

**Curriculum for UG Degree in Bachelor in Computer Applications  
BCA/BCA (Honours)/ BCA (Honours with Research) and Specialization  
in  
(i) AI & ML  
(ii) Data Science**

**(Based on AICTE Curriculum and Credit Framework for BCA Program and Formative  
Assessment Guidelines under NEP-2020)**



**With Effect From the session 2025-26**

**MAHARSHI DAYANAND UNIVERSITY  
ROHTAK (HARYANA)**

**GENERAL COURSE  
STRUCTURE  
&  
CREDIT DISTRIBUTION**

## GENERAL COURSE STRUCTURE & THEME

### 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

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

### Course Level/Duration/System:

Undergraduate / Three or Four years/6 or 8 Semesters with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:

- a. **One year:** Under Graduate Certificate in Computer Application
- b. **Two years:** Under Graduate Diploma in Computer Application
- c. **Three years:** Bachelor in Computer Application (BCA)
- d. **Four years:** Bachelor in Computer Application with Honours: BCA (Honours) or Bachelor in Computer Application Honours with Research: BCA (Honours with Research)

### Minimum Eligibility Criteria:

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

1. **BCA (Honours with Research):** BCA Degree
2. **For BCA (Honours):** BCA Degree

Note: The students who are eligible for BCA (Honours with Research) shall have choice to pursue either BCA (Honours) or BCA (Honours with Research).

## SEMESTER WISE CREDIT DISTRIBUTION:

SEMESTER WISE CREDIT DISTRIBUTION OF PROPOSED BCA [BCA (HONOURS) AND BCA (HONOURS WITH RESEARCH)] PROGRAM:

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)							
VII	5	0	3	0	4	8	20
VIII					8	12	20
BCA (Honours with Research)							
VII	12					8	20
VIII	20						20

### Category-wise distribution\*

Description	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective course	Value added Courses	Skill Enhancement courses	Discipline Specific Elective	Total
BCA	50	3	2	6	28	31	120
BCA (Honours)	55	3	5	6	40	51	160
BCA (Honours with Research)	82	3	2	6	28	39	160
<b>3 Years BCA Program</b>					<b>Total Credits = 120</b>		
<b>4 Years BCA (Honours) and BCA (Honours with Research)</b>					<b>Total Credits = 160</b>		

Note: Students can take extra credit course from their own department or from other department as per the Admitting Body / University norms.

## INDUCTION PROGRAM

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal, (Link:<https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf>). For more, Refer **Appendix III.**

<b>Induction program (mandatory)</b>	<b>Three-week duration</b>
Induction program for students to be offered right at the start of the first year.	<ul style="list-style-type: none"> <li>• Physical activity</li> <li>• Creative Arts</li> <li>• Universal Human Values</li> <li>• Literary</li> <li>• Proficiency Modules</li> <li>• Lectures by Eminent People</li> <li>• Visits to local Areas</li> <li>• Familiarization to Department/Branch &amp; Innovations</li> </ul>

**Mandatory Visits/ Workshop/Expert Lectures:**

1. It is mandatory to arrange one industrial visit every semester for the students of each branch.
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 for each branch by inviting resource persons from domain specific industry.

**For Summer Internship / Projects / Seminar etc.**

1. Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

**Note:** *The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc.*

## Semester wise Structure and Curriculum for UG Course in BCA

### SEMESTER I

S. No.	Course Code	University Nomenclature Course Code	Course Title	L	T	P	Credit
<b>3 WEEKS COMPULSORY INDUCTION PROGRAM (UHV-I)</b>							
1	CC101	25BCA401DS01	Mathematics Foundations to Computer Science - I	3	0	0	3
2	SEC101	25BCA401SEC01	Problem Solving Techniques	3	0	4	5
3	CC102	25BCA401DS02	Computer Architecture	3	0	4	5
4	AEC101	25ENGX01AE01	General English - I	1	1	0	2
5	MDE101	25SOCX01MD01	Indian Knowledge System	2	0	0	2
6	VAC101	25CSAX01VA01	Environmental Science and sustainability	2	0	0	2
7	AEC102	25HNDX01AE01 or 25SKTX01AE01	Additional Course - Indian or Foreign Language Other than Mother Tongue and English (1-1- 0) [optional course]*	1	1	0	0*
<b>TOTAL</b>							<b>19</b>

**Note:**

**L T P** shown in all the tables of the scheme against the courses are w.r.t. the Workload for the semester.

^Indian Knowledge System: Indian Culture and Civilization Indian Vision for Human Society Indian Science Indian Town Planning and Architecture Indian Mathematics and Astronomy Indian Aesthetics Indian Health, Wellness

\*Indian Languages: Sanskrit/Hindi/All Regional languages

Foreign Languages: (not limited to) Spanish/German/French/Korean/Mandarin etc.

### SEMESTER II

S. No.	Course Code	University Nomenclature Course Code	Course Title	L	T	P	Credit
1	CC103	25BCA402DS01	Mathematics Foundations to Computer Science - II	3	0	0	3
2	CC104	25BCA402DS02	Data Structures	3	0	4	5
3	CC105	25BCA402DS03	Operating Systems	3	0	2	4

4	SEC102	25BCA402SEC01	Object Oriented Programming using Java	3	0	4	5
5	SEC103	25BCA402SEC02	Web Technologies	1	0	2	2
6	VAC102	25EVSX01AC01	Indian Constitution	2	0	0	2
7	AEC103	25HNDX02AE01 or 25SKTX02AE01	Additional Course - Indian or Foreign Language Other than Mother Tongue and English (1-1- 0)) [optional course]*	1	1	0	0*
<b>TOTAL</b>							<b>21</b>

\*Indian Languages: Sanskrit/Hindi/All Regional languages

Foreign Languages: (not limited to) Spanish/German/French/Korean/Mandarin etc.

**After Year 1, Students are advised to take Social Responsibility & Community Engagement - encompassing Community Engagement with an NGO in the vacation time.**

An UNDER GRADUATE CERTIFICATE IN COMPUTER APPLICATION will be awarded, if a student wishes to exit at the end of First year.

#### 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 respective **University/Admitting Body**, and students will be required to complete the 08-week program during the summer term following their second semester.

The exiting students will clear the subject / submit the Internship Report as per the University schedule.

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

1	III	DSE*201	26BCA403DSE21	Feature Engineering
2	IV	DSE*202	26BCA404DSE21	Introduction to ML
3	V	DSE301	27BCA405DSE21	Neural Network
4	V	DSE302	27BCA405DSE22	Digital Image Processing
5	V	DSE303	27BCA405DSE23	Natural Language Processing
6	VI	DSE304	27BCA406DSE21	Deep Learning for Computer Vision
7	VI	DSE305	27BCA406DSE22	Predictive Analysis
8	VII	DSE401	28BCA407DSE21	Explainable AI
9	VII	DSE402	28BCA407DSE22	Evolutionary Algorithm
10	VIII	DSE403	28BCA408DSE21	Speech Recognition
11	VIII	DSE404	28BCA408DSE22	Augmented Reality & Virtual Reality
12	VIII	DSE405	28BCA408DSE23	Security aspects of ML

**SUMMATIVE ASSESSMENT**  
**For Core Courses and Discipline Specific Elective Courses**

**For three credits of theory and two credit of practical (3:0:2)**

		Marks Distribution
Theory	Internal	25
	External	50
Practical		50
<b>Total</b>		125

**For three credits of theory and one credit of practical (3:0:1)**

		Marks Distribution
Theory	Internal	25
	External	50
Practical		25
<b>Total</b>		100

**For three credits of theory (3:0:0)**

		Marks Distribution
Theory	Internal	25
	External	50
Practical		0
<b>Total</b>		75

**For two credits of theory and two credits of tutorial (2:2:0)**

		Marks Distribution
Theory	Internal	50
	External	50
Practical		0
<b>Total</b>		100

**For two credits of theory and two credits of practical (2:0:2)**

		Marks Distribution
Theory	Internal	15
	External	35
Practical		50
<b>Total</b>		100

**For two credits of tutorial and two credits of practical (0:2:2)**

		Marks Distribution
Theory	Internal	50
	External	0
Practical		50
<b>Total</b>		100

**For one credit of theory and one credit of tutorial (2:0:0)**

		Marks Distribution
Theory	Internal	15
	External	35
Practical		0
<b>Total</b>		50

**For one credit of theory and two credit of practical (1:0:2)**

		Marks Distribution
Theory	Internal	5
	External	20
Practical		50
<b>Total</b>		75

**For one credit of theory and one credit of tutorial (1:1:0)**

		Marks Distribution
Theory	Internal	25
	External	25
Practical		0
<b>Total</b>		50

**Evaluation Scheme for Practical/Lab Examination: 25 Marks**

		Marks Distribution
Program 1	Flowchart/Algorithm	01
	Writing Program	01
	Execution and Program Format	02
Program 2	Flowchart/Algorithm	01
	Writing Program	01
	Execution and Program Format	02
Viva Voce		07
Practical File*		05
Attendance*		05
Total		25

**\*: Marks to be provided by the Internal Teacher**

**Evaluation Scheme for Practical/Lab Examination: 50 Marks**

		Marks Distribution
Program 1	Flowchart/Algorithm	02
	Writing Program	03
	Execution and Program Format	05
Program 2	Flowchart/Algorithm	02
	Writing Program	03
	Execution and Program Format	05
Viva Voce		20
Practical File*		05
Attendance*		05
Total		50

**\*: Marks to be provided by the Internal Teacher**

## FORMATIVE ASSESSMENT

### For Skill Enhancement Course

#### For two credits of theory and one credit of practical (2:0:1)

	Marks distribution
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

#### For three credits theory (3:0:0)

	Marks distribution
Written test (2 X 10)	20
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

#### For three credits practical (0:0:3)

	Marks distribution
Regular assessment through observation and class discussion	10
Lab work (practical file) / Field work (report)/Portfolio	30
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

#### For four credits practical (0:0:4)

	Marks distribution
Regular assessment through observation and class discussion	15
Lab work (practical file) / field work (report)/Portfolio	30
Case study / Mini project (2 X 15)	30
Assignment/Seminar / Presentation (2 X 10)	20
Attendance	05
<b>Total</b>	<b>100</b>

**For two credits of theory and two credits of practical (2:0:2)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
<b>Total</b>	<b>100</b>

**For one credit theory and three credits practical (1:0:3)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
<b>Total</b>	<b>100</b>

**For two credits practical (0:0:2)**

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	10
Lab work (practical file)/Field work (Report)/Mini project	20
Seminar/Presentation (2 X 7.5)	15
Attendance	05
<b>Total</b>	<b>50</b>

**For three credits theory and two credits practical (3:0:2)**

	<b>Marks distribution</b>
Regular Assessment through observation and class discussion	25
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
<b>Total</b>	<b>125</b>

**For two credits tutorial (0:2:0)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	05
Attendance	05

<b>Total</b>	<b>50</b>
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**For two credits theory and one credit practical (2:0:1)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

**For three credits theory (3:0:0)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
MCQs/ Quizzes/ Group Discussion (2 X 10)	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

**For three credits practical (0:0:3)**

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	10
Lab work (practical file) / Field work (report)/Portfolio	30
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

**For four credits practical (0:0:4)**

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	15
Lab work (practical file) / field work (report)/Portfolio	30
Case study / Mini project (2 X 15)	30
Assignment/Seminar / Presentation (2 X 10)	20
Attendance	05
<b>Total</b>	<b>100</b>

**For two credits theory and two credits practical (2:0:2)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
<b>Total</b>	<b>100</b>

**For one credit theory and three credits practical (1:0:3)**

	<b>Marks distribution</b>
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/ Portfolio	30
Case study / Mini project (1 X 15)	15
Assignment/Seminar / Presentation (3 X 10)	30
Attendance	05
<b>Total</b>	<b>100</b>

**For two credits practical (0:0:2)**

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	10
Lab work (practical file)/Field work (Report)/Mini project	20
Seminar/Presentation (2 X 7.5)	15
Attendance	05
<b>Total</b>	<b>50</b>

## Formative Assessment Model For Ability Enhancement Course

### For two credits theory (2:0:0)

	Marks distribution
Written test (2 X 5)	10
Peer discussion / Debate / Extempore speech (2X 10)	20
Role play	05
Essay / Article / Report writing	10
Attendance	05
<b>Total</b>	<b>50</b>

### For one credit theory and one credit tutorial (1:1:0)

	Marks distribution
Written test (2 X 5)	10
Peer discussion / Debate / Extempore speech (2X 10)	20
Role play	05
Essay / Article / Report writing	10
Attendance	05
<b>Total</b>	<b>50</b>

### For one credit tutorial (0:1:0)

	Marks distribution
Written test (2 X 5)	10
Peer discussion / Debate / Extempore speech (2X 10)	05
Essay / Article / Report writing	05
Attendance	05
<b>Total</b>	<b>25</b>

## Formative Assessment Model For Value Added Course

### For two credits theory (2:0:0)

	Marks distribution
Written test (2 X 10)	20
Class assignments / Case study / Mini project (2 X 5)	10
Quiz / seminar / Group discussion / Debate / QM profile (2 X 7.5)	15
Attendance	05
<b>Total</b>	<b>50</b>

**For two credits practical (0:0:2)**

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	20
Field work (Report)/Mini project	15
Assignment (2 X 5)	10
Attendance	05
<b>Total</b>	<b>50</b>

## Formative Assessment Models For Multidisciplinary Course

### For three credits theory (3:0:0)

	<b>Marks distribution</b>
Written test (2 X 10)	20
Class assignments / Case study / Mini project (2 X 10)	20
Book review / Essay / Seminar (1 X 10)	10
Quiz / Group discussion / Debate (2 X 10)	20
Attendance	05
<b>Total</b>	<b>75</b>

### For two credits theory and one credit practical (2:0:1)

	<b>Marks distribution</b>
Written test (2 X 10)	20
Lab work (practical file) / Field work (report)/Portfolio	20
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

### For three credits practical (0:0:3)

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	10
Lab work (practical file) / field work (report)/Portfolio	30
Assignment/Case study / Mini project (2 X 10)	20
Seminar / Presentation	10
Attendance	05
<b>Total</b>	<b>75</b>

### For two credits theory (2:0:0)

	<b>Marks distribution</b>
Written test (2 X 10)	20
Class assignments / Case study / Mini project (2 X 5)	10
Quiz / seminar / Group discussion / Debate / QM profile (2 X 7.5)	15
Attendance	05
<b>Total</b>	<b>50</b>

**Formative Assessment Model**  
**For UG/PG 4 Credit Practical Courses**

**For four credits of practical (0:0:4)**

	<b>Marks distribution</b>
Regular assessment through observation and class discussion	20
Lab work (practical file) / field work (report)/Portfolio	30
Assignment/Case study / Mini project (3 X 10)	30
Seminar / Presentation (2 X 7.5)	15
Attendance	05
<b>Total</b>	<b>100</b>

# **SEMESTER –I**

**SEMESTER –I**  
**Mathematics Foundation to Computer Science - I**

<b>CC101</b>	<b>25BCA401DS01</b>	<b>Mathematics Foundation to Computer Science - I</b>	<b>3L:0T:0P</b>	<b>3 Credits</b>
<p><b>Note:</b> The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.</p>				

**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 mathematical principles give a succinct abstraction of computer science problems and help them to analyze them efficiently.

**Course Content:**

**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, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, 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.

Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

**UNIT II: Counting and Recurrence Relation:**

Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem.

Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. 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, digraphs, weighted graphs, Euler and Hamiltonian graphs.

Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

**UNIT IV: Matrix Algebra:**

Types of matrices, algebra of matrices—addition, subtraction, and 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 values and Eigen vectors, 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

### Web Resources

1. <https://nptel.ac.in/courses/106103205>
2. <https://nptel.ac.in/courses/111101115>

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### Problem Solving Techniques

<b>SEC101</b>	<b>25BCA401SEC01</b>	<b>Problem Solving Techniques</b>	<b>3L:0T:4P</b>	<b>5 Credits</b>
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### Course Objectives

CO1: Understand basic terminology of computers, problem solving, programming Languages and their evolution (Understand)

CO2: Create specification from problem requirements by asking questions to disambiguate the requirement statement. (Create)

CO3: Design the solution from specification of a problem and write pseudo code of the algorithm using basic building blocks or structured programming constructs (Sequence, Selection and Repetition statement). (Create)

CO4: Translate an algorithm into a C computer program (Create)

CO5: Testing and analysing programs using debugging tools. (Analyze)

**Prerequisite:** This is an introductory programming course and hence no prerequisites

### Course Content:

#### UNIT I: (CO-1, CO-2)

Problems And Problem Instances, Generalization and Special Cases, Types of Computational Problems, Classification of Problems, Analysis of Problems, Solution Approaches, Algorithm

Development, Analysis of Algorithm, Efficiency, Correctness, Role of Data Structures in Problem Solving, Problem-Solving Steps (Understand the Problem, Plan, Execute, And Review), Breaking the Problem into Subproblems, Input/Output Specification, Input Validation, Pre and Post Conditions.

### **UNIT II: (CO-2, CO-3, CO-4)**

Structured Programming Concepts: Sequence (Input/Output/Assignment), Selection (If, If-Else) And Repetition (For, While, Do-While) Statements, Control Structure Stacking and Nesting.

Different Kinds of Repetitions: Entry Controlled, Exit Controlled, Counter Controlled, Definite, Indefinite and Sentinel-Controlled Repetitions. Pseudocode and Flowcharts. Definition And

Characteristics of Algorithms, Standard Algorithm Format. Problems Involving Iteration and Nesting: Displaying Different Patterns and Shapes Using Symbols and Numbers, Generating Arithmetic and Geometric Progression, Fibonacci and Other Sequences, Approximate Values For  $\pi$ ,  $\sin(x)$ ,  $\cos(x)$ , Etc. Using Taylor Series. Different Kinds of Data in The Real World and How They are Represented in The Computer Memory. Representation of Integers: Signed Magnitude Form, 1's Complement And 2's Complement. Representation of Real Numbers: IEEE 754 Floating Point Representation. Representation of Characters: ASCII, UNICODE.

C Language: Introduction To Programming Languages, Different Generations of Programming Languages. Typed Vs Typeless Programming Languages, History of C Language, An Empty C Program. C Language Counterparts For Input (scanf()), Output (printf()) Statements, Assignment, Arithmetic, Relational and Logical Operators. If, If-Else Statements, For, While, Do-While Statements. Data Types. Translating Pseudocode/Algorithm to C Program. Incremental Compilation and Testing of The C Program. Simple Problems Involving Input, Output, Assignment Statement, Selection and Repetition. Good Coding Practices.

### **UNIT III: (CO-2, CO-3, CO-4)**

Problems on Numbers: Extracting Digits of a Number (Left to Right and Right to Left), Palindrome, Prime Number, Prime Factors, Amicable Number, Perfect Number, Armstrong Number, Factorial, Converting Number from One Base to Another. Statistics (Maximum, Minimum, Sum and Average) on a Sequence of Numbers which are Read using SentinelControlled Repetition using only a few Variables.

C Language: else-if Ladder, switch Case, Increment/Decrement Operators, break and continue Statements.

### **UNIT IV: (CO-2, CO-3, CO-4, CO-5)**

Modular Programming, Top-Down and Bottom-Up Approaches to Problem Solving. Recursion.

Problems on Arrays: Reading and Writing of Array Elements, Maximum, Minimum, Sum, Average, Median and Mode. Sequential And Binary Search. Any one Sorting Algorithm. Matrix Operations.

C Language: Function Definition and Declaration (Prototype), Role of Return Statement, One Dimensional and Two-Dimensional Arrays. String Functions. Other Operators, Operator Precedence and Associativity. Debugging.

### **Text Books**

1. Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
2. AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
3. Harvey Deitel and Paul Deitel, C How to Program, 9<sup>th</sup> edition, Pearson India, 2015.
4. R G Dromey, How to Solve It by Computer.

**Reference Books**

1. Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2<sup>nd</sup> edition, Pearson, 2015.
2. Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, 8<sup>th</sup> edition, Pearson, 2015.

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**Problem Solving Techniques: Lab Problems**

**UNIT-II**

1. Converting degrees Celsius to Fahrenheit and vice versa?
2. Display three input numbers in sorted (non-decreasing) order?
3. Given a positive integer value n ( $\geq 0$ ) display number, square and cube of numbers from 1 to n in a tabular format?
4. Given an input positive integer number, display odd numbers from in the range [1,n]?
5. Display first mathematical tables, each table up to 10 rows? Generalise this to display first n ( $> 0$ ) mathematical tables up to m ( $m > 0$ ) rows?
6. Display following patterns of n rows ( $n > 0$ ), For the below examples n = 5? For each pattern write a separate algorithm/program?

\$	\$	12345	12345
\$\$	\$\$	1234	1234
\$\$\$	\$\$\$	123	123
\$\$\$\$	\$\$\$\$	12	12
\$\$\$\$\$	\$\$\$\$\$	1	1

7. Display the following patterns of n rows ( $n > 0$ ), for the below examples n = 5?



validated before converting to make sure the number uses only digits allowed in the input base?

12. Write a program to display a number in text form. For example If the number is 5432 the output should be “FIVE FOUR THREE TWO”?
13. Using the grading scheme described in the question 4 (UNIT III), Compute how many students awarded each grade and display the frequency as a bar chart (horizontal) using single “\*” for each student. Use sentinel controlled repetition (-1 as sentinel value) in reading the students marks. Use else-if ladder/switch case to compute the grade and the corresponding frequency.

Sample bar chart when the class has 7-A, 10-B, 3-C, 7-D and 1-F grades.

A:  
\*\*\*\*\*

B:  
\*\*\*\*\*

C: \*\*\* D:  
\*\*\*\*\*

F: \*

14. Compute maximum, minimum, sum and average of a sequence of numbers which are read using sentinel controlled repetition using only few variables?
15. Compute body mass index,  $BMI = \frac{\text{weightinKGs}}{(\text{HeightinMeters})^2}$ , Both weight and height values are positive real numbers. Your program should display BMI value followed by whether the person is Underweight, Normal, Overweight or Obese using the below ranges:

BMI Values

Underweight: less than 18.5

Normal:  $\geq 18.5$  and  $< 25$

Overweight:  $\geq 25$  and  $< 30$

Obese:  $\geq 30$

## UNIT IV

1. Design a modularized algorithm/program to check if a given positive integer number is a circular prime or not?
2. Design a modularized algorithm/program to compute a maximum of 8 numbers?
3. Design a modular algorithm/program which reads an array of n integer elements and outputs mean (average), range (max-min) and mode (most frequent elements)?
4. Design a modular algorithm/program which reads an array of n integer elements and outputs median?
5. Implement your own string length and string reversal functions?
6. Design algorithm/program to perform matrix operations addition, subtraction and transpose?
7. Write a recursive program to count the number of digits of a positive integer number?
8. Recursive solutions for the following problems:
  - a. Factorial of a number?
  - b. Display digits of a number from left to right (and right to left)?

- c. Compute  $x^y$  using only multiplication?
- d. To print a sequence of numbers entered using sentinel controlled repetition in reverse order?

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### Computer Architecture

<b>CC102</b>	<b>25BCA401DS02</b>	<b>Computer Architecture</b>	<b>3L:0T:4P</b>	<b>5 Credits</b>
<p><b>Note:</b> The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.</p>				

#### 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.

#### Course Content:

##### UNIT-I

**Digital Principles:** Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, 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.

**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, ASCII, EBCDIC, Excess3 Code, The Gray Code.

##### 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.

**Register:** 4 bit register with parallel load, 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, InputOutput 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,2011Edition.
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,
- 3 M.V .Subramanyam, “Switching Theory and Logic Design”, Laxmi Publications (P) Ltd.
- 4Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.

#### **Suggestive Laboratory Experiments:**

1. Verify logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2. To study and verify NAND as a Universal Gate
3. To verify De- Morgan’s theorem for 2 variables
4. Design and test of an S-R flip-flop using NAND/NOR gate.
5. Convert BCD to Excess-3 code using NAND gate
6. To Convert Binary to Grey Code
7. Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate
8. Realize Decoder and Encoder circuit using Basic Gates.
9. Design and implement the 4:1 MUX using gates.
10. Implementation of 4-Bit Parallel Adder Using 7483 IC.
11. Design and verify operation of half adder and full adder.
12. Design and verify operation of half subtractor.
13. Design and Implement a 4 bit shift register using Flip flops.
14. Implement Boolean function using logic gates in both SOP and POS
15. Design and Implement a 4 bit synchronous counter.
16. Design and verify 4 bit asynchronous counter.

## 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. Identify and Troubleshoot the problems of RAM, SMPS and motherboard
4. Configure BIOS settings- disable and enable USB and LAN 5.Adding additional RAM to the system.(expanding RAM size).
6. To Study mother board layout of a system.
7. Demonstrate the assembly of a PC
8. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse) ,USB, LAN, Speaker, Audio.
9. Install and configure windows OS
10. To study the installation of Printer and trouble shooting.

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### General English – I

AEC 101	25ENGX01AE01	General English - I	1L:1T:0P	2 Credits
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### Course Objective:

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

### Course Content:

#### Unit- I: Vocabulary Building and Basic Writing Skills

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.

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- II: Identifying Common Errors in Writing

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

### Unit- III: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.

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations.

#### Text/Reference Books:

1. AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
7. 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

**Course Outcomes:** The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills

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#### Indian Knowledge System

MDE 101	25SOCX01MD01	Indian Knowledge System	2L:0T:0P	2 Credits
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\*For Detailed Course Refer APPENDIX – II

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**Environmental Science and Sustainability**

<b>VAC 101</b>	<b>25CSAX01VA01</b>	<b>Environmental Science and Sustainability</b>	<b>2L:0T:0P</b>	<b>2 Credits</b>
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**Course description:**

This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. The course content is divided into four comprehensive units. Unit 1 introduces basic environmental principles, the man-environment relationship, and sustainability issues.

Unit 2 focuses on ecosystems, biodiversity, and sustainable practices.

Unit 3 addresses environmental pollution, waste management, and sustainable development strategies. Finally,

Unit 4 explores social issues, environmental legislation, and practical applications through hands-on fieldwork. Through this holistic approach, students will gain a deep understanding of environmental processes, the importance of sustainable practices, and their role in promoting sustainability within business contexts.

**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.

**Course Content:**

**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.

### **Readings:**

#### **Text Books (Latest Editions):**

- Poonia, M.P. *Environmental Studies* (3<sup>rd</sup> ed.), Khanna Book Publishing Co.
- Bharucha, E. *Textbook of Environmental Studies* (3<sup>rd</sup> 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* (4<sup>th</sup> ed.). Oxford University Press.
- Miller, G.T. & Spoolman S. *Living in the Environment*. (20<sup>th</sup> 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* (13<sup>th</sup> ed.). Pearson.

### **References**

#### **Web links:**

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

**Course Outcome(s):**

1. Explore the basic environmental concepts and issues relevant to the business and management field.
2. Recognize the interdependence between environmental processes and socio-economic dynamics.
3. Determine the role of business decisions, policies, and actions in minimizing environmental degradation.
4. Identify possible solutions to curb environmental problems caused by managerial actions.
5. Develop skills to address immediate environmental concerns through changes in business operations, policies, and decisions.

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# **SEMESTER –II**

## **SEMESTER –II**

### **Mathematics Foundation to Computer Science - II**

<b>CC103</b>	<b>25BCA402DS01</b>	<b>Mathematics Foundation to Computer Science - II</b>	<b>3L:0T:0P</b>	<b>3 Credits</b>
<b>Note:</b> The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.				

#### **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.

#### **Course Content:**

##### UNIT I:

##### **Logic and Methods of Proofs:**

Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF). Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.

##### UNIT II:

##### **Algebraic Structures:**

Semi-group, Monoid, Group, Subgroup, Cyclic group.

##### UNIT III:

##### **Numerical Methods:**

Concept and importance of errors in 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 Only formula and problem solving for all the topics mentioned above.

##### UNIT IV:

##### **Optimization Techniques:**

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method, Duality.

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

### Web Resources

1. <https://nptel.ac.in/courses/111107127>
2. <https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf>

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## Data Structures

CC104	25BCA402DS02	Data Structures	3L:0T:4P	5 Credits
<p><b>Note:</b> The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.</p>				

### Course Objectives

CO1: Understand the fundamental concepts of Data Structures and their applications.

CO2: Develop problem-solving skills using Data Structures.

CO3: Implement Data Structures using C programming language.

Prerequisite:

1. **Programming Fundamentals:** Understanding the basic syntax and semantics of C programming language.
2. **Problem-Solving Skills:** Ability to break down a problem into smaller steps and devise a step-by-step solution and familiarity with simple algorithms.

## Course Content:

### UNIT I:

**Introduction and Overview:** Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff.

**Arrays:** Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching: Linear Search and Binary Search, Comparison of Methods. Sorting: Bubble Sort,

Selection Sort, and Insertion Sort. Two-Dimensional Arrays, Representation of Two-Dimensional Arrays in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.

### UNIT II:

**Linked Lists:** Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists: Addition of Polynomials.

**Hashing and Collision:** Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining.

### UNIT III:

**Stacks:** Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression.

**Recursion:** Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi.

**Queues:** Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.

### UNIT IV:

**Graphs:** Definition, Terminology, Representation, Traversal.

**Trees:** Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.

### Text Books

1. R.B. Patel, "Expert Data Structures with C", Khanna Book Publishing Company, 2023 (AICTE Recommended Textbook)
2. Seymour Lipschutz, "Data Structures with C", Schaum's Outlines, Tata McGraw-Hill, 2011.

3. Yashavant Kanetkar, "Data Structures Through C", 4<sup>th</sup> Edition, BPB Publications, 2022.

### Reference Books

1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.

### Web Resources

1. **GeeksforGeeks** - Data Structures Tutorial
2. **Khan Academy** - [Algorithms Course](#)

### Lab Programs:

1. Write a program for insertion and deletion operations in an array.
2. Write a program to search for an element in an array using Linear Search and Binary Search.
3. Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort.
4. Write a program to merge two arrays.
5. Write a program to add and subtract two matrices.
6. Write a program to multiply two matrices.
7. Write a program to insert an element into a Singly Linked List:
  - (a) At the beginning
  - (b) At the end
  - (c) At a specified position
8. Write a program to delete an element from a Singly Linked List:
  - (a) At the beginning
  - (b) At the end
  - (c) A specified element
9. Write a program to perform the following operations in a Doubly Linked List:
  - (a) Create
  - (b) Search for an element
10. Write a program to perform the following operations in a Circular Linked List:
  - (a) Create
  - (b) Delete an element from the end
11. Write a program to implement stack operations using an array.
12. Write a program to implement stack operations using a linked list.
13. Write a program to add two polynomials using a linked lists.
14. Write a program to evaluate a postfix expression using a stack.
15. Write a program to perform the following using recursion:
  - (a) Find the factorial of a number
  - (b) Find the GCD of two numbers
  - (c) Solve Towers of Hanoi problem
16. Write a program to implement simple queue operations using an array.
17. Write a program to implement circular queue operations using an array.
18. Write a program to implement circular queue operations using a linked list.
19. Write a program to perform the following operations on a binary search tree.

- (a) Preorder Traversal
  - (b) Inorder Traversal
  - (c) Postorder Traversal
20. Write a program to perform insertion operation in a binary search tree.

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### Operating Systems

<b>CC105</b>	<b>25BCA402DS03</b>	<b>Operating Systems</b>	<b>3L:0T:2P</b>	<b>4 Credits</b>
<p><b>Note:</b> The examiner has to set nine questions in all by setting two questions from each Unit and Question No. 1 consisting of short-answer questions covering the entire syllabus. Students must attempt five questions in all by selecting one question from each Unit and Question No. 1, which is compulsory. All questions will carry equal marks.</p>				

#### Course Content:

##### 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.

**I/O Management:** Principles of I/O Hardware: Disk structure, Disk scheduling algorithms.

**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.

**Course Outcomes (COs):**

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

CO1: Explain the fundamentals of the operating system.

CO2: Comprehend multithreaded programming, CPU scheduling, process management, process synchronization, memory, deadlocks, and storage management.

CO3: Compare the performance of CPU scheduling algorithms

CO4: Identify the features of I/O and File handling methods.

### Operating Systems LAB

**List of experiments**

1. Write C program to simulate the FCFS CPU Scheduling algorithm.
2. Write C program to simulate the SJF CPU Scheduling algorithm.
3. Write C program to simulate the Round Robin CPU Scheduling algorithm.
4. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
5. Write a C program to implement the Producer – Consumer problem using semaphores.
6. Write a C program to illustrate the IPC mechanism using Pipes.
7. Write a C program to illustrate the IPC mechanism using FIFOs.
8. Write a C program to simulate Paging memory management technique.
9. Write a C program to simulate Segmentation memory management technique.
10. Write a C program to simulate the Best Fit contiguous memory allocation technique.
11. Write a C program to simulate the First Fit contiguous memory allocation technique.
12. Write a C program to simulate the concept of Dining-Philosophers problem.
13. Write a C program to simulate the MVT algorithm.
14. Write a C program to implement FIFO page replacement technique.
15. Write a C program to write a C program for implementing sequential file allocation method.

**Course Outcomes (COs):**

CO1: To implement scheduling of algorithms.

CO2:Understanding the concept of critical section problems.  
 CO3:Concepts of file allocation of frames.  
 CO4:Concept of Page replacement algorithms.

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### Object Oriented Programming using Java

SEC102	25BCA402SEC01	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

**Prerequisite:** Knowledge of Problem Solving Techniques using C programming language

#### Course Content:

##### 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, C and C++, Java and Internet, Java Environment.

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

Text Book 1: Chapters 1, 2 and 3.

##### 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.

Text Book 1: Chapters 4, 5, 6, and 7.

### UNIT III:

**Classes, Objects and Methods:** Defining Class, Methods Declaration, Constructors, Methods

Overloading, Overriding Methods, Inheritance

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

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

Text Book 1: Chapters 8, 9, and 10.

### 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 Book 1: Chapters 11 & 13.

### Text Books

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw-Hill Education.

### Reference Books

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson, 2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, Oxford University Press, 2014.

### Web Resources

1. <https://www.w3schools.com/java/>.
2. <http://www.java2s.com/>.
3. [https://onlinecourses.nptel.ac.in/noc22\\_cs47/preview](https://onlinecourses.nptel.ac.in/noc22_cs47/preview)

### List of Practical:

1. 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.

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### Web Technologies

<b>SEC103</b>	<b>25BCA402SEC02</b>	<b>Web Technologies</b>	<b>1L:0T:2P</b>	<b>2 Credits</b>
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#### Course Objectives

- CO1:To understand the concepts and architecture of the World Wide Web, Markup languages along with Cascading Style Sheets.
- CO2:To understand the concepts of event handling and data validation mechanisms.

CO3:To understand the concepts of embedded dynamic scripting on client and server side Internet Programming and basic full stack web development.

CO4:To develop modern interactive web applications

**Prerequisite:**

1. Proficiency in at least one programming language, such as Python, Java, or C++. Understanding of programming concepts such as loops, conditionals, functions, and data structures like arrays, lists.
2. Familiarity with object-oriented programming (OOP) principles, including classes, objects, inheritance, and polymorphism.

**Course Content:**

**Unit I:**

Introduction to HTML, history of HTML, Objective, basic Structures of HTML, Header Tags, body tags, Paragraph Tags.

Tags for FORM Creation, TABLE, FORM, TEXTAREA, SELECT, IMG, IFRAME FIELDSET, ANCHOR.

Lists in HTML, Introduction to DIV tag, NAVBAR Design.

**Unit-II:**

Introduction to CSS, types, Selectors, and Responsiveness of a web page.

Introduction to Bootstrap, downloads/linking, using classes of Bootstrap, understanding the Grid System in Bootstrap.

Introduction to www, Protocols and Programs, Applications and development tools, web browsers, DNS, Web hosting Provider, Setting up of Windows/Linux/Unix web servers, Web hosting in cloud, Types of Web Hosting.

**Unit III:**

Introduction to JavaScript: Functions and Events, Document Object model traversing using JavaScript. Output System in JavaScript i.e. Alert, throughput, Input box, Console. Variables and Arrays in JavaScript.Date and String handling in JavaScript.

**Unit-IV:**

Manipulating CSS through JavaScript: Form Validation like Required validator, length validator, Pattern validator. Advanced JavaScript, Combining HTML, CSS and JavaScript events and buttons, controlling your browser.Introduction to AJAX, Purpose, advantages and disadvantages, AJAX based Web applications and alternatives of AJAX.

Introduction to XML: uses, Key concepts, DTD & schemas, XSL, XSLT,and XSL Elements and transforming with XSLT. Introduction to XHTML.

JSON: Introduction to JSON, Keys and Values, Types of Values, Arrays, Objects

**Text Books**

1. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
2. Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017

**Reference Books**

1. Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.
2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

## **Web Resources**

1. [www.javatpoint.com](http://www.javatpoint.com)
2. [www.w3schools.com](http://www.w3schools.com)
3. <https://www.geeksforgeeks.org/web-technology/>

## **Practical list of Programs:**

### **PART-A**

1. Create your class time table using table tag.
2. Design a Webpage for your college containing description of courses, department, faculties, library etc. using list tags, href tags, and anchor tags.
3. Create web page using Frame with rows and columns where we will have header frame, left frame, right frame, and status bar frame. On clicking in the left frame, information should be displayed in right frame.
4. Create Your Resume using HTML, use text, link, size, color and lists.
5. Create a Web Page of a super market using (internal CSS) 6. Use Inline CSS to format your resume that you have created.
7. Use External CSS to format your time table created.
8. Use all the CSS (inline, internal and external) to format college web page that you have created.
9. Write a HTML Program to create your college website using for mobile device.

### **PART – B**

- 1) Write an HTML/JavaScript page to create login page with validations.
- 2) Develop a Simple calculator for addition, subtraction, multiplication and division operation using JavaScript.
- 3) Use Regular Expressions for validations in Login Page using JavaScript.
- 4) Write a Program to retrieve date from a text file and displaying it using AJAX.
- 5) Create XML file to store Student Information like Register Number, Name, Mobile Number, DOB, and Email-Id.
- 6) Create a DTD for (0).
- 7) Create XML scheme for (0).
- 8) Create XSL file to convert XML file to XHTML file.
- 9) Write a JavaScript program using Switch case.
- 10) Write a JavaScript program using any 5 events.
- 11) Write a JavaScript program using built in JavaScript objects.
- 12) Write program for populating values from JSON text.
- 13) Write a program to transform JSON text to a JavaScript object.

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### Indian Constitution

VAC102	25EVSX01AC01	Indian Constitution	2L:0T:0P	2 Credits
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#### Course Content:

##### 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 and Election Commission

- District Administration
- Municipal Corporation
- Zila Panchayat
- 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

**Course Outcome(s):**

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

1. Constitutional Framework: Analyze the Indian Constitution's history, Preamble, Fundamental Rights, and basic structure.
2. Union Government Structure: Describe the roles of the President, Prime Minister, and the legislative bodies (Lok Sabha and Rajya Sabha).
3. State Government Mechanisms: Examine the powers of the Governor, Chief Minister, and the State Secretariat.
4. Local Administration: Assess the functioning of local government bodies like District Administration, Municipal Corporations, and Zila Panchayats.
5. Electoral Processes: Analyze the role of the Election Commission in conducting free and fair elections.
6. Application of Knowledge: Apply constitutional principles to contemporary political issues and evaluate governance effectiveness.

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# हिंदी भाषा संवर्धन-1

Semester I

<b>Course Code</b>	225HNDX01AE01	<b>Course Credits</b>	2 (L:T:P:) (1:1:0)
<b>Max. Marks</b>	100		

**Note:** Evaluation will be based on formative assessment.

	<b>Marks distribution</b>
Written test (2 X 10)	20
Peer discussion / Debate / Extempore speech (2X 20)	40
Role play	10
Essay / Article / Report writing	20
Attendance	10
<b>Total</b>	<b>100</b>

## Course Objectives:

1. विद्यार्थियों को हिन्दी भाषा के महत्त्व एवं गुणवत्ता से सुविज्ञ करवाकर हिन्दी की ओर उन्मुख करना।
2. विद्यार्थियों को हिन्दी-भाषा की वैज्ञानिकता के विषय में बतलाकर इसके गौरव से सुपरिचित करवाना।
3. हिन्दी भाषा के माध्यम से नवयुवक-नवयुवतियों को राष्ट्रियता के पुनीत भावों की ओर उन्मुख करना।

## Course Outcomes

1. शुद्ध हिन्दी के प्रयोग में अभिवृद्धि होगी।
2. व्यवसाय एवं रोजगार की उपलब्धता वाले सभी क्षेत्रों में हिन्दी भाषा में निष्णात युवाओं की प्रतिभागिता में अभिवृद्धि होगी।
3. अन्तरराष्ट्रीय स्तर पर हिन्दी-भाषा के वर्चस्व की स्थापना होगी और हिन्दी-भाषी को देश और विदेश में समुचित सम्मान मिलेगा।

## इकाई-1

लिपि का मानकीकरण, मानक वर्णमाला, देवनागरी अंक माला, अनुस्वार और विसर्ग, अनुनासिक,

## इकाई— II

सृजनात्मक साहित्य का अर्थ, परिभाषा और स्वरूप: आलोचनात्मक साहित्य का अर्थ, परिभाषा और स्वरूप: सृजनात्मक साहित्य का भाषा-विकास में महत्त्व,

## इकाई— III

अनुवाद : अर्थ, परिभाषा और स्वरूपय अनुवाद का महत्त्व, अनुवादक के गुण, अनुवाद के प्रकार : अनुवाद में कंप्यूटर का योगदान, सीरियलों का हिंदी अनुवाद, बैंकिंग साहित्य का अनुवाद, अनुवाद-क्षेत्र में रोजगार

## इकाई—IV

पत्र प्रस्तुतीकरण का अर्थ, पत्र प्रस्तुतीकरण और नवीन शोधात्मक वैचारिकता, पत्र प्रस्तुतीकरण और शिक्षक की भूमिका, प्रस्तोता का मनोबल, वक्तृत्व कला का विकास, शोधात्मक अभिरुचि का विकास

### प्रेरणास्पद पुस्तकें :

1. डॉ० हरिश्चन्द्र वर्मा, शुद्ध लेखन और हिन्दी का मानक रूप, विद्या भारती, संस्कृति शिक्षा संस्थान, कुरुक्षेत्र (हरियाणा)
2. सम्पा० कालिका प्रसाद, राजवल्लभ सहाय, मुकुन्दीलाल श्रीवास्तव, बृहत् हिन्दी कोश: ज्ञानमण्डल लिमिटेड, वाराणसी
3. मुख्य सम्पादक, डॉ० लक्ष्मीनारायण शर्मा, परिशोध, मानव-मूल्य विशेषांक, 1993
4. डॉ० धर्मपाल मैनी, भारतीय जीवनमूल्य, भारतीय संस्कृति संस्थान, गुड़गाँव
5. बृहत् प्रशासन शब्दावली, हिन्दी-अंग्रेजी, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली-110006
6. बृहत् प्रशासन शब्दावली, अंग्रेजी-हिन्दी, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली-110006
7. बृहत् पारिभाषिक शब्द-संग्रह, मानविकी, खंड- I, वैज्ञानिक तथा तकनीकी शब्दावली आयोग, केन्द्रीय हिन्दी निदेशालय शिक्षा तथा समाज कल्याण मंत्रालय, भारत सरकार
8. डॉ० अनन्त चौधरी, नागरी लिपि और हिन्दी-वर्तनी बिहार हिन्दी ग्रन्थ अकादमी, पटना-3
9. डॉ० सुरेश सिंहल, अनुवाद सिद्धान्त एवं व्यवहार, अभिनव प्रकाशन, दिल्ली-6
10. डॉ० सुरेश सिंहल, प्रयोजनमूलक अनुवाद, मोनिका प्रकाशन, दिल्ली-110053