Annexure 1A.6

Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD)
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Department of Computer Science

Bachelor of Computer Applications

Programme Outcomes

PO1: Attain and apply fundamental knowledge in basic concepts of science.

PO2: Gain Competence to communicate effectively.

PO3: Develop critical thinking for innovations.

PO4: Identify problems and suggest appropriate scientific, technological and environmental solutions

PO5: Function individually or as a team in a work environment.

PO6: Acquire research skills to inquire synthesize and articulate solution for community development.

PO7: Create and apply ICT tools for learning and technology development.

PO8: Exhibit professional ethics and norms for social development.

PO9: Implement acquired knowledge in basic sciences for self-directed and life long learning.

PO10: Promote entrepreneurial skills.

Programme Specific Outcomes

PSO1: Create computational knowledge base and acquires skill sets in diversified fields of computer applications.

PSO2: Inculcate professional, social, ethical skills and entrepreneurial practices towards holistic development while applying computer concepts

PSO3: Acquire competent skills for thriving career and higher studies in applications of computers.

BCA Scheme of Instruction & Examinations
(for students admitted from 2025-2026 & onwards)

Part	Subject Code	Name of Paper/Component	Hours of instruction/ week	Scheme of Examination				
				Duration of exam	CIA	CE	Total	Credits
First Semester								
I	23BLT001/ 23BLH001/ 23BLF001	பொதுத்தமிழ்தாள் I – இக்காலஇலக்கியம்/ Prose and Non-Detailed Texts/ French I	2	3	50	50	100	2
II	23BAEEC1	**Ability Enhancement Compulsory Course – I** English for Communication	4	3	50	50	100	4
III	**Core Courses**							
	25BCAC01	Mathematical Foundation to Computer Science	3	3	50	50	100	3
	25BCAC02	Computer Architecture	5+1	3	50	50	100	6
	25BCAC03	Problem Solving Techniques	3	3	50	50	100	3
	25BCAC03P	Problem Solving Techniques Laboratory	4P	3	50	50	100	2 (5)
	Skill Enhancement Course							
	25BCASE1	Office Automation	2+4P	3	50	50	100	4
IV	**Skill Enhancement Compulsory Courses**							
	23BVBNC2/ 23BVBNS2/ 23BVBSP2	**Value Based Course Elective I** NCC/NSS/Sports	3/2	2	60	40	100	4/1/1
		Games - Practical	1					
		Library	1					
		Total	**30**				**Total**	**28/25**
Second Semester								
I	23BLT002/ 23BLH002/ 23BLF002	பொதுத்தமிழ்தாள் II அறஇலக்கியம்/ Grammar, Translation and General Essay /French II	2	3	50	50	100	2
II	25BAEES1	**Ability Enhancement Compulsory Course -II** Environmental Studies	4	3	50	50	100	4
III	**Core Courses**							
	25BCAC04	Probability and Statistics	3	3	50	50	100	3
	25BCAC05	Data Structures	3	3	50	50	100	3 (5)
	25BCAC05P	Data Structures Laboratory	4P	3	50	50	100	2
	25BCAC06	Operating System	5+1	3	50	50	100	6
	Skill Enhancement Course							
	25BCASE2	Object Oriented Programming	2+4P	3	50	50	100	4
IV	**Skill Enhancement Compulsory Courses**							
	23BVBNC2/ 23BVBNS2/ 23BVBSP2	**Value Based Course Elective I** NCC/NSS/Sports	3/2	2	60	40	100	4/1/1
		Games–Practical	1		-	-	-	
		Library	1					
		Total	**30**				**Total**	**28/25**

Part	Subject Code	Name of Paper/Component	Hours of instruction /week	Scheme of Examination				
				Duration of exam	CIA	CE	Total	Credits
Third Semester								
I	23BLT003/ 23BLH003/ 23BLF003	பொதுத்தமிழ்தாள் III சமயஇலக்கியம்/ Ancient and Modern Poetry/ French III	2	3	50	50	100	2
II	**Generic Elective**							
		Generic Elective I	5+1	3	50	50	100	6
III	**Core Courses**							
	25BCAC07	Database Management System	3	3	50	50	100	3
	25BCAC07P	Database Management System Laboratory	4P	3	50	50	100	2 (5)
	25BCAC08	Software Engineering	4	3	50	50	100	4
	Discipline Specific Elective Course - I							
	25BCADE1A/ 25BCADE1B	Basics of Data Analytics using Spreadsheet/ Feature Engineering	1+4P	3	50	50	100	3
	Skill Enhancement Course							
	25BCASE3	Python Programming	2+4P	3	50	50	100	4
IV	**Skill Enhancement Compulsory Courses**							
	23BSBCS1	**Skill Based Compulsory Course-I** Communication Skill	4P	3	50	50	100	2
	23BVBNC3/ 23BVBNS3/ 23BVBSP3	**Value Based Course Elective I** NCC/NSS/Sports	3/2	2	60	40	100	4/1/1
		Value Based Course Elective II	2	3	50	50	100	2
		Total	**30**				**Total**	**32/29**
Fourth Semester								
I	23BLT004/ 23BLH004/ 23BLF004	பொதுத்தமிழ்தாள் IV – சங்கஇலக்கியம்/Introduction to Functional Hindi/French IV	2	3	50	50	100	2
II	**Generic Elective**							
		Generic Elective II	5+1	3	50	50	100	6
III	**Core Courses**							
	25BCAC09	Entrepreneurship and Startup Ecosystem	2	3	50	50	100	2
	25BCAC10	Computer Networks	5+1	3	50	50	100	6
	25BCAC11	Design and Analysis of Algorithm	4	3	50	50	100	4
	Discipline Specific Elective Course - II							
	25BCADE2A/ 25BCADE2B	Introduction to Data Science/ Introduction to Artificial Intelligence	1+4P	3	50	50	100	3
	Skill Enhancement Course							
	25BCASE4	Web Technologies	2+4P	3	50	50	100	4
IV	**Skill Enhancement Compulsory Courses**							
	23BSBSS1	**Skill Based Compulsory Course-II** Soft Skill	4P	3	50	50	100	2
	23BVBNC4/ 23BVBNS4/ 23BVBSP4	**Value Based Course Elective I** NCC/NSS/Sports	3/2	2	60	40	100	4/1/1
		Value Based Course Elective III	2	3	50	50	100	2
		Total	**30**				**Total**	**35/32**
Internship during Summer Vacation for 15 days								

Part	Subject Code	Name of Paper/Component	Hours of instruction /week	Scheme of Examination				
				Duration of exam	CIA	CE	Total	Credits
	Fifth Semester							
III	**Core Courses**							
	25BCAC12	Data Visualization	5+1	3	50	50	100	6
	Discipline Specific Elective Course – III & IV							
	25BCADE3A/ 25BCADE3B	Time Series Analysis/ Digital Image Processing	2+4P	3	50	50	100	4
	25BCADE4A/ 25BCADE4B	Big Data Analytics/ Natural Language Processing	5	3	50	50	100	5
	Skill Enhancement Courses							
	25BCASE5	Quantitative Techniques	3	3	50	50	100	3
	25BCASE6	Internship/capstone Project	8P	3	50	50	100	4
	Professional Development Course							
	25BCAPD1	Computer Ethics	1	3	50	50	100	Remarks
IV	**Skill Enhancement Compulsory Courses**							
	23BVBNC4/ 23BVBNS4/ 23BVBSP4	**Value Based Course Elective I** NCC/NSS/Sports	3/2	2	60	40	100	4/1/1
		Total	**30**				**Total**	**26/23**
	Sixth Semester							
III	**Core Courses**							
	25BCAC13	Machine Learning	5+1	3	50	50	100	6
	Discipline Specific Elective Course – V & VI							
	25BCADE5A/ 25BCADE5B	Exploratory Data Analysis/ Deep Learning for Computer Vision	2+4P	3	50	50	100	4
	25BCADE6A/ 25BCADE6B	Business Intelligence and Analytics/ Predictive Analytics	5	3	50	50	100	5
	Skill Enhancement Course							
	25BCASE7	Project/Internship	8P	3	50	50	100	4
	Professional Development Course							
	25BCAPD2	Professional IT Skills	3	3	50	50	100	Remarks
IV	**Skill Enhancement Compulsory Courses**							
	23BVBNC6/ 23BVBNS6/ 23BVBSP6	**Value Based Courses Elective I** NCC/NSS/Sports	3/2	2	60	40	100	4/1/1
		Total	**30**				**Total**	**23/20**
	Overall Total							**172/154**

- **Ability Enhancement Compulsory Courses**
  - English for Communication
  - Environmental Studies
- **Skill Enhancement courses** are Skill Based and / or Value Based which are aimed at providing hands on training, competencies, skills etc. and may be opted by the students from the electives offered by the departments or from SWAYAM MOOCs/NPTEL

Skill Based courses

- **Skill Based Compulsory courses I – 23BSBCS1–Communication Skill during 3rd semester**
- **Skill Based Compulsory courses II-23BSBSS1–Soft Skill during 4th semester**

- **Value Based Courses-Elective I**

Value Based Courses Elective I	Subject Code	Semester	No. of Credits
NCC/	23BVBNC1-6/	1-6	24 Credits
NSS/	23BVBNS1-6/		6 Credits
Sports	23BVBSP1-6		6 Credits

* **Discipline Specific Elective Courses** should be related to their own core which may be from SWAYAM,MOOCs/NPTEL also

1. Data Science

S.No.	Semester	Course Code	Discipline Specific Elective
1	III	25BCADE1A	Basics of Data Analytics using Spreadsheet
2	IV	25BCADE2A	Introduction to Data Science
3	V	25BCADE3A	Time Series Analysis
4	V	25BCADE4A	Big Data Analytics
5	VI	25BCADE5A	Exploratory Data Analysis
6	VI	25BCADE6A	Business Intelligence and Analytics

2. Artificial Intelligence and Machine Learning

S.No.	Semester	Course Code	Discipline Specific Elective
1	III	25BCADE1B	Feature Engineering
2	IV	25BCADE2B	Introduction to Artificial Intelligence
3	V	25BCADE3B	Digital Image Processing
4	V	25BCADE4B	Natural Language Processing
5	VI	25BCADE5B	Deep Learning for Computer Vision
6	VI	25BCADE6B	Predictive Analytics

Generic Elective Courses offered for other disciplines/ departments

- A Core Course offered in a Discipline/Subject may be offered as a Generic Elective for other departments.

S.No.	Generic Elective Courses	Semester	Hours of Instruction/Week Theory+Tutorial	Credits
1	**23BCAGE1 Internet Basics**	1	5+1	6
2	**23BCAGE2 Computer Fundamentals**		5+1	
3	**23BCAGE3 Industry4.0**	3	5+1	
4	**23BCAGE4 Digital Marketing**		5+1	
5	**23BCAGE5 Fundamentals of Data Science**	4	5+1	
6	**23BCAGE6 Introduction to Artificial Intelligence**		5+1	

Total credits to earn the degree

1. Part I components – 8 Credits (Languages)
2. Part II components – 20 Credits [Ability Enhancement Courses – 8, Generic Elective Courses – 12]
3. Part III components –112 Credits [Core Courses – 61, Discipline Specific Elective Courses -24 and Skill Enhancement Courses – 27]
4. Part IV components – 14 Credits [Skill based Compulsory Courses – 4, Value based Courses Elective I (NCC/NSS/Sports)-24/6/6, Value based Courses Elective II – 4]
5. **Minimum One Course should be from SWAYAM MOOCs/NPTEL** for Credit Transfer in DSE, Generic Elective.

Mathematical Foundation to Computer Science

Semester I
25BCAC01

Hours of Instruction/Week: 3
No. of Credits: 3

Objectives:

1. Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.
2. To educate the students how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze.
3. To enable the students to gain knowledge in mathematical techniques that is foundations for understanding advanced computational methods, including numerical methods and optimization.

Unit I: Set, Relation and Function **9hrs**

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

Unit II: Matrix Algebra **9hrs**

Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, rank of a matrix, inverse of a matrix, Caley-Hamilton theorem

Unit III: Elementary Graph Theory **9hrs**

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

Unit IV: Numerical Methods **9hrs**

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

Unit V: Optimization Techniques **9hrs**

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Simplex method, Transportation problem-North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution

Total Hours: 45

Text Books:

1. ***Garg, Reena (2024), Engineering Mathematics,*** Khanna Book Publishing Company
2. ***Kolman B., Busby R. and Ross S. (2015), Discrete Mathematical Structures***, Sixth Edition, Pearson Education,
3. ***Vasishtha A. R. and Vasishtha A. K. (2022), Matrices,*** Krishna Prakashan

Reference Books:

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

E-Learning Resources:

1. https://nptel.ac.in/courses/106103205
2. https://nptel.ac.in/courses/111101115
3. http://cec.nic.in/E-

Course Outcomes:

CO1: Recall the concepts of matrices, set theories, relations, functions
CO2: Ability to understand and perform basic matrix operations
CO3: Understand and apply fundamental concepts of graph theory to analyze relationships between objects
CO4: Apply various numerical techniques to approximate solutions for complex mathematical problems that may not have exact analytical solutions
CO5: Identify, formulate, and solve real-world optimization problems using various mathematical methods

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	M	H	M	L	M	M	L	L	M	M	M	L
CO2	M	M	M	L	M	L	M	M	L	M	M	L	M
CO3	M	M	M	M	M	L	M	M	L	L	M	L	M
CO4	M	M	L	M	M	M	M	M	L	M	M	L	M
CO5	M	M	L	M	M	M	M	M	M	M	M	L	L

Computer Architecture

Semester I **Hours of Instruction/Week: 5+1**
25BCAC02 **No. of Credits: 6**

Objectives:

1. To make students understand the basic structure, operation and characteristics of digital computer.
2. To familiarize the students with process or instruction handling with parallelism and control implementation
3. To familiarize the students with hierarchical memory system and Input-output transfer Schemes

Unit I:Digital Principles and Number Systems **18hrs**

Definition for Digital signals, Digital logic, Digital computers, VonNeumann Architecture, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2 and 3 variable K Map, K-Map Simplifications, Decimal, Binary, Octal, Hexadecimal, Number System Conversions. Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess3 Code, The Gray Code.

Unit II: Combinational and Sequential Circuits **18hrs**

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, Binary Counters-4 bit synchronous and Asynchronous binary counter.

Unit III: Register Transfer and Basic Computer Organization **18 hrs**

Register Transfer Language, Register Transfer, Bus & Memory Transfer.Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input -Output Interrupt, Design of Basic Computer.

Unit IV: Processor and Control Unit **18 hrs**

Central Processing Unit: Introduction, General Register Organization, StackOrganization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation,Program Control, Reduced Instruction Set Computer(RISC), RISC Vs CISC. Pipelining: Arithmetic Pipeline and Instruction Pipeline.

Unit V: I/O and Memory Organization **18hrs**

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, Associative Memory, Cache Memory.

Total Hours: 90

List of Programs:

1. Simulate and verify the logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer Gates.
2. Simulate and verify the Truth Tables of J-K Flip-Flop using NAND/NOR gate.
3. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit).
4. To Study mother board layout of a system.
5. To study the installation of Printer and trouble shooting.

Text Books:

1. ***Donald P Leach, Albert Paul Malvino, Goutam Saha*** **(2011),** ***Digital Principles & Applications***, Tata McGraw Hill Education Private Limited.
2. ***M. Morris Mano, Computer System Architecture (2017)***, Pearson/Phi, Third Edition.

Reference Books:

1. ***William Stallings (2016), Computer Organization and Architecture,*** Pearson/PHI, Tenth Edition.
2. ***Andrew S. Tanenbaum, Structured Computer Organization (2002),*** PHI /Pearson 4th Edition.
3. ***M.V .Subramanyam, Switching Theory and Logic Design (2011),*** Laxmi Publications (P) Ltd.
4. ***Ikvinderpal Singh, Computer Organization Architecture (2025),*** Khanna Book Publishing.

E-learning Resources:

1. https://nptel.ac.in/courses/106102062
2. https://onlinecourses.swayam2.ac.in/ntr25_ed43/preview
3. https://de-iitr.vlabs.ac.in/exp/truth-table-gates/simulation.html
4. https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/simulation.html

Course Outcomes:

CO1: Recall the basics of digital electronics and binary number system.
CO2: Familiarity in the implementation of combinational and sequential circuits.
CO3: Apprehend the organization of basic computers.
CO4: Responsive on parallel processing.
CO5: Clarity on I/O and memory organization.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	M	M	M	-	L	M	L	L	L	H	M	L
CO2	H	M	M	M	-	-	-	L	L	-	L	-	-
CO3	M	L	M	L	L	L	L	L	M	-	L	L	-
CO4	M	L	L	_	_	L	L	L	M	-	M	L	L
CO5	L	L	L	L	L	M	-	-	M	L	H	M	M

Problem Solving Techniques

Semester I **Hours of Instruction/Week: 3**

25BCAC03 **No. of Credits: 3**

Objectives:

1. To learn the basic concepts of problem-solving techniques.
2. To develop skills in C Programming.
3. To know the methodology of writing programs using C for different applications.

Unit I: Problem Solving using Computers **9 hrs**

Introduction- Problem and Problem Instances - Types of computational problems – classification and analysis of problems – Problem Solving steps –Breaking the problem into sub problems, Input/Output specification, Input validation, Pre and Post Conditions. Solution approaches - Algorithms-Characteristics of Algorithms-Flow Charts– Symbols used in Flow Charts - Pseudo code – Sequence, Selection and Iteration.

Unit II: Introduction to C **9 hrs**

History of C- Structure of a C program - Character set in C- C Tokens- Keywords and Identifiers - Constants- Variables in C. Basic Data Types- Type declaration- Operators and Expressions- Managing Input and output operation-Conditional statements and Looping statements.

Unit III: Arrays and Strings **9 hrs**

Introduction to array- advantages of arrays- array declaration-array initialization-Types of arrays: Single and Multidimensional arrays, Character Arrays-Strings.

Unit IV: Functions **9 hrs**

Introductiontofunctions-advantagesoffunctions-declaringafunction-callingafunction-passing arguments for a function- Categories of functions- nesting of functions - Recursion. Structures and Union.

Unit V: Pointers and File Management **9 hrs**

Introduction to Pointers- Pointers and Arrays- passing pointers to functions. Introduction to Files- Defining and Opening a File, Closing a File- Input/ Output operations on File- command line arguments.

Total Hours: 45

Text Books:

1. ***Venkatesh, Nagaraju Y (2024), Practical C Programming for Problem Solving,*** Khanna Book Publishing Company.
2. ***Harvey Deitel and Paul Deitel (2015), C How to Program,*** Ninth edition,Pearson India.
3. ***E.Balagurusamy (2011), Programming in ANSI C,*** Tata Mc Graw Hill Publishing Company Ltd, Fifth Edition.

Reference Books:

1. ***AICTE's Programming for Problem Solving (with Lab Manual) (2024),*** Khanna Book Publishing Company.
2. ***Reema Thareja (2014), Fundamentals of Computers,*** Oxford University Press.
3. ***BrianW.Kernighan,DennisRitchie (2015), The C Programming Language,*** Second Edition, Pearson Publication

E-learning Resource:

1. http://www.cprogramming.com/tutorial/c-tutorial.html?inl=nv
2. https://onlinecourses.nptel.ac.in/noc19_cs42/preview
3. https://www.learn-c.org/

Course Outcomes:

CO1: Understands problem solving methodologies by learning algorithm and flowcharts.

CO2: Obtain knowledge about the fundamentals of C programming.

CO3: Implement different operations on arrays.

CO4: Understand use of functions, structures and unions.

CO5: Gain knowledge about the basics of file handling mechanism.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	L	L	L	-	L	M	L	L	M	H	M	L
CO2	M	L	L	L	-	L	H	L	L	L	L	L	L
CO3	L	-	L	L	-	L	M	M	L	-	M	-	M
CO4	M	-	M	M	-	M	H	M	M	M	L	L	L
CO5	M	-	M	M	-	M	L	M	M	M	-	M	L

Problem Solving Techniques Laboratory

Semester I **Hours of Instruction/Week: 4P**

25BCAC03P **No. of Credits: 2**

List of Programs:

1. Display the input numbers in sorted (non-decreasing) order.
2. Given a positive integer value where (n>=0) display number, square and cube of numbers from 1 to n in a tabular format.
3. Display following patterns of n rows (n>0), for the below examples n = 5, for each pattern write a separate algorithm/program.

12345 1234 123 12 1	12345 1234 123 12 1

4. Compute character grade from the marks ($0 \leq$ marks ≤ 100) of a subject. Grading Scheme: 80-100: A, 60 - 79: B, 50 - 59: C, 40-49: D, 0-39: F? Solve this using both else-if ladder and switch case?
5. Check if a given positive integer number is a prime number or not.
6. Write a program to display a number in text form. For example, if the number is 5432 the output should be —FIVE FOUR THREE TWOI?
7. Compute body mass index,BMI =weightinKGs /(HeightinMeters *HeightinMeters), 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: BMIValues - Underweight: less than18.5, Normal: >=18.5 and <25 ,Overweight:>=25and <30, Obese>=30
8. Design a modularized program to compute a maximum of n numbers.
9. Write a program to implement string length and string reversal functions.
10. Write a program to apply recursive function for the following problems:

a. Factorial of a number. b. Compute x^y using only multiplication.

Total Hours: 60

Course Outcomes:

CO1: Construct programs that demonstrate effective use of C features.

CO2: Read, understand and trace the execution of programs written in C language.

CO3: Develop programs using control statements, arrays and Strings.

CO4: Understand code reusability with the help of user-defined functions.

CO5: Apply programming constructs to develop simple applications.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	L	-	L	L	-	L	L	L	-	L	-	M
CO2	L	-	L	L	L	L	L	L	M	L	L	-	L
CO3	L	L	L	M	-	L	M	M	L	L	M	L	L
CO4	M	-	M	L	M	M	M	M	L	L	M	M	-
CO5	M	M	M	L	-	M	L	M	H	M	M	L	M

Office Automation

Semester I **Hours of Instruction/Week: 2+4P**

25BCASE1 **No. of Credits: 4**

Objectives:

1. To provide an in-depth training in use of office automation packages.
2. To understand how to use software packages in day to day activities
3. To promote the intensive and extensive application of ICT

MS-WORD: Formatting Text & Paragraphs, Styles-Word Art, Smart Art Working with Tables- Shapes. Mail Merge, printing Documents-Google Docs. **MS-EXCEL**: Working & Editing In Workbooks, Creating Formats & Links, Formatting a Worksheet & creating graphic objects, Creating Charts, formatting and analyzing data, Organizing Data in a List , Sharing & Importing Data, Printing- Google Sheets. **MS-POWER POINT**: Creating a presentation, Creating & editing slides, Previewing a slide show, Adding picture & graph, Adding sound & video, Adding autoshape, Animating objects – Google Slides. **MS-ACCESS**:Creating a New Database, Creating Tables - Relationship between tables - Working with Forms, Creating Queries, Sorting Records, Creating Reports, Types of Reports - Google Forms.

Total Hours: 90

List of Programs:

1. Working with Tables and formatting in MS-Word
2. Mail Merge Concepts in MS-Word
3. Performing Calculations in worksheet by applying formula in MS-Excel
4. Preparation of charts in MS-Excel
5. Creating Presentation Slides using Hyperlinks, Pictures and Buttons in MS-PowerPoint
6. Working with Animations in MS-PowerPoint
7. Creation of Tables and relationships in MS-Access
8. Working with Queries in MS-Access
9. Creating Reports in MS-Access
10. Working with Google Docs, Sheets, Forms and Slides

Text Book:

1. ***Lisa. A. Bucki, John Walkenbach, Michael Alexander (2013),*** Microsoft Office 2021 Bible, Fourth Edition, Wiley.

Reference Books:

1. ***Guy Hart- Davis (2010), Beginning Microsoft Office 2010***, Apress.
2. ***Gary B. Shelly, Philip. J. Pratt (2010), Microsoft Access 2010: Complete***, Cashman Series.
3. ***Cronan (2010), Microsoft Office Access 2010 Quick Steps***, Tata McGraw Hill.

E-Learning Resources:

1. https://learn-u.com › using-technology-in-the-classroom
2. https://www.spreadsheet.com
3. https://edu.gcfglobal.org › access
4. https://www.niu.edu › citl › guides › instructional-guide

Course Outcomes:

CO1: Basic Knowledge of Word Processing and their usage.

CO2: Basic Knowledge of Spreadsheet Processing and their usage.

CO3: Basic Knowledge of presentations.

CO4: Understand and apply the basic concepts of database management system.

CO5: Enhance the knowledge in connecting to other databases.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	L	M	L	H	M	H	M	H	H	M	H	H
CO2	M	M	M	L	H	H	H	H	M	H	H	H	H
CO3	M	M	M	L	M	M	H	M	H	M	M	H	H
CO4	M	M	H	L	H	H	H	H	M	H	H	H	H
CO5	M	L	H	L	H	H	H	H	M	H	H	H	H

Probability and Statistics

Semester II **Hours of Instruction/Week: 3**

25BCAC04 **No. of Credits: 3**

Objectives:

1. To make the students handle randomness scientifically using theory of probability
2. To make the students able to represent the statistical data in a systematic way and analyze it to draw meaningful information from them
3. To enable the students scope to apply probabilistic and statistical techniques to deal with the real-life problems

Unit I: Measures of Central Tendency **9 hrs**

Basic concepts of Statistics, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data.Measures of Central Tendency: Arithmetic mean, median and mode—their properties Measures of Dispersion: Range, mean deviation, variance and standard deviation.

Unit II: Correlation and Regression **9 hrs**

Correlation: Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. Regression: Linear regression-fitting by least square method and interpretation.

Unit III: Concepts of probability **9 hrs**

Concepts of probability: Experiment and sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability. Random Variables: Discrete and continuous random variable.

Unit IV: Sampling Distribution **9 hrs**

Sampling Distribution: Concept of Population and Sample, parameter and statistic, sampling distribution of sample mean and sample proportion.

Unit V: Statistical Inference **9 hrs**

Statistical Inference: Estimation and Hypothesis Testing (only concept), 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.

Total Hours: 45

Text Books:

1. ***Manish Sharma, Amit Gupta (2010), The Practice of Business Statistics***, Khanna Book Publishing Company
2. ***Das N. G., Statistical Methods (2010),*** Combined Edition, Tata McGraw Hill
3. ***Ross Sheldon. M (2021), Introduction to Probability and Statistics for Engineers and Scientists***, Sixth Edition, Elsevier

4. ***Miller Irwin and Miller Marylees (2005), Mathematical Statistics with Applications***, Seventh Edition, Pearson Education

Reference Books:

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

E-Learning Resources:

1. https://nptel.ac.in/courses/111106112
2. https://nptel.ac.in/courses/111105041
3. https://www.statistics.com/

Course Outcomes:

CO1: Compare measures of Central Tendency and Dispersion for a given set of data and discuss the nature of the sample
CO2: Compute correlation and regression for given data
CO3: Ability to: define fundamental probability concepts, calculate probabilities using various rules and techniques
CO4: Understand the concept of a sampling distribution, calculate key characteristics like mean and standard deviation of a sampling distribution
CO5: Apply statistical methods to make inferences about population parameters based on sample data

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	M	M	M	L	M	M	L	L	M	M	M	L
CO2	M	M	L	L	M	L	M	M	L	M	M	L	M
CO3	M	M	L	M	M	L	M	M	L	L	M	L	M
CO4	L	M	M	M	M	M	M	M	L	M	M	L	M
CO5	L	M	M	M	M	M	M	M	M	M	M	L	L

Data Structures

Semester II **Hours of Instruction/Week: 3**

25BCAC05 **No. of Credits: 3**

Objectives:

1. Understand the fundamental concepts of Data Structures and their applications.
2. Develop problem-solving skills using Data Structures.
3. Implement Data Structures using C programming language.

UNIT I: Introduction and Overview **9 hrs**

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.

UNIT II: Stacks **9 hrs**

Definition, Representation of Stacks using Arrays , Operations on Stacks, Application of Stacks: Arithmetic Expressions - Polish Notation - Conversion of Infix Expression to Postfix Expression - Evaluation of Postfix Expression- Recursion.

UNIT III: Queue **9 hrs**

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

UNIT IV: Linked Lists and Trees **9 hrs**

Linked List: Definition, Representation, and Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree.

Unit V: Sorting and Searching **9 hrs**

Sorting: Bubble Sort, Selection Sort, and Insertion Sort, Quick sort. Searching: Linear Search and Binary Search, Breadth First Search, Depth First Search

Total Hours: 45

Text Books:

1. ***R.B. Patel (2023), "Expert Data Structures with C",*** Khanna Book Publishing Company.
2. ***Seymour Lipschutz (2011), "Data Structures with C",*** Schaum's Outlines, Tata McGraw-Hill.
3. ***Yashavant Kanetkar (2022), "Data Structures Through C",*** Fourth Edition, BPB Publications.

Reference Books:

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

E- Learning Resources :

1. https://nptel.ac.in/courses/106102064
2. http://www.digimat.in/nptel/courses/video/106102064/L01.html
3. https://www.geeksforgeeks.org/data-structures/

Course Outcomes:

CO1: Analyzing the complexity of algorithms.
CO2: Implementing stack operations and applying them in arithmetic expression evaluation and recursion.
CO3: Implementing different types of queues and applying them in real-world scenarios.
CO4: Developing and manipulating linked lists and binary trees for efficient data organization and retrieval.
CO5: Applying various sorting and searching techniques for efficient data processing.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	L	H	M	L	L	M	L	H	L	M	M	H
CO2	M	M	M	M	M	M	M	M	H	M	M	H	H
CO3	M	M	L	M	M	M	M	L	M	L	M	L	L
CO4	M	L	L	H	L	M	H	L	M	L	L	M	M
CO5	M	M	M	M	M	M	L	L	L	-	L	L	L

Data Structures Laboratory

Semester II **Hours of Instruction/Week: 4P**

25BCAC05P **No. of Credits: 2**

List of Programs:

1. Write a program for insertion and deletion operations in an array.
2. Write a program to add and subtract two matrices.
3. Write a program to convert an infix to postfix expression using a stack.
4. Write a program to evaluate a postfix expression using a stack.
5. Write a program to implement Recursion.
6 Write a program to implement simple queue operations using an array.
7 Write a program to insert and delete an element into a Singly Linked List.
8. Write a program to perform the traversal operations on a binary search tree.
9. Write a Program to implement Bubble Sort.
10. Write a program to search for an element in an array using Linear Search.

Total Hours: 60

Course Outcomes:

CO1: Construct programs that demonstrate effective use of arrays.
CO2: Applying linear data structures to solve simple problems.
CO3: Applying non-linear data structures for simple problems.
CO4: Ability to choose the appropriate traversal techniques to access the elements.
CO5: Apply searching and sorting techniques for simple applications.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	M	H	L	-	L	L	L	L	L	M	M	L
CO2	M	M	M	M	-	M	L	L	M	L	M	L	M
CO3	H	M	L	M	M	M	L	M	M	L	M	L	M
CO4	H	L	L	H	L	M	L	M	M	M	H	M	M
CO5	H	M	M	M	M	M	L	L	L	M	H	L	L

Operating System

Semester II **Hours of Instruction/Week: 5+1**

25BCAC06 **No. of Credits: 6**

Objectives:

1. Gain knowledge about the functionalities of operating system.
2. To understand the various resources managed by operating system.
3. Explore on case studies and security of operating systems.

Unit 1: Introduction and Operating Systems Structure **18 hrs**

Operating Systems Overview: Definition, Evaluation, Components and Services, Structure, Architecture, system calls, system programs, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems.

Unit II: Process Management and Scheduling **18 hrs**

Process Management: Process Definition, Process states, Process State transitions, 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 – First Come First Serve (FCFS), Shortest Job First (SJF) and Round Robin (RR).

Unit III: Process Synchronization and Deadlocks **18 hrs**

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, Virtual Memory **18 hrs**

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.

Unit V: Operating System Security & Protection **18 hrs**

Security Environment, Design Principles of Security, User Authentication, Protection Mechanism: Protection Domain, Access Control List. Case study of Linux and Windows Operating System.

Total Hours: 90

List of Programs:

1. Simulate First Come First Serve CPU Scheduling algorithm.
2. Simulate Bankers Algorithm for Deadlock Avoidance.
3. Implement the Producer–Consumer problem using semaphores.
4. Simulate Paging memory management technique.
5. Implement sequential file allocation method

Text Books:

1. ***Ekta Walia (2022), Operating Systems Concepts***, Khanna Publishing House.
2. ***Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2018), Operating System Principles***, Tenth Edition OR Later edition, Wiley India Private Limited, New Delhi.
3. ***Stallings (2006), Operating Systems, Internals and Design Principles***, Fifth Edition, Pearson Education, India.
4. ***H.M.Deitel, (2004), Operating Systems***, Pearson Publications, Second Edition.

Reference Books:

1. ***Andrew S. Tanenbaum (2014), Modern Operating Systems***, Pearson Prentice Hall of India, Fourth Edition.
2. ***William Stallings (2006), Operating Systems,*** Prentice Hall of India, Fifth Edition.

E-learning Resources:

1. nptel.ac.in/courses/106108101/
2. w3schools.in/operating-system-tutorial
3. https://swayam.gov.in/course/237-operating-system

Course Outcomes:

CO1: Recall the concepts of file management.

CO2: Apply security aspects in appropriate situations.

CO3: Apply knowledge gained through processor scheduling to other applications.

CO4: Analyze features and limitations of operating systems.

CO5: Explore various other operating systems.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	L	H	H	M	M	M	L	H	L	M	M	H
CO2	M	L	M	H	H	H	M	M	H	M	M	H	H
CO3	H	L	M	M	L	M	M	L	M	L	M	M	M
CO4	H	L	M	H	M	M	H	L	M	L	M	M	M
CO5	M	L	L	M	M	M	L	L	M	-	L	M	L

Object Oriented Programming

Semester II **Hours of Instruction/Week: 2+4P**

25BCASE2 **No. of Credits: 4**

Introduction - Java structure, Java Virtual Machine, Constant and Variables, Data Types, Operators, Control Statements. Class and methods, creation of objects, Constructor, Constructor overloading, Method overloading, Arrays, Strings. Inheritance, Types of Inheritance, Extending a Class, Method overriding. Interfaces, extending interface, implementing interface. Packages, creating and accessing package, package hierarchy, import statement. Exception Handling, try, catch, throw and throws, multiple catch statement, finally statement – Applets, Applet life cycle, Graphic programming – Event handling.

List of Programs:

1. Create a Java class called Student with the following details as variables within it.
   a. USN, Name, Brach, 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.
2. Write a Java program to create a class called —Book‖ with instance variables title, author and price. Implement a default constructor and two parameterized constructors.
   a. One constructor takes title and author as parameters
   b. The other constructor takes title, author and price as parameters
   c. Print the values of the variables for each constructor
3. Write a Java program to create Shoppingcart class that contains three overloaded versions of the addItem() method given below:
   a. addItem() method accepts name of an item and adds it to the cart
   b. addItem() method accepts item name and quantity allowing user to add multiple items of the same type to the cart.
   c. addItem() method accepts item name, quantity, price, calculating the total cost and providing more detailed information.
4. 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 superclass. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
5. 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.
6. 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.

7. Write a Java package program for the class book and then import the data from the package and display the result.
8. Create an exception subclass Under Age, which prints —Under Agell along with the age value when an object of Under Age class is printed in the catch statement. Write a class exception Demo in which the method test() throws Under Age exception if the variable age passed to it as argument is less than 18. Write main() method also to show working of the program.
9. Write a Java program to compute factorial value using Applet.
10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired.

Total Hours: 90

Text Books

1. ***Balaguruswamy E. (2023), Programming with JAVA: A Primer***, Seventh Edition. India: McGraw Hill Education.
2. ***Schildt, H. (2022), Java: The Complete Reference,*** Twelfth Edition, McGraw-Hill Education.
3. ***Tanweer Alam (2015), Core JAVA,*** Khanna Book Publishing Company Private Limited.

Reference Books

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

Web Resources

1. https://www.w3schools.com/java/.
2. http://www.java2s.com/.
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

Course Outcomes:

CO1: Develop Java applications using OOP concepts with appropriate program structure.

CO2: Demonstrate the concepts of polymorphism and inheritance.

CO3: Use and create packages and interfaces in a Java program.

CO4: Implement exception handling in Java.

CO5: To develop an applet program using AWT.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	M	L	L	M	L	L	L	M	L	M	L
CO2	M	M	M	L	M	L	L	M	L	M	M	L	M
CO3	M	M	L	M	M	L	L	M	L	M	L	M	L
CO4	M	H	M	M	M	M	M	M	L	M	L	M	L
CO5	M	M	L	L	M	M	L	M	M	M	M	L	L