Binary Trees.

Binary Search Tree: Introduction to Binary Search Trees, Construction of Binary Search Trees, Searching, Insertion and Deletion Operations, Applications of Binary Search Trees.

AVL Trees: Introduction to AVL Trees, Height-Balanced Trees, Balance Factor, Rotations and Basic Operations.

Text Books:

- ✓ *Classic Data Structure, D. Samanta, PHI, 2/ed.*
- ✓ *Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Pubs.*

Reference Book:

- ✓ *Sastry C.V., Nayak R, Ch. Rajaramesh, Data Structure & Algorithms, I. K. International Publishing House Pvt. Ltd, New Delhi.*

Lab: Data Structures

Q1. Write a program in C to accept 'n' numbers from user, store these numbers into an array and count the number of occurrences of each number.

Q2. Write a program in C to insert and delete elements into/from appropriate position in an array.

Q3. Write a program in C to read an array of 'n' numbers and also read a number to be linear searched. If search number is found then print its position.

Q4. Write a program in C to search for an element in an array using binary search.

Q5. Write a program in C to read an array of 'n' numbers to sort an array using bubble sort.

Q6. Write a program in C to read an array of 'n' numbers to sort an array using selection sort.

- Q7. Write a program in C to create a single linked list and display all elements using the traversing operation.
- Q8. Write a program in C to search a specific value in a single linked list and display its position.
- Q9. Write a program in C to find the maximum and minimum element in the list and count the number of nodes in a linked list.
- Q10. Write a program in C to merge two sorted linked lists into a single sorted linked list.
- Q11. Write a program in C to create a doubly linked list and perform insertion, detection and backward traversal.
- Q12. Write a program in C to Push and Pop operations on Stack using array.
- Q13. Write a program in C to Push and Pop operations on Stack using Linked list.
- Q14. Write a program in C to implement a Queue using linked list with the operations:
- a) Insert an element to the queue.
 - b) Delete an element from the queue.
 - c) Display the queue after each operation.
- Q15. Write a program in C to Linked list implementation of Queue and perform operations such as enqueue and dequeue.
- Q16. Write a program in C to Linked list implementation of Circular Queue.
- Q17. Write a program in C to Implement a menu driven program for the following operations on Binary Search Tree (BST) of Integers
- a. Create a BST of N Integers: 8, 10, 3, 1, 6, 14, 7
 - b. Traverse the BST in Inorder
 - c. Traverse the BST in Preorder
 - d. Traverse the BST in and Post Order
- Q18. Write a program in C to Implement a menu driven program for the following operations on Graph(G)
- a. Create a Graph N using Adjacency Matrix.
 - b. Implementation of BFS traversal.
 - c. Implementation of DFS traversal for each graph representations.

CC 105	Operating Systems	3L : 1T : 0P	4 Credits
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Course Objectives:

- To understand Operating system structure and services.
- To understand the concepts of Process, memory, storage, and I/O management.
- To explore different applications of data structures.

UNIT I:

Operating Systems Overview: Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems.

Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

UNIT II:

Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads.

Process Scheduling: Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms

UNIT III:

Process Synchronization: Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors.

Deadlocks: System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.

UNIT IV:

Memory Management: Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation.

Virtual Memory: Demand paging, Page Replacement algorithms, Allocation of frames, thrashing.

Text Books:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

Reference Books:

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

SEC 102	Object Oriented Programming using Java	3L : 0T : 4P	5 Credits
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Course Objectives

CO1: To introduce the object-oriented programming system concepts

CO2: To introduce syntax and semantics of Java programming language

CO3: To develop modular programs using Java

CO4: To setup JDK environment to create, debug and run Java programs

UNIT I: Fundamentals of Object Oriented Programming: Basic Concepts of Object Oriented Programming (OOP), Benefits and Applications of OOP. Java Evolution: Java Features, Difference between Java and C, Java and Internet, Java Environment.

Overview of Java Language: Introduction to Simple Java Program, Use of Comments, Java Program Structure, Java Tokens and statements, Implementing Java program And JVM, Command Line Arguments.

UNIT II: Constants, Variables and Data Types: Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Type casting.

Operators & Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity.

Decision Making, Branching & Looping: Decision Making with Control Statements, Looping statements, Jump in loops, Labelled loops.

UNIT III: Classes, Objects and Methods: Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance

Arrays and Strings: 1D arrays, Creating an Array, 2D arrays, Strings, Wrapper Classes, Enumerated Types

Inheritance: Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism.

UNIT IV: Packages: Basics of packages, System packages, Creating and accessing packages, Creating user defined packages, Adding class to a package.

Exception Handling: Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, Multiple catch statements, Creating user defined exceptions.

Text Books:

□ E. Balagurusamy, “Programming with Java”, TMH, 4/Ed.

Reference Books:

□ Herbert Schildt, “The Complete Reference to Java”, TMH, 10/Ed.

Lab: Java Programming

- Q1. Write a program to read two numbers from user and print their product.
2. Write a program to print the square of a number passed through command line arguments.
3. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
4. Write a java program to find the largest number out of n natural numbers.
5. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non recursive functions.
6. Write a java program to multiply two given matrices.
7. Write a Java program for sorting a given list of names in ascending order.
8. Write a Java program that checks whether a given string is a palindrome or not .
Ex:MADAM is a palindrome.
9. Write a java program to read n number of values in an array and display it in reverse order.
10. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
11. Create a JAVA class called Student with the following details as variables within it. a. USN, NAME, BRANCH, PHONE, PERCENTAGE b. Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone, and percentage of these objects with suitable headings.
12. Write a Java program that displays the number of characters, lines and words in a text.
13. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.

14. Write a Java program to create a class Employee with a method called calculateSalary(). Create two subclasses Manager and Programmer. In each subclass, override the calculateSalary() method to calculate and return the salary based on their specific roles.
15. Write a Java program using an interface called 'Bank' having function 'rate_of_interest()'. Implement this interface to create two separate bank classes 'SBI' and 'PNB' to print different rates of interest. Include additional member variables, constructors also in classes 'SBI' and 'PNB'.
16. Write a Java package program for the class book and then import the data from the package and display the result.
17. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.
18. Write a Java program for demonstrating the divide by zero exception handling.
19. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
20. Create an exception subclass UnderAge, which prints "Under Age" along with the age value when an object of UnderAge class is printed in the catch statement. Write a class exceptionDemo in which the method test() throws UnderAge exception if the variable age passed to it as argument is less than 18. Write main() method also to show working of the program.

SEC 103	Web Technologies	1L : 0T : 2P	2 Credits
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Course Objectives:

- To introduce the fundamental concepts, structure, syntax, and elements of HTML for developing web pages.
- To develop skills in creating well-structured web pages using headings, paragraphs, hyperlinks, images, lists, tables, and other HTML elements.
- To develop practical skills in designing interactive web forms using different input controls and HTML5 form features.
- To introduce HTML5 semantic elements, multimedia components, graphics, and other modern web page features.
- To develop an understanding of CSS and its application in styling, formatting, and positioning HTML elements.
- To develop skills in designing responsive, user-friendly, and visually appealing web pages using CSS, Flexbox, Grid, and media queries.

Unit I: Introduction to HTML and Web Page Structure

Introduction to HTML and Web Technologies, Structure of an HTML Document, <!DOCTYPE>, <html>, <head>, and <body> Elements, HTML Tags and Elements, Block-Level and Inline Elements, Attributes, Comments, Headings, Paragraphs, Line Breaks, Horizontal Rules, Text Formatting, Superscript and Subscript, Quotations, Special Characters and HTML Entities, Hyperlinks, Internal and External Links, Email Links, Images, Image Attributes, Favicon, Lists, Ordered Lists, Unordered Lists, Description Lists, Nested Lists, and Creating a Basic Web Page.

Unit II: HTML Tables, Forms and Page Layout

HTML Tables, Table Structure, Table Headings, Rows and Columns, rowspan and colspan, Table Captions, Table Borders and Styling, Creating HTML Forms, Form Attributes, Text Input, Password Field, Email Field, Number Field, Date and Time Fields, Radio Buttons, Checkboxes, Select and Option Elements, Textarea, File Upload, Hidden Fields, Submit and Reset Buttons, Form Validation Attributes, required, placeholder, pattern, min, max, and maxlength, GET and POST Methods, Fieldsets and Legends, HTML Page Layout, Containers, Div and Span Elements, and Designing Registration and Login Forms.

Unit III: HTML5, Multimedia and Interactive Web Elements

Introduction to HTML5, Semantic HTML5 Elements, Header, Navigation, Main, Section, Article, Aside, Footer, Figure and Figcaption, Audio and Video Elements, Audio and Video Controls, Embedding External Content using iframe, YouTube and Map Embedding, HTML5 Graphics, Canvas Element, SVG Basics, HTML5 Input Types, Email, URL, Telephone, Number, Range, Color, Date, Month, Week, Time, Datetime-local, Search, HTML5 Form Validation, Data Lists, Progress and Meter Elements, Details and Summary Elements, and Creating Multimedia Web Pages.

Unit IV: CSS and Responsive Web Page Design

Introduction to CSS, Advantages of CSS, Inline, Internal and External CSS, CSS Syntax, Selectors, Element, Class, ID, Attribute and Universal Selectors, Grouping and Descendant Selectors, Colors, Backgrounds, Borders, Fonts, Text Properties, Links and Lists Styling, Width and Height, Margins, Padding, CSS Box Model, Display Properties, Visibility, Positioning, Floating and Clearing, z-index, Pseudo-classes and Pseudo-elements, CSS Flexbox, CSS Grid, Navigation Bar Design, Cards and Buttons, Form Styling, Image Styling, Basic Animations and Transitions, Responsive Web Design, Media Queries, Mobile-Friendly Layouts, and Development of a Complete Responsive Website.

Text Book:

- ✓ *Web Technologies (Black Book), DreamTech Press*

Reference Books:

- ✓ *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP* 4th Edition by Ivan Bayross.

Lab: Web Technologies

1. Create a basic HTML web page demonstrating the use of headings, paragraphs, line breaks, horizontal rules, comments, and text formatting elements.
2. Create a personal profile web page using headings, paragraphs, images, hyperlinks, and basic HTML formatting elements.
3. Create a web page demonstrating ordered lists, unordered lists, description lists, nested lists, and different list styles.
4. Create a web page containing internal links, external links, email links, and links to different sections of the same page.
5. Create an image gallery using HTML with multiple images, alternative text, image dimensions, captions, and hyperlinks.
6. Create a timetable for a college class using HTML tables with headings, borders, rowspan, and colspan.
7. Create a student registration form using text boxes, password fields, radio buttons, checkboxes, select lists, textarea, submit, and reset buttons.
8. Create a login form using HTML and implement suitable input fields and HTML5 form validation attributes.
9. Create an admission form using HTML5 input types such as email, telephone, number, date, URL, and file upload.
10. Create a feedback form using radio buttons, checkboxes, select lists, textarea, and HTML5 validation attributes.
11. Create a college website home page using HTML5 semantic elements such as header, nav, main, section, article, aside, and footer.
12. Create a web page containing audio and video files using HTML5 multimedia elements and appropriate controls.

13. Create a web page embedding external content using iframe, such as a YouTube video, Google Map, or another web page.
14. Create a web page demonstrating the use of HTML5 figure, figcaption, details, summary, progress, and meter elements.
15. Create a web page using HTML5 Canvas to draw basic shapes, lines, circles, and text.
16. Create a web page demonstrating basic SVG graphics such as rectangles, circles, lines, and text.
17. Create a web page using inline, internal, and external CSS and demonstrate the difference between the three methods.
18. Design a web page using CSS selectors including element, class, ID, universal, attribute, grouping, and descendant selectors.
19. Design a web page demonstrating CSS colors, backgrounds, borders, fonts, text properties, links, lists, and image styling.
20. Design a webpage demonstrating the CSS box model using margins, padding, borders, width, height, and different display properties.
21. Create a responsive navigation bar using HTML and CSS with suitable hover effects and styling.
22. Create a responsive webpage using CSS Flexbox containing a header, navigation section, content area, cards, and footer.
23. Create a responsive webpage using CSS Grid to arrange content into multiple rows and columns and make the layout adaptable to different screen sizes.

VAC 102	Indian Constitution	2L : 0T : 0P	2 Credits
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Unit 1: The Constitution - Introduction

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

Unit 2: Union Government

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit 3: State Government

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 4: Local Administration

- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5: Election Commission

- a. Role and Functioning
- b. Chief Election Commissioner
- c. State Election Commission

Suggested Learning Resources:

1. Ethics and Politics of the Indian Constitution by Rajeev Bhargava, Oxford University Press, New Delhi, 2008
2. The Constitution of India by B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India by DD Basu Lexis Nexis; Twenty-Third, 2018 edition

Suggested Software/Learning Websites:

- a. <https://www.constitution.org/cons/india/const.html>
- b. <http://www.legislative.gov.in/constitution-of-india>
- c. <https://www.sci.gov.in/constitution>
- d. <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

Cases

- Rustom Cavasjee Cooper v. Union of India, (1970) 1 SCC 248
- State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068 (confirmation of a private monopoly, not a violation of fundamental right)
- Mithilesh Garg v. Union of India, (1992) 1 SCC 168 : AIR 1992 SC 221 (Right to carry on business, not breached when it is liberalised)
- Chintamanrao v. The State of Madhya Pradesh, AIR 1951 SC 118 (scope of reasonable restrictions in relation to trade and occupation)
- Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC 220 (the reasonableness of the restriction imposed may depend upon the nature of the business and prevailing conditions including public health and morality)
- T. B. Ibrahim v. Regional Transport Authority. Tanjore, AIR 1953 SC 79
- Harman Singh v. RTA, Calcutta, AIR 1954 SC 190
- Dwarka Prasad Laxmi Narain v. State of U.P., AIR 1954 SC 224 ● State of Bombay v. R.M.D. Chamarbaugwala, AIR 1957 SC 699
- Parbhani Transport Coop. Society Ltd. v. Regional Transport Authority, Aurangabad, AIR 1960 SC 801
- State of Bombay v. R. M. D. Chamarbaugwala, (1957) S.C.R. 874,
- G.K.Krishnan vs State of Tamil Nadu, 1975 SCC (1) 375
- Automobile Transport (Rajasthan) Ltd. Vs State of Rajasthan, AIR 1962 SC 1406

SEMESTER – III

CC 201	Probability and Statistics	3L : 0T : 0P	3 Credits
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Course Objectives

- CO1: This course aims to make the students trained to handle randomness scientifically using theory of probability.
- CO2: This course intends to make the students able to represent the statistical data in a systematic way and analyze it to draw meaningful information from them.
- CO3: Through plentiful examples and exercises, this course provides the students scope to apply probabilistic and statistical techniques to deal with the real-life problems.

UNIT I:

Measures of Central Tendency:

Arithmetic Mean: Simple, Combined and weighted mean, Properties, Direct and shortcut methods (Assumed mean, step-deviation) for individual, Discrete and Continuous series.

Median: Properties, Calculation for individual, Discrete and Continuous series.

Mode: Properties, Calculation for individual, Discrete and Continuous series.

Empirical relationship between Mean, Median & Mode.

UNIT II:

Measures of Dispersion: Range, mean deviation, quartile deviation, variance and standard deviation.

Correlation: Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.

UNIT III:

Concepts of probability: sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability, Bayes' theorem.

Random Variables: Discrete and continuous random variable, probability distribution of a random variable, probability mass function, probability density function, expectation and variance of a random variable.

Standard Probability Distribution: Binomial distribution, Poisson Distribution.

UNIT IV:

Sampling Distribution: Population and sample, parameter and statistics, sample distribution of sample mean and sample proportion.

Hypothesis Testing for a Single Population: Concept of a hypothesis testing, tests involving a population mean and population proportion (z test and t test). Chi square test for independence of attributes and goodness of fit.

Text Books

1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook)
2. Das N. G., Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.
3. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.
4. Miller Irwin and Miller Marylees, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2005

Reference Books

1. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013
2. Montgomery Douglas and Runger George C., Applied Statistics and Probability for Engineers, Wiley, 2016.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024.

CC 202	Database Management Systems	3L : 0T : 4P	5 Credits
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Course Objectives

- Understanding Core Concepts of DBMS
- Proficiency in Database Design and SQL
- Application of Advanced Database Techniques

UNIT I:

Introduction to Databases: Definition of Data, Database, and DBMS, Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators.

Data Models: Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented).

Database Design: Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER, Features, Introduction to the Relational Model and Relational Schema

UNIT II:

Relational Algebra and Calculus: Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division.

Structured Query Language (SQL): SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses (Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join, Views, Nested Query.

UNIT III:

Normalization and Database Design: Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.

UNIT IV:

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks

Text Books

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hours", 1st edition, Sams Publishing, 2024

Reference Books

1. Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.(2019)
2. R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

Lab: Data Base Management System

DDL Commands

1. Create the above tables
2. 6. Add a new attribute state in supplier table
3. Remove attribute city from supplier table
4. Modify the data type of phone attribute
5. Change the name of attribute city to address
6. Change a table's name, supplier to sup
7. Use truncate to delete the contents of supplies table
8. Remove the part table from database

DML Commands

1. Insert at least 10 records in tables supplier, part and supplies
2. Show the contents in tables supplier, part and supplies
3. Find the name and city of all suppliers
4. Find the name and phoneno of all suppliers who stay in 'Delhi'
5. Find all distinct branches of suppliers
6. Delete the record of the supplier whose SID is 204001
7. Delete all records of supplier table
8. Delete all records of suppliers whose city starts with capital A.
9. Find the supplier names which have 'lk' in any position
10. Find the supplier name where 'R' is in the second position
11. Find the name of supplier whose name starts with 'V' and ends with 'A'
12. Change the city of all suppliers to 'BOMBAY'
13. Change the city of supplier 'Vandana' to 'Goa'

Queries with Constraints 1.

1. Create the supplier table with Primary Key Constraint

2. Create supplies table with Foreign key Constraint
3. Create a part table with UNIQUE Constraint
4. Create supplier Table with Check Constraints
5. Create Supplier table with Default Constraint

Queries on TCL

1. Create Savepoints
2. Rollback to SavePoints
3. Use Commit to save on

Aggregate Functions

1. Find the minimum, maximum, average and sum of costs of parts
2. Count the total number of parts present
3. Retrieve the average cost of all parts supplied by 'Mike'

Queries on GROUP BY, HAVING AND ORDER BY Clauses

1. Display total price of parts of each color
2. Find the branch and the number of suppliers in that branch for branches which have more than 2 suppliers
3. Find all parts sorted by pname in ascending order and cost in descending order
4. Find the branch and the number of suppliers in that branch

Queries on Operators

1. Find the pname, phoneno and cost of parts which have cost equal to or greater than 200 and less than or equal to 600.
2. Find the sname , SID and branch of suppliers who are in 'local' branch or 'global' branch
3. Find the pname, phoneno and cost of parts for which cost is between 200 and 600
4. Find the pname and color of parts , which has the word 'NET' anywhere in its pname.
5. Find the PID and pname of parts with pname either 'NUT' or 'BOLT'
6. List the suppliers who supplied parts on '1st may2000', '12 JAN 2021' , '17 dec 2000' , '10 Jan 2021'
7. Find all the distinct costs of parts

Join Operators

1. Perform Inner join on two tables
2. Perform Natural Join on two tables
3. Perform Left Outer Join on tables
4. Perform Right Outer join on tables
5. Perform Full Outer Join on tables

Set Theory Operators

1. Show the use of UNION operator with union compatibility
2. Show the use of intersect operator with union compatibility
3. Show the use of minus operator with union compatibility
4. Find the cartesian product of two tables
5. List all parts except 'NUT' and 'BOLT' in ascending order of costs
6. Display all parts that have not been supplied so far

7. To display the supplier names who have supplied 'green' part with cost 500 Rupees AND 'red' part with cost 400 Rupees.
8. To display the supplier names who have supplied 'green' part with cost 500 Rupees OR 'red' part with cost 400 Rupees.
9. To Display the name of suppliers who have supplied all parts that are 'red' in color.

SEC 201	Python Programming	2L : 0T : 4P	4 Credits
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Course Objectives:

CO1: Develop modular Python programs.

CO2: Apply suitable Python programming constructs, built-in data structures using Python libraries to solve a problem.

CO3: Understand basic Data visualization and File handling in Python.

UNIT I: Introduction: History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements. Strings: Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings.

UNIT II: Control Flow Statements: Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit. Functions: Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Assert statement; Importing User defined module; Mutable and Immutable objects: Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.

UNIT III: Files: Types of Files; Creating, Reading and writing on Text and Binary Files; The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files. Exception Handling:

UNIT IV: Exception Handling: Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions.

Data visualization: Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves.

Text Books:

1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
3. Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.

Reference Books:

1. Think Python, by Allen Downey, 2nd edition, 2015, O'Reilly. https://drive.google.com/file/d/1p9Pul6d5UvnQrO9-QLE2_p4YvMk5cIg/view
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2nd edition, 2016, PHI India.

Lab: Python Programming

1. Write a program to find whether a number is a prime number.
2. Write a program to print m raise to power n, where m and n are read from the user.
3. Write a program having a parameterised function that returns True or False depending on whether the parameter passed is even or odd.
4. Write a program to print the summation of the following series upto n terms: 1-2+3-4+5-6+7 - - - - -n
5. Write a menu driven program to perform the following operations on strings using string built in functions.
 - a. Find the frequency of a character in a string.
 - b. Replace a character by another character in a string.
 - c. Remove the first occurrence of a character from a string.
 - d. Remove all occurrences of a character from a string.
6. Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1
7. Using Numpy module write menu driven program to do following
 - a. Create an array filled with 1's.
 - b. Find maximum and minimum values from an array
 - c. Dot product of 2 arrays.
 - d. Reshape a 1-D array to 2-D array.
8. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
9. Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
 - a. Print contents of t1 in 2 separate lines such that half values come on one line and other half in the next line.
 - b. Print all even values of t1 as another tuple t2.
 - c. Concatenate a tuple t2=(11,13,15) with t1.
 - d. Return maximum and minimum value from t1..
10. Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines.
11. Write a Python program to handle a ZeroDivisionError exception when dividing a number by zero.

12. Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
13. Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves.
14. Take as input in the months and profits made by a company ABC over a year. Represent this data using a line plot. Generated line plot must include X axis label name = Month Number and Y axis label name = Total profit.

CC 203	Software Engineering	3L : 0 T: 4P	3 Credits
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Course Objectives:

- To understand importance of Software engineering.
- To understand different software development models
- To understand various issues involved in a software development project

Unit I:

Introduction: Evolution of Software to an Engineering Discipline, Software Development Projects, Exploratory Style of Software Development, Emergence of Software Engineering, Changes in Software Development Practices, Computer Systems Engineering.

Software Lifecycle Models: Waterfall Model and its Extensions, Rapid Application Development (RAD), Agile Development Models, Spiral Model.

Unit II:

Software Project Management: Software Project Management Complexities, Responsibilities of a Software Project Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO, Halstead's Software Science, Staffing Level Estimation, Scheduling, Organization and Team Structures, Staffing, Risk Management, Software Configuration Management.

Unit III:

Requirement Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specifications, Formal System Specification Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL.

Software Design: Design Process, Characterize a Good Software Design, Cohesion and Coupling, Layered Arrangements of Modules, Approaches to Software Design (Function Oriented & Object-Oriented).

Unit IV:

Coding and Testing: Coding: Code Review, Software Documentation, Testing, Unit Testing, Black Box and White Box Testing, Debugging, Program Analysis Tools, Integration Testing, System Testing, Software Maintenance.

Text Books:

- ✓ *Software Engineering*– Ian Sommerville, 10/Ed, Pearson
- ✓ *Fundamental of Software Engineering*, Rajib Mall, Fifth Edition, PHI Publication, India.

Reference Books:

- ✓ *Software Engineering Concepts and Practice* – Ugrasen Suman, Cengage Learning India Pvt, Ltd.
- *Software Engineering*, R Khurana, Vikash Pubs.

DSE 201	Basics of Data Analytics	1L : 0T : 4P	3 Credits
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Course Objectives

CO1: Understand the basics of data analytics and its applications.

CO2: Develop proficiency in using spreadsheet software for data manipulation and analysis.

CO3: Build and use spreadsheet models for decision making & Communicate data insights effectively.

UNIT I: Introduction to Data Analytics

Understanding data and its types (structured, unstructured, semi-structured)-What is Data Analytics- Types of data Analytics-Importance of Data Analytics- Applications of Data Analytics.

UNIT II: Data, Ethics, and Industry

Data Collection Methods - Different Data Sources and Format - Data Cleaning and Transformation - Handling Missing Data and Outliers. - Ethical considerations in data analytics.

Real-world Applications of Data Analytics-Industry-specific applications (finance, marketing, operations)

UNIT III: Introduction to Data Visualization

Definition and importance of data visualization-Role of data visualization in decision makingTypes of data (numerical, categorical, temporal, geographical)-Data visualization process (data collection, exploration, analysis, visualization, interpretation)

UNIT IV: Designing Effective Visualizations

Principles of Good Visualization Design - Understanding and Using Color in Visualizations. Importance of Data Modelling in Visualization.Challenges and limitations of data visualization

Text Books

1. “Data Analytics” by V.K. Jain, Khanna Book Publishing Company, 2024.
2. “Excel Data Analysis For Dummies” by Stephen L. Nelson and E. C. Nelson, John Wiley & Sons; 3rd edition, 2016.
3. “Data Analysis Using Microsoft Excel” by Michael R. Middleton, Thomson, Brooks/Cole, 3rd edition , 2004

Reference Books

1. “Excel 2019 Bible” by Michael Alexander, Richard Kusleika, and John Walkenbach, John Wiley & Sons, 25 Sept 2018
2. “Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics” by Cliff T Ragsdale, Cengage Learning Asia. 2015
3. “Mastering Excel” by WebTech Solutions, Khanna Publishing House, 2024.

Lab: Data Analytics

Introduction to Excel and Basic Functions

1. Getting started with Excel: Workbook, Worksheet, Cells, and Ranges
 2. Using basic arithmetic functions: SUM, AVERAGE, MIN, MAX, ROUND
- Data Importing and Pre-processing
3. Importing data from various sources (CSV, text files, web data)
 4. Data transformation: text-to-columns, data validation techniques
 5. Using the Find and Replace and Text Functions (LEFT, RIGHT, MID, CONCATENATE, TRIM, CLEAN, TEXT)

Descriptive Statistics Using Excel

6. Calculating measures of central tendency: mean, median, mode
7. Computing measures of dispersion: range, variance, standard deviation
8. Creating and interpreting frequency distributions and histograms

Advanced Spreadsheet Functions

9. Using logical functions: IF, AND, OR, IFERROR
10. Lookup and reference functions: VLOOKUP, HLOOKUP, INDEX, MATCH
11. Data aggregation techniques: SUMIFS, COUNTIFS, AVERAGEIFS

Data Visualization Techniques

12. Creating various chart types: bar, line, pie, scatter
13. Advanced charting techniques: combo charts, dual-axis charts
14. Creating and customizing PivotTables and Pivot Charts

Dashboard Creation

15. Introduction to dashboards: concepts and components
16. Using PivotTables and Pivot Charts for dashboard elements
17. Applying conditional formatting for dynamic visual cues
18. Creating interactive dashboards with slicers and timeline

DSE 201	Disaster Management	2L : 0T : 0P	2 Credits
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Course Objective(s):

- To provide understanding of the concepts related to disaster
- To highlight the importance and role of disaster management
- To enhance awareness of institutional processes and management strategies to mitigate the impacts of disasters

Unit 1: Concepts and Terminologies

Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made); Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial);

Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability)

Unit 2: Key concepts of Disaster Management Cycle

Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning); Disaster risk reduction (DRR), Community based disaster risk reduction

Unit 3: Initiatives at national and international level

Disaster Risk Management in India and at international level: Related policies, plans, programmes and legislation; International strategy for disaster reduction and other initiatives

Unit 4: Emergency Management

Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material); Threats (Bomb and terrorist attacks) - Stampede and conflicts

Training and Demonstration Workshops (at least two workshops) be organized in association with the NIDM, NDRF, NCDC, Param Military, Fire Brigade, CISF, local administration etc.

Readings

1. Sharma, S.C. (2022), Disaster Management, Khanna Book Publishing.
2. Clements, B. W., (2009): Disasters and Public Health: Planning and Response, Elsevier Inc.
3. Dunkan, K., and Brebbia, C. A., (Eds.) (2009): Disaster Management and Human Health Risk: Reducing Risk, Improving Outcomes, WIT Press, UK.

4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.
5. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.
6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.
7. Carter, N. (1991) Disaster Management: A Disaster Management Handbook. Asian Development Bank, Manila.
8. Govt. of India (2008) Vulnerability Atlas of India. BMTPC, New Delhi.
9. Govt. of India (2011) Disaster Management in India. Ministry of Home Affairs, New Delhi.
10. Matthews, J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, Ian Mason.

E-Resources

<http://www.ndma.gov.in/en/>

<http://nidm.gov.in/>

<https://www.unisdr.org/>

<http://www.emdat.be>

<https://www.weather.gov/safety/>

<https://www.preventionweb.net/risk/>

vulnerability

SEMESTER – IV

CC 204	Entrepreneurship and Startup Ecosystem	1L : 1T : 0P	2 Credits
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Course Objective(s):

- To understand Entrepreneurship and its types
- To understand that not all ideas can be turned into viable business models and guestimate business potential of an idea
- To understand different type of finances available and financing methods
- To be able to draft business plans on an identified idea
- To understand the nuances of operating a startup – low budget marketing, stabilizing operations, build a team from scratch and scaling the business
- To know what is a Family Business and how is it different from Entrepreneurship

UNIT 1:

Introduction to Entrepreneurship & Family Business

- Definition and Concept of entrepreneurship
- Entrepreneur Characteristics
- Classification of Entrepreneurs
- Role of Entrepreneurship in Economic Development –Start-ups
- Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.

UNIT 2:

Evaluating Business opportunity

- Sources of business ideas and opportunity recognition
- Guesstimating the market potential of a business idea
- Feasibility analysis of the idea
- Industry, competition and environment analysis

UNIT 3:

Building Blocks of starting ventures

- Low cost Marketing using digital technologies
- Team building from scratch
- Venture Funding
- Establishing the value-chain and managing operations ● Legal aspects like IPR and compliances

UNIT 4:

Start-up Ecosystem

- Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc.
- Know various govt. schemes like Start-up India, Digital India, MSME etc.
- Sources of Venture Funding available in India
- Source of Technology, Intellectual Property management

Text Books (Latest Edition):

1. *Startup India Leaning Program* by Start Up India available at www.startupindia.gov.in
2. *Entrepreneurship*, Rajeev Roy, Oxford University Press
3. *Entrepreneurship: Successfully Launching New Ventures* by R. Duane Ireland
Bruce R. Barringer, Pearson Publishing
4. *Family Business Management* by Rajiv Agarwal, Sage Publishing
5. Anish Tiwari (2003), “Mapping the Startup Ecosystem in India”, *Economic & Political Weekly*
6. Ramachandran, K, *Indian Family Businesses: Their survival beyond three generations*,
ISB Working Paper Series

CC205	Computer Networks	3L:0T:4P	5 Credits
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Course Objectives:

CO1: Understand the fundamental concepts of Computer Networks and their applications.

CO2: Develop problem-solving skills related to network design, implementation, and troubleshooting.

CO3: Implement network protocols and configure network devices.

Unit I:

Introduction to Data Communications and Network Models: Protocols and Standards, Layers in OSI Models, Analog and Digital Signals, Network Topology, Transmission Modes, Transmission Impairment, Data Rate Limits, Performance, Network Devices & Drivers: Router, Modem, Repeater, Hub, Switch, Bridge (fundamental concepts only).

Unit II:

Signal Conversion: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Digital-to-analog Conversion, Analog-to-analog Conversion.

Switching Techniques: Packet Switching, Circuit Switching, Datagram Networks, Virtual-Circuit Networks, and Structure of a Switch.

Unit III:

Error Detection and Correction: Parity Check, Checksum, CRC, Error correction technique (Hamming code).

Data Link Control: Framing, Flow and Error Control, Noiseless Channels, Noisy channels, (Stop and Wait ARQ, Sliding Window Protocol, Go Back N, Selective Repeat) Point-to-Point Protocol

Unit IV:

Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses,

Virtual-Circuit Networks: Frame Relay and ATM,

Transport Layer: Process-Process Delivery: UDP, TCP.

Application layers: DNS, SMTP, POP, FTP, HTTP, Basics of WiFi (Fundamental concepts only)

Text Books:

1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.

Reference Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.

2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019.
3. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023.
4. Mastering PC Hardware & Networking, Khanna Publishing House, 2024.

Lab: Computer Network

1. Configure Basic Network Settings:

- a) IP Address Configuration
- b) Subnet Mask and Gateway Settings

2. Implement Network Protocols:

- a) Write a simple Python script to perform DNS resolution.
- b) Implement a basic HTTP client-server application.

3. Network Simulation:

- a) Use network simulation tools (e.g., Cisco Packet Tracer) to design and simulate network topologies.
- b) Configure routers and switches in a simulated environment.

4. Performance Measurement:

- a) Measure network performance using tools like `ping`, `traceroute`, and `iperf`.
- b) Analyze network traffic using Wireshark.

5. Implement VLANs:

- a) Configure VLANs on a switch and verify using simulation tools.

6. Set Up a Simple Web Server: Deploy a basic web server and configure HTTP/HTTPS access.

7. Network Security Lab:

- a) Implement basic firewall rules and VPN configurations.
- b) Perform vulnerability scanning and analyze results.

8. Network Troubleshooting:

- a) Diagnose and resolve common network issues.
- b) Use troubleshooting commands and techniques to fix connectivity problems.

CC 206	Design and Analysis of Algorithms	3L : 0T : 0P	3 Credits
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Course Objectives

CO1: This course envisions to impart to students the understanding of basic algorithm designing paradigms.

CO2: This course introduces the basic knowledge on how to analyse an algorithm.

CO3: This course expects to enable a student to synthesize efficient algorithms in common design situations and real-life problems.

UNIT I:

What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity.

Asymptotic notations (O , Ω , Θ) to measure growth of a function and application to measure complexity of algorithms.

Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication.

Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.

UNIT II:

The Divide & Conquer Design Technique:

The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication. Lower bound for comparison-based sorting.

The Greedy Design Technique:

The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

UNIT III:

The Dynamic Programming Design Technique:

The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem.

Algorithms on Graphs:

Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.

UNIT IV:

Limitations of Algorithmic Power:

Backtracking Method: n-Queen problem; sum of subsets problem, vertex cover problem.

Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Text Books

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)
2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.
4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012

Reference Books

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.
2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

CC207	Artificial Intelligence	3L : 1T : 4P	4 Credits
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Course Outcomes:

CO1: Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.

CO2: Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.

CO3: Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.

CO4: Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy sets.

CO5: Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI

Unit I:

Introduction: Definitions of AI, Four approaches to AI, Turing Test; Intelligent Agents: Agent function & programs, Rationality, Environment types, PEAS description, Structure of Agents, Types of Agent Programs, Problems solving by Searching - Example Problems, State space search; Uninformed Search Strategies: BFS, DFS, Depth Limited, Iterative Deepening DFS, Uniform Cost, Bi-directional Searches.

Unit II:

Search Algorithms & Reasoning: Introduction, Evaluation and Heuristic functions, Greedy Best First Search, A* Search, Example Problems; Local Search Algorithms: Hill Climbing Search and Simulated Annealing; Constraint Satisfaction Problems: Introduction & types of CSPs, Backtracking Search for CSPs; Adversarial Search: Introduction, Game playing, Minimax and α - β Pruning; Knowledge & Reasoning: KB-based Agents, The Wumpus World problem.

Unit III:

Logic & Reasoning: Logic, Propositional Logic, First-Order Logic (FOPL): Syntax & Semantics of FOPL, Inference in FOPL Forward and Backward Chaining, Knowledge Representation: Ontological Engineering, Categories and Objects, Semantic Nets, Frames.

Unit IV:

Planning: The Planning Problem, Planning with State-Space Search, Partial Order Planning, Planning Graphs, Hierarchical Planning; Uncertain Knowledge: Acting under Uncertainty, Bayes Rule & its use; Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain.

Text Books:

1. M.C. Trivedi, *A Classical Approach to Artificial Intelligence*, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J, *Artificial Intelligence: A new Synthesis*, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, *Introduction to Artificial Intelligence & Expert Systems*, PHI Learning 2010.
4. Rajiv Chopra, *Data Science with Artificial Intelligence, Machine Learning and Deep Learning*, Khanna Book Publishing Company, 2024.

Reference Books:

1. M.C. Trivedi, *Introduction to AI and Machine Learning*, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., “Artificial Intelligence - A Modern Approach”, 3rd edition, Prentice Hall
3. Van Hirtum, A. & Kolski, C. (2020). *Constraint Satisfaction Problems: Algorithms and Applications*. Springer
4. Rajiv Chopra, *Machine Learning and Machine Intelligence*, Khanna Book Publishing Company, 2024.

DSE 202	Basics of R Programming	1L : 0T : 4P	3 Credits
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Course Objectives

CO1: To introduce students to the R programming environment and its practical applications.

CO2: To develop proficiency in R syntax, data types, and control structures for problem-solving.

CO3: To enable students to create and manipulate vectors and lists for organizing and handling data in R.

CO4: To enable students to write and organize code using functions for reusability and clarity.

CO5: To familiarize students with basic data visualization techniques in R for effective data representation.

UNIT I

Introduction to R:History, Features, Advantages and Applications of R; Installing R and RStudio; RStudio interface and working environment; Working with the R Console and Script Editor; R syntax, Keywords, Data types: Numeric, Integer, Character, Logical and Complex; Variables, Constants, Operators: Arithmetic, Relational, Logical and Assignment. Input and output functions: readline(), print(), cat(); Writing and executing simple R programs.

UNIT II

Control Structures: Conditional Control Structures-if, if-else, if-else-if, nested if and switch().

Loops- for, while, repeat; break and next statements.

String Handling:Creating and accessing String, String concatenation, Basic string functions: nchar(), substr(), paste(), strsplit(), toupper(), tolower().

UNIT III

Vectors: Creating vectors, accessing and modifying elements, vector operations and Basic vector functions: length(), sum(), mean(), sort(), rev(), max(), min().

Lists: Creating Lists, Accessing List Elements, Naming List Elements. Modifying Lists: Adding, Updating, and Removing Elements. Nested Lists, Basic List Functions: length(), unlist(),lapply().

UNIT IV

Functions: Built-in Functions; User-defined Functions: Defining, calling and passing arguments, Default Values, Return Values.

Data Visualization in R: Creating basic plots - Bar chart, pie chart, histogram, boxplot and scatter plot; Customizing graphs with titles, labels and legends.

Text Books

1. “The Art of R Programming” by Norman Matloff, No Starch Press, 2011
2. “R Programming for Beginners” by Sandip Rakshit, McGraw Hill Education, 2017
3. “Beginner’s Guide for Data Analysis using R Programming” by Jeeva Jose, Khanna Book Publishing, 2025

Reference Books

1. “The R Book” by Michael J. Crawley, Wiley, 2017
2. “R Cookbook” by Paul Teetor, O’Reilly, 2011

Lab: R Programming

1. Install R and RStudio. Execute basic commands.
2. Write an R program to declare variables of different data types (numeric, integer, character, logical, complex) and display their values and types.
3. Write an R program to accept two numbers and perform addition, subtraction, multiplication, division, modulus, and exponentiation.
4. Write a simple R program to calculate the area and circumference of a circle based on user input.
5. Write an R program to check whether a number is positive, negative, or zero.
6. Write an R program to find the largest of three numbers using nested if.
7. Write an R program to display the grade of a student based on marks using switch().
8. Write an R program to print the first N natural numbers and their sum using a for loop.
9. Write an R program to generate the Fibonacci series using a while loop.
10. Write an R program to display natural numbers from N to 1 skipping even numbers using next.
11. Write a program to demonstrate string handling functions.
12. Write an R program to find the sum, mean, median, maximum, and minimum of a vector.
13. Write a program to create a list, access list elements, and name list elements.
14. Write a user-defined function to calculate the factorial of a number.
15. Write a user-defined function with default argument values to calculate simple interest.
16. Draw a pie chart showing department-wise student distribution.
17. Create a bar chart representing student marks.
18. Create a scatter plot showing the relationship between study hours and marks.

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SEC 202	Design Thinking and Innovation	1L : 1T : 0P	2 Credits
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Course Objectives:

Operating under turbulent and uncertain business environment, ‘innovation’ has become the key driver of organizational success for all companies. Managers are expected to be leading this change by navigating companies into rapid evolution of new products/services and business models.

The primary focus of DTI is to help learners develop creative thinking skills and apply design based approaches/tools for identifying and implementing innovation opportunities into implementable projects. Following a learning-by-doing approach, the objectives of the course are –

1. Introduce students to design-based thinking approach to solve problems
2. Observe and assimilate unstructured information to well framed solvable problems
3. Introduce student to templates of ideation
4. Understand the importance of prototyping in the innovation journey
5. Implementing innovation projects

Unit 1: Basics of Design Thinking

1. Understand the concept of innovation and its significance in business
2. Understanding creative thinking process and problem solving approaches
3. Know Design Thinking approach and its objective
4. Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product.
5. Discussion of a few global success stories like AirBnB, Apple, IDEO, Netflix etc.
6. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement

Unit 2: Learning to Empathize and Define the Problem

1. Know the importance of empathy in innovation process – how can students develop empathy using design tools
2. Observing and assimilating information
3. Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences.
4. What are wicked problems
5. Identifying wicked problems around us and the potential impact of their solutions

Unit 3 : Ideate, Prototype and Implement

1. Know the various templates of ideation like brainstorming, systems thinking
2. Concept of brainstorming – how to reach consensus on wicked problems
3. Mapping customer experience for ideation

4. Know the methods of prototyping, purpose of rapid prototyping.
5. Implementation

Unit 4 : Feedback, Re-Design & Re-Create

1. Feedback loop, focus on User Experience, address ergonomic challenges, user focused design
2. Final concept testing,
3. Final Presentation – Solving Problems through innovative design concepts & creative solution

Text Books (Latest Edition):

1. E Balaguruswamy (2023), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company
2. Tim Brown, (2008), “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, *Harvard Business Review*
3. 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing

Reference Book

1. Design Thinking by Nigel Cross, Bloomsbury

SEMESTER – V

DSE 301	Web Development with PHP	3L : 0T : 4P	5 Credits
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Course Objectives:

- To introduce the core architecture, syntax, and programming fundamentals of PHP for server-side web development.
- To develop proficiency in building interactive web applications by processing web forms, managing state via cookies and sessions, and organizing modular code using inclusions and functions.
- To provide foundational and practical knowledge of MySQL database design, SQL execution, and database connection drivers (MySQLi and PDO).
- To construct secure, full-stack database-driven applications by engineering complete CRUD workflows, search filtering, pagination, and file handling mechanisms.
- To instill robust web security practices, including parameterized prepared statements, input validation, sanitization, error handling, and secure application deployment.

Unit I:

Basics and Installation: PHP Introduction, Why PHP and where it stands in Web environment, Static vs. Dynamic Web Sites, Client-Side Scripting vs. Server-Side Scripting, PHP Advantages and Capabilities, PHP development environment, PHP installation and configuration.

Basic structure of a PHP program: Echo and print Statements, Comments in PHP, PHP Case Sensitivity, defining variable and constant, PHP Data Types, Variables, Constants, PHP Operators, Conditional Operators (if, if...else...if, nested if, if-elseif-else, switch Statement), Looping Constructs (while, do...while, for, foreach).

Unit II:

Functions: Introduction, User Defined Functions, Passing Arguments to Functions, Variable scope, Local and Global Scope, Passing Arguments, Returning Values from a Function, Using Include Files, The Require Statement, Dynamic Function Calls, Predefined PHP Functions.

Embedding PHP in HTML: Creating HTML forms, GET and POST methods, Reading Form Data of a Web Page, Using PHP to generate dynamic HTML content, Form validation, Handling text boxes, radio buttons, checkboxes, and select lists.

Cookies and Sessions: Introduction to cookies, Creating and accessing cookies, Modifying and deleting cookies, Introduction to sessions, starting a session, Session variables, Destroying sessions, Session-based authentication, Difference between cookies and sessions.

Unit III:

PHP–MySQL Connectivity: Connecting PHP with MySQL, MySQLi extension, PDO extension, creating a database connection, selecting a database, Executing SQL queries from PHP, Processing query results, displaying database records in HTML, inserting records through

PHP, updating records through PHP, deleting records through PHP, Closing database connections.

PHP and MySQL with Web Forms: Connecting HTML forms to MySQL, Form validation, CRUD Operations Using PHP and MySQL and Html (Concept of CRUD, create operation, read operation, update operation, delete operation, displaying records using HTML tables, Searching and filtering database records, Pagination of database records).

Unit IV:

Prepared Statements and Database Security: Introduction to prepared statements, Parameterized queries, Preventing SQL injection, Input validation and sanitization, Error handling, Secure database connections.

File Handling and Application Deployment: Reading and Writing Files in PHP, File Upload and Download, Directory Handling, Handling CSV and JSON Files, Email Handling, PHP Configuration, Error and Log Management, Application Deployment on a Web Server, Database Backup and Restore, and Basic Website Maintenance.

Text Book:

1. Web Technologies (Black Book), DreamTech Press

Reference Books:

1. Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP 4th Edition by Ivan Bayross.
2. PHP and MySQL Web Development by Luke Welling and Laura Thomson. Addison -Wesley.

Lab: Web Designing with PHP

1. Write a PHP program to display “Hello World” and demonstrate the use of echo, print, comments, variables, constants, and different data types.
2. Write a PHP program to perform arithmetic, relational, logical, assignment, increment/decrement, and conditional operations on two numbers.
3. Write a PHP program to demonstrate if, if-else, nested if, if-elseif-else, and switch statements.
4. Write a PHP program to demonstrate while, do-while, for, and foreach loops by generating suitable output.
5. Write a PHP program to find the largest of three numbers, check whether a number is prime, and determine whether a number is even or odd.
6. Write a PHP program using user-defined functions to perform addition, subtraction, multiplication, and division of two numbers.
7. Write a PHP program demonstrating local and global variable scope, passing arguments to functions, and returning values from functions.
8. Create a PHP application using include and require to implement reusable header, footer, navigation, and database configuration files.

9. Create an HTML form and write a PHP program to process text boxes, radio buttons, checkboxes, textarea, and select-list values using the POST method.
10. Create a student registration form using PHP and implement validation for name, email, mobile number, date of birth, gender, and other required fields.
11. Create a PHP application demonstrating the creation, retrieval, modification, and deletion of cookies.
12. Create a PHP application to demonstrate session creation, session variables, session access, session modification, and session destruction.
13. Develop a PHP-based login and logout system using sessions and restrict access to a dashboard page for authenticated users only.
14. Create a MySQL database and a student table using phpMyAdmin, insert sample records, and perform basic SQL operations to retrieve, update, and delete records.
15. Write a PHP program to establish a connection with MySQL using MySQLi and PDO and display student records from a database table.
16. Develop a PHP application to insert, display, update, and delete student records from a MySQL database.
17. Develop a complete Student Management System using PHP and MySQL implementing Create, Read, Update, and Delete operations.
18. Develop a PHP application to search and filter MySQL records based on student name, roll number, department, and other selected criteria.
19. Develop a PHP application to display MySQL records using pagination with a fixed number of records per page.
20. Rewrite a PHP–MySQL application using prepared statements and parameterized queries for insert, update, delete, and search operations.
21. Develop a secure PHP form implementing input validation, sanitization, error handling, and protection against SQL injection.
22. Write a PHP program to create, open, read, write, append, and delete text files and demonstrate basic directory handling.
23. Develop a PHP application to upload images/documents to the server with file type, file size, and file extension validation and display the uploaded files.
24. Develop a PHP application to import student records from a CSV file into a MySQL database and export database records in CSV and JSON formats.
25. Develop a complete database-driven PHP web application incorporating user authentication, form validation, CRUD operations, search and filtering, file upload, prepared statements, and basic security practices.

Mini Project

1. Student Information Management System
2. Library Management System
3. Online Notice Management System
4. Employee Management System
5. Online Event Registration System
6. Hostel Management System

DSE 302	Internet of Things	3L : 0T : 4P	5 Credits
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Course Objectives:

- To know the evolution of the Internet of Things (IoT), its working mechanisms.
- To know and develop Applications of IoT in our daily life.
- Understand IoT networking components and various topologies
- Understand IoT connectivity & communication technologies

Unit I:

Emergence of IoT: Introduction, Evolution of IoT, Layered Architecture, Networking Components, Addressing Strategies. IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Embedded Systems.

IoT Levels and Deployment Templates: Introduction, IoT Level-1 to Level-6. IoT Sensing and Actuation: Introduction, Sensors, their characteristics and types. Actuators, their characteristics and types.

Unit II:

Application Domains of IoT: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle. Paradigms, Challenges and Future: Evolution of new IoT Paradigms, Challenges associated with IoT, Emerging Pillars of IoT.

IoT Processing Topologies: Data Format, importance of processing, processing topologies, IoT device design and selection considerations, Processing offloading.

Unit III:

IoT Connectivity Technologies: Introduction & types, IEEE 802.15.4, Zigbee, Thread, Wireless HART, RFID, NFC, Z-Wave, LoRa, Wi-Fi, Bluetooth.

IoT Communication Technologies: Introduction, Protocols for Infrastructure, Discovery, Data, Identification, Device Management and Semantic.

Unit IV:

Introduction to various IoT Development Platforms, Sensor development boards/platforms, Arduino versus Raspberry Pi. Arduino: Introduction, installation & setup. Introduction to Sketch, Data Types, Operators, Control Statements, Arrays, String, Common Functions and Libraries.

Text Books:

- ✓ *Introduction to IoT by S Mishra, A. Mukharjee, & A. Roy, Cambridge University Press.*
- ✓ *Internet of Things: A hands-on approach by A. Bahga & V. Madisetti, University Press.*

Reference Books:

- ✓ *The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)*

- ✓ *D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry; IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1st Edition, Pearson India Pvt. Ltd., 2018.*

Lab: Using Arduino

1. Introduction to IoTs.
2. Introduction to Arduino.
3. Controlling the Light Emitting Diode (BLINKING LED) using Arduino.
4. Interfacing of the PIR sensor for motion detection using Arduino.
5. Design of Traffic simulator using Arduino.
6. Interfacing the RGB LED with the Arduino.
7. Controlling the LED blink rate with the potentiometer interfacing with Arduino.
8. Interfacing of temperature sensor LM35 with Arduino.
9. Interfacing Servo Motor using Arduino.
10. Interfacing of the Active Buzzer using Arduino.
11. Interfacing of the Ultrasonic Sensor using Arduino.
12. Interfacing of the IR remote sensor for home automation using Arduino.
13. Fire alarm system by interfacing Arduino with gas sensor.
14. Design of Electronic voting machine using Arduino.

Using 8085 Microprocessor/8051 Microcontroller:

1. Program to add two 8-bit numbers.
2. Program to subtract two 8-bit numbers.
3. Program to find 1's and 2's Complement of 8-bit number.
4. Program to find 1's and 2's Complement of 16-bit number.
5. Program to find smaller among two numbers.
6. Program to find larger among two numbers.

DSE 303	Digital Image Processing	3L : 0T : 4P	5 Credits
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Course Objectives:

- Define digital image processing systems, representation models, sampling, and quantization.
- Perform basic pixel operations and handle image data structures.
- Implement spatial domain methods like point processing, intensity transformations, and histograms.
- Apply spatial and frequency domain filters (such as low-pass and high-pass filters) to improve visual quality.
- Identify sources of image degradation and apply restoration algorithms (e.g., inverse and Wiener filtering).

UNIT-I

Introduction to digital image – Digital image, Image acquisition, Digitization of images (Sampling and Quantization), Types of images, Image Characteristics (Brightness, luminance, contrast, intensity), Image resolution

Image Transformation - Definition of 1-D and 2-D signals, Orthogonal and Unitary transforms of 2-D signals, Properties of Unitary Transforms

UNIT-II

Image enhancement in spatial domain - Point operations, Contrast stretching, Clipping and thresholding,

Image Filtering Operations in spatial domain - Spatial averaging, Spatial low pass filtering, Spatial high pass filtering, Median filtering, Min, Max filtering,

Histogram modelling: Histogram equalization, Histogram specification. Digital Negative.

UNIT-III

Image Filtering Operations in frequency domain – Types of frequency domain filter, Smoothing filters, Ideal Low Pass Filters (ILPF), Properties of ILPF, Ringing.

Computer Vision: Concept, Applications of Computer Vision, **Object Detection Using Image Processing**, Image Recognition.

Colour Models: The RGB model, The CMY and CMYK Colour Model, The HIS model.

UNIT-IV

Transformation Techniques - Transformations in the Frequency domain (DCT), Discrete Fourier Transform, Discrete Cosine Transform.

2D Transformation: Translation, Rotation, Reflection, Scaling and shearing about origin and any other pivot point. Homogeneous coordinate.

Text Books:

- Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods
- Image Processing, Analysis, and Machine Vision by Milan Sonka, Vaclav Hlavac,
- Digital Image Processing: An Algorithmic Introduction by Wilhelm Burger and Mark J. Burge.

Lab: Digital Image Processing

1. To study the image processing concept.
2. To analyse spatial resolution of images using MATLAB.
3. To perform intensity transformation of images using MATLAB.
4. To perform image sampling and quantization using MATLAB.
5. Image Simulation(Binary & Gray Scale):
 - a) Display of an image, Negative of an image
 - b) Complement, Converting and Simulation of an image.
6. Implementation of relationships between Pixels:
 - a) Neighbour of 4 point,
 - b) Neighbour of 8 point and
 - c) Neighbour of Diagonal point
7. Implementation of transformations of an image: Scaling & Rotation.
8. Display the color image and its resized images by different methods:
 - a) Display the color image
 - b) Display resized image by Bilinear method
 - c) Display resized image by Nearest method
 - d) Display resized image by Bicubic method
9. Contrast stretching of a low contrast image, Histogram, and Histogram equalization:
 - a) Image Enhancement (Original image, grayimage, enhanced image)
 - b) Histogram of Gray image and Histogram of equalized image.
10. To Implement smoothing or averaging filter in spatial domain.
11. Implementation of image intensity slicing technique for image enhancement.
12. To perform image enhancement by spatial filtering (Average, Gaussian, Laplacian).
13. To detect edges in an image (Edge detection algorithm) by sobel operator and canny operator.
14. To detect lines in the images using MATLAB (Horizontal lines, vertical lines).
15. To detect points in an image.
16. Perform morphological operation: erosion and dilation.
17. Program for opening and closing of the image.
18. To perform analysis of images with different color models.

SEC 301	Quantitative Techniques	2L : 0T : 0P	2 Credits
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Course Objectives

CO1: To provide students with a thorough understanding of various quantitative technique concepts.

CO2: To Develop a strong foundation in the number system, percentages, and ratios and proportions.

CO3: Understand and apply the concepts of coding-decoding, and number series.

CO4: To Solve problems related to averages, ratio and proportion.

CO5: To Enhance their geometrical skills.

Unit – 1:

Whole numbers, Integers, Rational and irrational numbers, Fractions, Square roots and Cube roots, Surds and Indices, Problems on Numbers, Divisibility, Steps of Long Division Method for Finding Square Roots

Unit -2:

Basic concepts, Different formulae of Percentage, Profit and Loss, Discount, Simple interest, Ratio and Proportion, Mixture, Time and Work, Basic concepts of Time, Distance and Speed

Unit – 3:

Concept of Angles, Different Polygons like triangles, rectangle, square, right angled triangle, Pythagorean Theorem, Perimeter and Area of Triangles, Rectangles, Circles. Bar Graphs, Pie charts, Probability.

Unit – 4:

LOGICAL REASONING: Analogy basing on kinds of relationships, Simple Analogy; Pattern and Series of Numbers, Letters, Figures. Coding-Decoding of Numbers, Letters, Symbols (Figures), Blood relations, Venn Diagrams, Mirror Images, Problems on Cubes and Dices.

Text Books:

1. Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal.
2. Logical Reasoning by S. Chand.
3. Magical Book on Quicker Maths by M. Tyra.

SEMESTER – VI

CC 301	Mathematics IV	3L : 0T : 0P	3 Credits
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Course Objectives:

- Organize, manage, graphically display, and summarize raw business data using frequency distributions, charts, and tables.
- Calculate and interpret measures of central tendency (mean, median, mode) and dispersion (variance, standard deviation, range) to evaluate data spread and business risk.
- Apply probability rules, theoretical distributions (discrete and continuous), and sampling techniques to solve uncertainty-driven business problems.

Unit I:

Data Classification and tabulation: Introduction, Classification, Function of classification, Rules of classification, Bases of classification, Frequency distribution, Types of frequency distribution (Group, ungroup and continuous). Data Tabulation, Meaning and importance, Parts of a table, Requisites of a good table.

Data Representation: Introduction, Difference between Diagrams and graphs, General rules for constructing diagram, Types of diagrams (1-Dimension and 2-dimension), Limitation of Diagrams and Graphs.

Unit-II

Linear Regression Analysis: Introduction, Linear and Non-Linear Regression, Lines of Regression, Line of Regression of Y on X, Line of Regression of X on Y, Angle between the lines of regression, Coefficient of regression, Regression analysis vs Correlation analysis, to find the mean values from two lines of regression, to find the regression coefficient from two lines of regression.

Unit-III

High Speed computation and errors: Accuracy of numbers, Chopping and rounding off numbers, ceiling and flooring of numbers, Significant figures, Errors, Types of Error, absolute error, Relative error, percentage error, truncation error.

Floating Point Arithmetic: Floating point addition, subtraction, Condition for over flow and condition for under flow, Multiplication and Division of Floating Point.

Unit-IV

Time Series: Introduction, Component of Time Series, Secular Trend, Measurement of secular Trend, Free hand method, method of semi average, method of moving average, method of least square, Seasonal variations, methods for measuring seasonal variation, Methods of simple average, ratio to trend method.

Text Books:

1. "Fundamental of Statistics" by S.C. Gupta, Himalaya Publishing House
2. "Computer Based Numerical and Statistical Technique" by Dr. Santosh Kumar.

DSE-304	Data Mining	3L : 2T : 0P	5 Credits
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Course Objectives:

- To understand Fundamentals of data mining and its different classification, Major issues in Data Mining and Data Preprocessing.
- Implementation of data warehouse and development of Data Cube Technology.
- Understanding mining Frequent Patterns, Associations and Correlations.
- To analyze different techniques of Classification and Prediction.
- The basics of Cluster Analysis.

Unit I

Data Mining Basics: Introduction, application areas in data mining, KDD process. Getting to know your data: Data Objects and attribute types. Data pre-processing: Why pre-process data? Data cleaning, data integration, data transformation and reduction. Graphical Methods for data mining exploration Classification: Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, K-Nearest Neighbors, Ensemble Methods.

Unit II

Mining frequent Patterns, Associations and Correlations: Introduction, Market Basket Analysis, Frequent Item-set Generation using Apriori algorithm, Rule generation. Alternative Methods for Generating Frequent Item sets using FP-Growth Algorithm, Evaluation of Association Patterns. From association analysis to correlation analysis.

Unit III

Data Warehousing: Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata, reporting, Query tools and Applications, Online Analytical Processing (OLAP), OLTP and Multidimensional Data Analysis, Data Cube, Efficient Methods for Data Cube Computation, Data Generalization by Attribute-Oriented Induction

Unit IV

Clustering: Overview, K-Means, K Medoid, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms. Visualizing Clusters: Dendrogram, Tree Maps, Rectangle Plots, Data image. Advanced Techniques: Text Mining, Extracting Attributes, Structural Approaches. Bayesian Approach to Classifying Text. Web Mining, Classifying Web Pages, Extracting Knowledge from Web.

Texts Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques, Elsevier, Third Edition, 2011.
2. Wendy L. Martinez, Angel R. Martinez and Jeffrey L. Solka, Exploratory Data Analysis with Matlab, CRC Press (Taylor & Francis Group), Second Edition, 2010.

DSE 305	Cyber security	3L : 2T : 0P	5 Credits
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Course Objectives:

- To understand the growing importance of cyber security.
- To understand the use of crypto systems.
- To learn about various security issues and cyber crimes

Unit I:

Introduction: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles. Confidentiality, Integrity, Availability, Computer Criminals, Motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit II:

Cryptography: History and development of Cryptography. Substitution and affine ciphers, Transpositions Cipher, Confusion, diffusion, Symmetric, Asymmetric Encryption. DES, Modes of DES, Uses of Encryption, Hash function, key exchange, Digital Signatures, Digital Certificates.

Unit III:

Software Security: Types of Malicious Software, Advanced Persistent Threat, Propagation, Infected Content - Viruses, Propagation, Vulnerability Exploit - Worms, Propagation, Social Engineering, SPAM E-Mail, Trojans, Payload, System Corruption, Attack Agent, Zombie, Bots, Information Theft, Keyloggers, Phishing, Spyware, Stealthing, Backdoors, Rootkits, Countermeasures.

Network Security: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Overview of Intrusion Detection, Honeypots, The Need for Firewalls

Unit IV:

Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.

Text Books:

- ✓ *C. P. Pfleeger, S. L. Pfleeger; Security in Computing, Prentice Hall of India, 2006*
- ✓ *W. Stallings, L. Brown, Computer Security: Principles and Practice, 4th edition, Pearson Education, 2018.*
- ✓ *Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley*

AEC-301	Soft Skills	2L:0T:0P	2Credits
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Course Objectives:

- **Master Communication:** Learn to express ideas clearly, write professionally, and practice active listening during discussions.
- **Enhance Problem-Solving:** Cultivate critical thinking to analyze complex situations and generate practical solutions.
- **Improve Teamwork:** Build the ability to collaborate respectfully with diverse teams and manage conflicts constructively.
- **Develop Emotional Intelligence:** Recognize and manage personal emotions while showing empathy toward colleagues.
- **Boost Time Management:** Prioritize daily tasks effectively to increase productivity and reduce workplace stress.

Unit I:

Introduction & Self-Discovery (Foundational): Introduction & Self-Discovery (Foundational) Meaning of soft skills, difference between hard and soft skills, and their role in career progression.

Self-Awareness: Discovering strengths, weaknesses, values, and beliefs.

Attitude & Mindset: Developing positive thinking, emotional resilience, and a growth mindset.

Goal Setting: Setting SMART goals (Specific, Measurable, Achievable, Relevant, Time-bound) and career planning.

Unit II:

Communication Skills

LSRW Approach: Basics of Listening, Speaking, Reading, and Writing.

Verbal & Non-Verbal: Body language, facial expressions, eye contact, and paralanguage.

Active Listening: Hearing vs. listening, overcoming listening barriers.

Business Writing: Email etiquette, memo drafting, report writing, and professional correspondence.

Public Speaking: Overcoming stage fear, speech delivery, and structuring presentations. [

Unit III:

Interpersonal Skills & Teamwork

Relationship Building: Empathy, rapport building, and respect for cultural diversity.

Team Dynamics: Roles and responsibilities in effective teams, collaboration, and synergy.

Conflict Management: Identifying friction, negotiation skills, and finding win-win solutions.

Networking: Professional networking and maintaining workplace relationships.

Unit IV:

Emotional Intelligence (EQ) & Self-Management

Managing Emotions: Self-regulation, impulse control, and stress management techniques.

Empathy: Understanding and validating peers' and clients' emotions.

Adaptability: Embracing change, flexibility, and coping with uncertainty.

Analytical Skills: Identifying root causes of workplace challenges.

Career & Interview Skills

Resume/CV Writing: Crafting professional resumes and cover letters.

Group Discussions (GD): Rules, strategies, dos and don'ts, and mock GD sessions.

Interview Preparation: Handling technical/HR rounds, non-verbal cues during interviews, and mock interviews

Text Books

- Soft Skills by Soma Mahesh Kumar (McGraw Hill)
- Text Book of Soft Skills by Paul Martin and Kavita Krishnamurthi (Global Vision Publishing House)