APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

(A State Government University)

BCA (Hons) - 2024

FIRST YEAR SYLLABUS

SEMESTER 1

Bachelor of Computer Application (Hons)

SEMESTER S1 – BCA

PROFESSIONAL ENGLISH

Course Code	**BCAET101**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enhance pronunciation and vocabulary proficiency.
2. To strengthen grammar usage and error correction.
3. To develop active listening and speaking skills.
4. To improve reading comprehension and critical analysis.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (36 Hrs)
1	**Pronunciation:** Phonemic symbols - Vowels - Consonants - Syllables - Word stress - Sentence stress – Mother tongue influence. **Vocabulary:** synonyms - phrasal verbs-idiomatic expressions- vocabulary in everyday life. **Grammar:** Major tenses - frequently used constructions- dealing with common mistakes.	**12**
2	**Listening:** Active listening – Barriers to listening – Listening and note taking– Listening to announcements – Listening to news on the radio and television.	**7**
3	**Speaking Skills:** Word stress and rhythm – Pauses and sense groups – Falling and rising tones –Fluency and pace of delivery – Art of small talk – Participating in conversations – Making a short formal speech – Group discussion skills -debating skills and telephone skills.	**9**
4	**Reading Skills:** Reading with a purpose – making predictions – Understanding text structure – Locating main points – Making inferences - comprehension skills - Reading graphics - reading critically – Reading research papers.	**8**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	10	12.5	12.5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply the principles of correct pronunciation, vocabulary usage, and grammatical structures by effectively using phonemic symbols, stress patterns, and vocabulary in everyday communication, while minimizing errors influenced by their mother tongue.	**K3**
CO2	Demonstrate active listening skills by effectively identifying and overcoming barriers to listening, accurately taking notes, and comprehending spoken information from announcements, radio broadcasts, and television news, applying these skills in both academic and real-world contexts.	**K3**
CO3	Apply effective speaking techniques, including appropriate word stress, rhythm, and tone, to engage fluently in small talk, participate in conversations, deliver short formal speeches, and contribute meaningfully to group discussions, debates, and telephone conversations.	**K3**
CO4	Apply reading strategies to effectively extract and interpret information from various texts, including making predictions, identifying main points, understanding text structure, and analyzing graphics, while enhancing comprehension and critical reading of research papers.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A Textbook of English Phonetics for Indian Students.	T. Balasubramanian	Laxmi Publications	3rd Edition 2017
2	A Course in Listening and Speaking I & II	Sasikumar V, Kiranmai Dutt and Geetha Rajeevan	Foundation Books	2007
3	Interchange Student's Book 2	Jack C. Richards	Cambridge University Press	5th Edition 2017
4	Interchange Student's Book 3	Jack C. Richards	Cambridge University Press	5th Edition 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Communication Studies	Sky Marsan	Palgrave Macmillan	2006
2	Effective Communication for Arts and Humanities Students	Joan Van Emden and Lucinda Becker	Palgrave Macmillan	2003
3	Communication and Language Skills.	Sanghita Sen, Alankrita Mahendra and Priyadarshi Patnaik.	Cambridge University Press	2015
4	Study Listening: A Course in Listening to Lectures and Note-taking	Tony Lynch	Cambridge University Press	2nd Edition 2004
5	Study Speaking: A Course in Spoken English for Academic Purposes	Anderson, Kenneth, Joan Maclean, and Tony Lynch	Cambridge University Press	2nd Edition 2004
6	Study Reading: A Course in Reading Skills for Academic Purposes	Glendinning, Eric H. and Beverly Holmstrom	Cambridge University Press	2nd Edition 2004

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_hs09/preview
2	https://onlinecourses.nptel.ac.in/noc24_hs175/preview
3	https://onlinecourses.nptel.ac.in/noc24_hs73/preview
4	https://nptel.ac.in/courses/109106067

SEMESTER S1

FOUNDATIONAL MATHEMATICS

Course Code	**BCPCT102**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To develop a strong foundation in mathematical logic and set theory.
2. To gain proficiency in handling real numbers and algebraic techniques such as matrix operations and determinants to solve linear equations.
3. To understand sequences, series, and their convergence.
4. To develop a basic understanding of differentiation and integration, including their fundamental rules and applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (36 Hrs)
1	**Set Theory and Logic:** **Sets:** Types of sets, Venn diagrams, Set operations, Algebra of sets, Applications. **Relations and Functions:** Types, Properties, Composition, and Inverse of functions. **Propositional Logic:** Statements, Logical connectives, Truth tables, Tautologies, Contradictions, Logical equivalence, and Implications.	**9**
2	**Algebra:** **Real Numbers:** Properties, Absolute value, Inequalities. **Matrices and Determinants:** Operations on matrices, Types of matrices, Determinants, Properties of determinants, Inverse of a matrix, Applications in solving linear equations.	**9**
3	**Sequences and Series:**	**9**

	Arithmetic and Geometric Progressions: nth term, Sum of n terms, Applications. **Convergence and Divergence of Series:** Tests for convergence, Alternating series, Power series. **Binomial Theorem:** Expansion, General and middle terms, Approximation.	
4	**Calculus:** **Differentiation:** Definition, Rules, Higher-order derivatives, Applications in curve sketching, Maxima and minima. **Integration:** Definite and indefinite integrals, Techniques of integration, Applications in area and volume. **Differential Equations:** First-order linear differential equations, Separable variables, Applications.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply set theory and propositional logic to solve problems involving data organization, analysis, and logical reasoning.	**K3**
CO2	Apply properties of real numbers and matrix operations to solve inequalities and systems of linear equations.	**K3**
CO3	Practice arithmetic and geometric progressions, convergence tests, and the Binomial Theorem to analyze sequences, series, and approximate mathematical expressions.	**K3**
CO4	Utilize differentiation, integration, and differential equations to solve and model real-world problems	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw Hill Education	7th Edition 2017
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Mathematical Logic	Elliott Mendelson	CRC Press	6th Edition 2015
2	A Textbook of Engineering Mathematics	N.P. Bali, Manish Goyal	Laxmi Publications	9th Edition 2016
3	Mathematics for Degree Students	P.K. Mittal	S Chand Publishing	2010

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://nptel.ac.in/courses/106106183
2	https://nptel.ac.in/courses/122104018
3	https://nptel.ac.in/courses/111106053
4	https://nptel.ac.in/courses/111106146

SEMESTER S1

BUSINESS MANAGEMENT AND FUNDAMENTALS OF ACCOUNTANCY

Course Code	**BCMDT103**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To understand the fundamentals of management.
2. To learn core management functions, analyse different organizational structures and evaluate various leadership theories.
3. To understand the controlling process, control tools, and identify contemporary issues in management.
4. To learn the basic accounting concepts and prepare financial statements.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Definition and Scope of Management:** Nature, significance, and process of management. Management vs. Administration **Evolution of Management Thought:** Classical, Neo-Classical, and Modern Theories. Contributions of Henry Fayol, F.W. Taylor, and Elton Mayo. **Management Functions:** Planning, Organizing, Leading, Controlling and Coordination. **Planning:** Types of Plans - Strategic, Tactical, Operational. Planning Process. **Decision-Making Process:** Types of Decisions, Decision-Making Models - Rational, Bounded Rationality, Intuitive. Tools and Techniques for Decision Making. **Goal Setting and Management by Objectives** (MBO).	**12**
2	**Organizational Structure:** Types of Organizational Structures - Functional, Divisional and Matrix. Factors Influencing Organizational Design. **Delegation of Authority:** Centralization vs. Decentralization, Span of Control **Leadership:** Theories of Leadership: Trait, Behavioural and Contingency. Leadership Styles and their Impact.	**9**
3	**Controlling Process:** Steps in Control Process, Types of Control - Feedforward, Concurrent and Feedback. Tools of Control - Budgets, Break-even Analysis and Audits. **Contemporary Issues in Management:** Corporate Social Responsibility (CSR), Ethics in Management, Globalization and its Impact on Management, Emerging Trends - Agile Management, Digital Transformation.	**9**

4	**Introduction to Accounting:** Accounting Concepts and Conventions, Double Entry System. **Basic Accounting Terms:** Assets, Liabilities, Capital, Revenue, Expenses, Ledger, Journal, and Trial Balance. **Journal Entries, Ledger Posting.** **Subsidiary Books:** Purchase Book, Sales Book, Cash Book, Petty Cash Book, Bank Reconciliation Statement **Preparation of Final Accounts:** Trial Balance, Final Accounts without Adjustments - Trading Account, Profit and Loss Account, Balance Sheet.	**14**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe and differentiate the core concepts and functions of management, and apply decision-making models and planning processes to real-world management scenarios.	**K2**
CO2	Understand different organizational structures and leadership theories, and assess how delegation of authority, centralization vs. decentralization, and leadership styles influence organizational effectiveness.	**K2**
CO3	Explain the steps and types of control processes, and evaluate contemporary management issues and emerging trends such as CSR, ethics, globalization, agile management, and digital transformation.	**K2**
CO4	Apply accounting concepts and conventions to accurately record transactions, post journal entries, maintain subsidiary books, prepare final accounts.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Management Principles, Processes, and Practices	Anil Bhat, Arya Kumar	Oxford University Press	2008
2	Management: A Global, Innovative, And Entrepreneurial Perspective	Heinz Weihrich, Mark V Cannice, Harold Koontz	McGraw-Hill	15th Edition 2019
3	Principles and Practice of Management	L.M. Prasad	Sultan Chand & Sons-New Delhi	2019
4	Financial Accounting	S.N. Maheshwari, Suneel K Maheshwari, Sharad K Maheshwari	Vikas Publishing House	6th Edition 2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Essentials of Management	Harold Koontz, Heinz Weihrich, Mark V. Cannice	McGraw-Hill	11th Edition 2020
2	Principles of Management	P.C. Tripathi, P.N. Reddy, Ashish Bajpai	McGraw-Hill	7th Edition 2021
3	Management Theory and Practice	J.S. Chandan	Vikas Publishing House	1987
4	Principles and Practice of Accountancy	R.L Gupta , V.K. Gupta	Sultan Chand & Sons-New Delhi	2019
5	Introduction To Accountancy	T.S. Grewal, S.C. Gupta	S. Chand Publishing	2024

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://nptel.ac.in/courses/110107150
2	https://onlinecourses.nptel.ac.in/noc21_mg88/preview
3	https://onlinecourses.nptel.ac.in/noc24_mg81/preview
4	https://onlinecourses.nptel.ac.in/noc24_ec01/preview

SEMESTER S1

DIGITAL ELECTRONICS & LOGIC DESIGNS

Course Code	**BCPCT104**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To introduce students the principles of data conversion and digital system.
2. To provide insight into digital systems and logic circuit design.
3. To equip students with practical skills for designing and implementing combinational and sequential circuits.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Number Systems:** Number systems: Decimal numbers, Binary numbers, Octal numbers, Hexadecimal numbers, and their mutual conversions. **Binary arithmetic:** Addition and subtraction of binary numbers, unsigned and signed numbers, 1's and 2's complement, signed numbers, addition and subtraction with signed numbers, floating-point operations. Error detection and correction, Weighted code - BCD code, Gray code, Excess-3 code, Non weighted codes - ASCII, EBCDIC.	**8**
2	**Logic Gates:** AND gate, OR gate, NOT gate, NAND gate, NOR gate, X-OR gate, X-NOR gate, The universal property of NAND gate and NOR gate, Realization of basic gates. **Boolean Algebra:** Boolean operations and expressions, Laws and rules of Boolean algebra, Demorgan's Theorem, Boolean expressions, Simplification of Boolean expression. Boolean expression for logic circuits, Sum of Products method, Product of Sum method, Karnaugh map SOP with examples.	**10**
3	**Combinational circuits:** Basic Adders: Half adder and Full adder, Subtractors: Half subtractor and Full subtractor, Decoders, Encoders, Multiplexer, Demultiplexer. **Sequential circuits:** Latches, Flip-Flops - SR flip-flop, D flip-flop, JK flip-flop, T flip-flop, Master slave JK flip-flop, Timing diagrams.	**13**

4	**Registers:** SISO, SIPO, PISO, PIPO, Bidirectional Shift Register. **Counters:** Asynchronous Counters, Decade counter. Synchronous counters, Decade counter, up/down counter, Mod N counter. Digital to Analog Conversion, Analog to Digital Conversion.	**13**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Apply various number systems concepts to perform arithmetic operations, number conversions and error detection and correction.	**K3**
CO2	Apply the principles of logic gates and Boolean algebra to design, simplify, and implement digital circuits, utilizing methods such as Sum of Products, Product of Sum, and Karnaugh maps for optimized circuit realization.	**K3**
CO3	Describe the operations and functionalities of basic combinational circuits, such as adders, subtractors, decoders, encoders, multiplexers, and demultiplexers, as well as the fundamental concepts of sequential circuits, including various types of flip-flops.	**K2**
CO4	Explain the principles and operations of different types of registers and counters, as well as the fundamental methods of digital-to-analog and analog-to-digital conversions.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Fundamentals	Thomas L. Floyd	Pearson	11th Edition 2017

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Digital Principles and Applications	Donald P Leach, Albert Paul Malvino, Goutam Saha	McGraw Hill Education	8th Edition 2014
2	Logic and Computer Design Fundamentals	M. Morris Mano, Charles Kime	Pearson Education India	4th Edition 2013
3	Fundamentals of Digital Circuits	A. Anand Kumar	PHI Publications	4th Edition 2016
4	Digital Computer Fundamentals	Thomas C. Bartee	Tata Mcgraw Hill Education	6th Edition 2010

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_ee147/preview
2	https://onlinecourses.nptel.ac.in/noc24_ee52/preview
3	https://onlinecourses.nptel.ac.in/noc24_ee17/preview

SEMESTER S1

STRUCTURED PROGRAMMING USING C

Course Code	**BCPCT105**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To introduce students to the fundamental concepts of programming using the C language.
2. To develop problem-solving skills by translating algorithms into C programs.
3. To understand and apply control structures, functions, arrays, pointers, and file handling in C.
4. To enable students to write efficient, readable, and well-documented C programs.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Introduction to C Programming** **Introduction:** Types of Programming Languages - Structured Programming - Algorithms and Flowcharts with examples. **History and Features of C:** Overview of the C language, its evolution, and its role in programming. **Basic Structure of a C Program:** Explanation of the components of a C program, including header files, main function, and statements. **Data Types and Variables:** Introduction to various data types, variables, constants, and keywords. **Operators in C:** Arithmetic, relational, logical, bitwise, assignment, and other operators. **Input and Output:** Single character input - getchar, getch, getc, Single character output - putchar, putc, Formatted I/O – printf, scanf, gets, puts. **Basic Program Structure:** Writing, compiling, and executing simple C programs.	**11**
2	**Control Structures and Functions:** **Conditional Statements:** if, if-else, nested if, switch-case statements. **Looping Structures:** for, while, do-while loops; break, continue, and goto statements. **Functions:** Introduction to functions, need for functions, function declaration, definition, and calling; return values, recursion, and storage classes. **Parameter Passing:** Call by value and call by reference.	**10**
3	**Arrays, Strings, and Pointers:**	**12**

	Arrays: Definition, declaration, and initialization of one-dimensional and multi-dimensional arrays; array operations. **Strings:** Introduction to strings, string handling functions (strlen, strcpy, strcmp, strcat, etc.). **Pointers:** Introduction to pointers, pointer arithmetic, pointers and arrays, pointers to functions, pointers to structures.	
4	**Structures, Unions, and File Handling:** **Structures and Unions:** Definition and declaration, accessing structure members, array of structures, nested structures, structure pointers, unions, and comparison with structures. **File Handling:** Basics of file operations, opening and closing a file, reading, and writing to files, file pointers, error handling in file operations.	**11**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamental concepts of programming, including the C language's basic structure, effective usage of data types, operators, and I/O functions, and write, compile, and execute simple C programs.	**K3**
CO2	Use conditional statements and looping structures, design and implement functions with various parameter-passing techniques, and apply recursion to solve problems in C programming.	**K3**
CO3	Use arrays and strings for data manipulation and apply pointers for dynamic memory management and complex data structures in C programming.	**K3**
CO4	Operate on structures and unions for complex data organization and perform file operations effectively in C programming.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The C Programming Language	Brian W. Kernighan, Dennis Ritchie	Pearson Education India	2nd Edition 2015
2	Programming in ANSI C	E Balagurusamy	McGraw Hill	9th Edition 2024
3	Let Us C	Yashavant Kanetkar	BPB Publications	19th Edition 2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	C: The Complete Reference	Herb Schildt	McGraw Hill Education	4th Edition 2017
2	Programming With C	Byron Gottfried, Jitender Chhabra	Tata McGraw-Hill	3rd Edition 2010
3	C How to Program	Paul Deitel, Harvey Deitel	Pearson Education Limited	9th Edition 2022

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs02/preview
2	https://onlinecourses.nptel.ac.in/noc24_cs123/preview
3	https://onlinecourses.nptel.ac.in/noc24_cs128/preview

SEMESTER S1 - BCA

STRUCTURED PROGRAMMING LAB

Course Code	**BCPCL106**	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:4:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

1. Gain a strong foundation in C programming by learning and applying fundamental constructs such as data types, operators, control structures, and basic I/O operations.
2. Enhance problem-solving abilities through the design and implementation of functions, including recursion, and by understanding different parameter-passing techniques.
3. Acquire skills in managing arrays, strings, and dynamic memory, and understand the use of pointers for efficient data handling and memory management.
4. Learn to use advanced features such as structures, unions, and file handling, to write robust, modular, and maintainable C programs.

Experiment No.	Experiments
1	Program to Add Two Numbers
2	Program to Check Whether a Number is Prime or Not
3	Program to Swap Two Numbers
4	Program to Calculate Fahrenheit to Celsius
5	Program to Print Prime Numbers From 1 to N
6	Program to find Simple Interest
7	Program to find Compound Interest
8	Program for Area and Perimeter of Rectangle
9	Program to Check Whether a Character is Vowel or Consonant
10	Program to Find Largest Number Among Three Numbers
11	Program to Check Leap Year
12	Program to Find Factorial of a Number
13	Program to Print Fibonacci Series
14	Program to Display Armstrong Numbers Between 1 to 1000
15	Program to Reverse a Number

16	Program to Check Whether a Number is a Palindrome or Not
17	Program to find all Factors of a Natural Number
18	Program to Print Pascal's Pattern Triangle Pyramid
19	Program to Find All Roots of a Quadratic Equation
20	Program to Calculate the Factorial of a Number Using Recursion
21	Program to Calculate Power Using Recursion
22	Program to Find the Largest Element in an Array
23	Program to Find the Maximum and Minimum in an Array
24	Program to Check Whether Two Matrices Are Equal or Not
25	Program to Find the Transpose
26	Program to Add Two Matrices
27	Program to Add or Concatenate Two Strings
28	Program to check if the string is palindrome or not
29	Program to Reverse an Array or String
30	program to Reverse a String Using Recursion
31	Program to Compare Two Strings
32	Program to Insert a String into Another String
33	Program For Decimal to Binary Conversion
34	Program For Binary to Decimal Conversion
35	Program to convert Hexadecimal to Decimal and vice versa
36	Program to convert Octal to Decimal and vice versa
37	Program to Find the Largest Element in an Array using Pointers
38	Program to Swap Two Numbers using pointers
39	Program to Store Information of Students Using Structure
40	Program to Store Student Records as Structures and Sort them by Name
41	Program to Add Two Complex Numbers by Passing Structure to a Function
42	Program to Store Student Records as Structures and Sort them by Age or ID
43	Program to Read/Write Structure to a File
44	Program to Compare Two Files and Report Mismatches
45	Program to Append the Content of One Text File to Another

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Algorithm/Design/Procedure	Program/Code Efficiency	Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- ***Submission of Record:*** *Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Write, compile, and debug C programs that effectively utilize basic programming constructs such as data types, operators, control structures, and input/output functions.	**K3**
CO2	Demonstrate the ability to design and implement complex functions, including recursive solutions, and apply various parameter-passing techniques to solve programming challenges.	**K3**
CO3	Use arrays, strings, and pointers to manage and manipulate data.	**K3**
CO4	Design and implement programs using structures, unions, and file handling, ensuring code modularity, efficiency, and effective data management.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The C Programming Language	Brian W. Kernighan, Dennis Ritchie	Pearson Education India	2nd Edition 2015
2	Programming in ANSI C	E Balagurusamy	McGraw Hill	9th Edition 2024
3	Let Us C	Yashavant Kanetkar	BPB Publications	19th Edition 2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	C: The Complete Reference	Herb Schildt	McGraw Hill Education	4th Edition 2017
2	Programming With C	Byron Gottfried, Jitender Chhabra	Tata McGraw-Hill	3rd Edition 2010
3	C How to Program	Paul Deitel, Harvey Deitel	Pearson Education Limited	9th Edition 2022

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs02/preview
2	https://onlinecourses.nptel.ac.in/noc24_cs123/preview
3	https://onlinecourses.nptel.ac.in/noc24_cs128/preview

Continuous Assessment (25 Marks):

1. **Preparation and Pre-Lab Work (7 Marks)**
   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (7 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (6 Marks)**
   - Quality of Reports: Clarity, completeness, and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.

- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**
   - Oral Examination: Ability to explain the experiment, results, and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for End Semester Examination (50 Marks):

1. **Procedure/Design/Algorithm (10 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
   - Creativity and logic in algorithm and/or interface design.
2. **Program/Code Efficiency (15 Marks)**
   - Correctness of the program or procedure which leads to the output or result.
   - Efficiency of the code or procedure.
3. **Quality of Output (10 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.
   - Analysis and Interpretation: Validity of inferences drawn from the program output.
4. **Viva Voce (10 Marks)**
   - Ability to explain the experiment, procedure results and answer related question.
   - Proficiency in answering questions related to theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
   - Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S1

LINUX LAB

Course Code	**BCPCL107**	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:4:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

1. Gain comprehensive knowledge of file and directory management commands, along with text processing techniques, enabling efficient manipulation, organization, and handling of data within the Linux environment.
2. Develop proficiency in system and user management commands, including process control and user administration, to effectively manage and monitor Linux systems.
3. Acquire the skills to manage network configurations, troubleshoot connectivity issues, and handle disk storage, ensuring robust network and storage infrastructure.
4. Learn and apply concepts of filters and pipes, along with file compression and archiving techniques, to enhance command-line efficiency and streamline workflow automation in Linux.

Experiment No.	Experiments
1	Familiarize **File Management Commands** that are used for managing files and directories: Eg. *ls, cp, mv, rm, touch, mkdir, rmdir, chmod, chown, ln…*
2	Familiarize **Text Processing Commands** that are used for processing and manipulating text files: Eg. *cat, echo, grep, awk, sed, cut, sort, uniq, tr, wc…*
3	Learn the concepts of **filters and pipes**.
4	Familiarize **System Management Commands** that are used for managing the system, including users, processes, and hardware: Eg. *ps, top, kill, killall, nice, renice, bg, fg, jobs, uptime, df, du, free, uname, shutdown, reboot…*
5	Familiarize **User Management Commands** that are used for managing users and groups: Eg. *useradd, usermod, userdel, passwd, groupadd, groupdel, groups, who, su…*
6	Familiarize **File Compression and Archiving Commands** that are used for compressing and archiving files: Eg. *tar, gzip, gunzip, zip, unzip, bzip2, bunzip2…*
7	Familiarize **Networking Commands** that are used for managing network connections, configurations, and troubleshooting: Eg. *ping, ifconfig, ip, netstat, scp, ssh, ftp, wget…*
8	Familiarize **Disk and Storage Management Commands** that are used for managing disks, partitions, and storage devices: Eg. *fdisk, parted, mkfs, mount, umount, lsblk, df, du, fsck…*
9	Basic Script: Write a shell script that displays "Hello, World!" on the screen.

10	Variables: Create a script that stores your name in a variable and then prints "Hello, [Name]!".
11	Arithmetic Operations: Write a script that takes two numbers as input and performs addition, subtraction, multiplication, and division.
12	Conditional Statements: Write a script that checks if a number is even or odd.
13	Case Statement: Write a script that reads a character and checks if it is a vowel or a consonant.
14	Loop Basics: Write a script to print the first 10 natural numbers using a for loop.
15	While Loop: Create a script that uses a while loop to calculate the factorial of a number.
16	Read User Input: Write a script that prompts the user to enter a file name and then checks if the file exists.
17	File Test Operators: Write a script to check if a given file is a regular file, a directory, or does not exist.
18	String Comparison: Write a script that compares two strings and checks if they are equal.
19	File Operations: Write a script that reads a file line by line and prints each line with its line number.
20	Command-Line Arguments: Write a script that accepts a file name as a command-line argument and displays the content of the file.
21	Environment Variables: Create a script that prints the current user's home directory, shell, and path using environment variables.
22	Arrays: Write a script that stores a list of names in an array and prints each name using a loop.
23	User Interaction: Write a script that prompts the user for a directory name and lists all files in that directory.
24	Pattern Matching: Write a script to count the number of files in the current directory with a specific extension (e.g., .txt).
25	File Permission Check: Create a script that checks if a file has read, write, and execute permissions.
26	String Manipulation: Write a script that takes a string as input and outputs the string in reverse.
27	Date and Time: Write a script that displays the current date and time in the format DD/MM/YYYY HH:MM:SS.
28	Recursive Functions: Create a script that uses a recursive function to find the GCD (Greatest Common Divisor) of two numbers.
29	Backup Script: Write a script that creates a backup of a directory by copying it to a new location with the current date as part of the name.
30	User Management: Write a script to add a new user to the system and set up a home directory with default files.
31	Process Management: Write a script that checks if a given process is running and starts it if it's not.

32	Cron Jobs: Create a script that sets up a cron job to run a specific task every day at a particular time.
33	System Monitoring: Write a script that monitors disk usage and sends an alert if it exceeds a certain threshold.
34	Network Information: Create a script that displays the current IP address and the network interface details.
35	Logging: Write a script that logs system events (like user logins) to a file with a timestamp.
36	Compression Script: Write a script that compresses all log files in a directory into a single archive.

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

Algorithm/Design/Procedure	Program/Code Efficiency	Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- ***Submission of Record:*** *Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Demonstrate the ability to use file management commands to create, organize, and manipulate files and directories, ensuring effective data handling within the Linux environment.	**K3**
CO2	Apply text processing commands to extract, filter, and transform text data, using concepts of filters and pipes to automate and streamline data processing tasks.	**K3**
CO3	Utilize system and user management commands to control processes, manage user accounts, and monitor system performance, contributing to effective system administration and user management.	**K3**
CO4	Configure and troubleshoot network connections, and manage disk storage efficiently using networking and disk management commands, ensuring a well-maintained and secure Linux system.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Unix Shell Programming	Yashavant Kanetkar	BPB Pushlications	2003
2	Mastering Linux Shell Scripting	Mokhtar Ebrahim, Andrew Mallett	Packt Publishing Ltd	2018
3	Linux Command Line and Shell Scripting Bible	Richard Blum, Christine Bresnahan	Wiley	4th Edition 2020

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Learning the bash Shell	Cameron Newham	O'Reilly Media	2005
2	Learning Linux Shell Scripting	Ganesh Naik	Packt Publishing	2nd Edition 2018
3	Linux Shell Scripting Cookbook	Clif Flynt, Sarath Lakshman, Shantanu Tushar	Packt Publishing	3rd Edition 2017

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://archive.nptel.ac.in/courses/117/106/117106113/
2	https://onlinecourses.swayam2.ac.in/aic20_sp24/preview

Continuous Assessment (25 Marks):

1. **Preparation and Pre-Lab Work (7 Marks)**
   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (7 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (6 Marks)**
   - Quality of Reports: Clarity, completeness, and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.
4. **Viva Voce (5 Marks)**
   - Oral Examination: Ability to explain the experiment, results, and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for End Semester Examination (50 Marks):

1. **Procedure/Design/Algorithm (10 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
   - Creativity and logic in algorithm and/or interface design.
2. **Program/Code Efficiency (15 Marks)**
   - Correctness of the program or procedure which leads to the output or result.
   - Efficiency of the code or procedure.
3. **Quality of Output (10 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.
   - Analysis and Interpretation: Validity of inferences drawn from the program output.
4. **Viva Voce (10 Marks)**
   - Ability to explain the experiment, procedure results and answer related question.
   - Proficiency in answering questions related to theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
   - Completeness, clarity, and accuracy of the lab record submitted

SEMESTER 2

Bachelor of Computer Application

SEMESTER S2

TECHNICAL COMMUNICATION

Course Code	**BCAET201**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Mns
Prerequisites (if any)	BCAET101: Professional English	Course Type	Theory

Course Objectives:

1. To develop proficiency in academic and technical writing.
2. To enhance vocabulary and grammatical accuracy for technical communication.
3. To master diverse writing formats.
4. To develop presentation and communication skills.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (36 Hrs)
1	**The Process of Writing:** **Academic writing:** Purpose of academic writing - types of academic writing **Structuring the essay:** planning an essay- brain-storming- organizing and outlining- writing a thesis statement- nature of supporting sentences- writing paragraphs- structure of an essay. **Vocabulary for writing:** Selection of vocabulary –abbreviations- choice of nouns and adjectives- appropriate verbs and adverbs- conjunctions and prepositions- prefixes and suffixes- synonyms- common errors. **Composing the content:** writing introductions and conclusions- ordering the paragraphs - proof-reading and editing- finalising the essay.	**11**
2	**Elements of Writing:** Articles - Nouns and prepositions - Subject-verb agreement - Phrasal verbs - Modals - Tenses - Conditionals – Prefixes and suffixes – Prepositions - Adverbs – Relative pronouns - Passives - Conjunctions - Embedded questions - Punctuation – Abbreviations.	**7**
3	**Writing Models:** Letters - Resume and covering letters - Email - Filling application forms - Notices - Minutes - Agenda – Essays writing product reviews-writing case studies, designing questionnaires - Seminar papers – Project reports.	**9**
4	**Presentation Skills:** Soft skills for academic presentations - Effective communication skills – Structuring the presentation - Choosing appropriate medium – Flip charts – PowerPoint presentation – Clarity and brevity - Interaction and persuasion - Interview skills –Group Discussions.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	10	12.5	12.5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Compose a well-structured academic essay on a given topic by planning, brainstorming, organizing, and outlining and by utilizing appropriate vocabulary and grammatical structures.	**K3**
CO2	Accurately use a range of grammatical elements to produce clear and grammatically precise texts.	**K3**
CO3	Effectively produce a variety of professional and academic documents by applying appropriate formatting, style, and content conventions to meet the specific requirements of each document type.	**K3**
CO4	Deliver clear, structured, and engaging academic presentations by utilizing effective communication skills, selecting appropriate presentation mediums, and ensuring clarity and brevity.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	College Writing Skills with Readings	John Langan, Zoe Albright	McGraw Hill Education	11th Edition 2023
2	Critical Thinking Academic Writing	Pramod K. Nayar, Marilyn Anderson, Madhucchanda Sen	Pearson Education	2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Successful College Writing: Skills - Strategies - Learning Styles	Kathleen T. McWhorter	Bedford Books	5th Edition 2011
2	Writing for Academic And Professional Success	Jacob George, Anwar Sadath	Maximum Publishers	2017
3	Technical Writing, Presentation Skills and Online Presentation	Greenlaw, Raymond	Information Science Reference	2012
4	Academic Writing and Grammar for Students	Alex Osmond	SAGE Publications	2013
5	Technical Communication: A Reader-Centered Approach	Paul V. Anderson	Wadsworth Pub Co	7th Edition 2010
6	Interchange Student's Book 2	Jack C. Richards	Cambridge University Press	5th Edition 2017
7	Interchange Student's Book 3	Jack C. Richards	Cambridge University Press	5th Edition 2017

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://nptel.ac.in/courses/109106094
2	https://onlinecourses.nptel.ac.in/noc22_hs05/preview
3	https://onlinecourses.nptel.ac.in/noc24_ge37/preview
4	https://nptel.ac.in/courses/109104031

SEMESTER S2

DISCRETE MATHEMATICS

Course Code	**BCPCT202**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCT102: Foundational Mathematics	Course Type	Theory

Course Objectives:

1. To develop proficiency in mathematical logic and proof techniques.
2. To equip students with the ability on using combinatorial analysis and recurrence relations.
3. To familiarize students with the concepts and applications of graph theory.
4. To help students grasp fundamental concepts of groups, rings, and Boolean algebra, and their applications in computer applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Mathematical Logic and Proof Techniques:** **Propositional and Predicate Logic:** Syntax, Semantics, Proof techniques. **Methods of Proof:** Direct, Indirect, Contradiction, and Contrapositive. **Mathematical Induction:** Principle, Applications, Strong induction.	**11**
2	**Combinatorics:** **Counting Principles:** Permutations and combinations, Binomial coefficients, Multinomial theorem. **Recurrence Relations:** Formulation, Solving linear recurrence relations, Homogeneous and non-homogeneous relations. **Generating Functions:** Ordinary and exponential generating functions, Applications.	**11**
3	**Graph Theory:** **Introduction to Graphs:** Types, Representation, Subgraphs, Graph isomorphism. **Trees:** Properties, Binary trees, Spanning trees, Minimum spanning trees. **Algorithms:** Dijkstra's, Kruskal's, and Prim's algorithms, Shortest path, and Network flows.	**11**
4	**Algebraic Structures:** **Groups and Rings:** Definitions, Examples, Homomorphisms, Subgroups, Cosets, Lagrange's theorem. **Boolean Algebra:** Boolean functions, Simplification of Boolean expressions, Karnaugh maps. Applications of Algebraic Structures in Computer Science.	**11**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	10	12.5	12.5	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Apply propositional and predicate logic to formulate and validate logical arguments and solve real-world problems in computing and discrete mathematics.	**K3**
CO2	Apply counting principles such as permutations, combinations, and the binomial theorem, along with recurrence relations and generating functions, to model and solve complex counting problems and analyse recurrence-based computational algorithms in various applications.	**K3**
CO3	Apply graph theory concepts, including graph types, trees, and algorithms, to solve real-world problems related to shortest paths, network flows, and spanning trees in computer networks and optimization tasks.	**K3**
CO4	Use the concepts of groups, rings, and Boolean algebra, including homomorphisms, Lagrange's theorem, and Karnaugh maps, to simplify logical expressions and solve algebraic problems.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw Hill Education	8th Edition 2021
2	Discrete Mathematics	R. K. Bisht, H. S. Dhami.	Oxford University Press, New Delhi.	2015

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Discrete Mathematical Structures	Bernard Kolman, Robert Busby, Sharon C. Ross	Pearson Education India	6th Edition 2015
2	Discrete Mathematics	Chandrasekaran N., Umaparvathi M.	PHI	3rd Edition 2022
3	Graph Theory with Applications to Engineering and Computer Science	Narsingh Deo	PHI	1979
4	Discrete Mathematics	B.S. Vatsa	New Age Publishers	4th Edition 2009

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs98/preview
2	https://onlinecourses.nptel.ac.in/noc24_cs58/preview
3	https://onlinecourses.nptel.ac.in/noc22_cs49/preview
4	https://nptel.ac.in/courses/111106102

SEMESTER S2

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code	BCPCT203	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCT104: Digital Electronics & Logic Designs	Course Type	Theory

Course Objectives:

1. To understand the fundamental concepts of computer organization and architecture.
2. To analyze the performance of computer systems.
3. To explore the various components of a computer system, including the CPU, memory, and I/O devices.
4. To understand instruction sets and the execution of instructions.
5. To gain knowledge of advanced topics such as pipelining, parallelism, and memory hierarchy.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Basic Structure of Computers:** **Introduction to Computer Systems:** Overview of Computer Architecture and Organization, Basic structure and functions of a computer system, Evolution of computers. **Data Representation:** Number systems, Conversion between different number systems, Representation of negative numbers, Binary arithmetic. **Computer Arithmetic:** Floating-point representation, Fixed-point representation, Arithmetic operations on fixed and floating-point numbers, ALU design basics.	**8**
2	**Processor Design and Control Unit:** **Basic Processor Organization:** CPU structure and functions, Instruction format, types, and execution cycle, RISC vs. CISC architectures, Register organization. **Control Unit Design:** Hardwired control, Microprogrammed control, Design of control unit, Control memory and address sequencing. **Instruction Set Architecture (ISA):** Characteristics of instruction sets, Addressing modes, Instruction types - Data transfer, arithmetic, logical, control, I/O, Examples of typical instruction set architecture.	**12**
3	**Memory Organization:** **Memory Hierarchy:** Introduction to memory hierarchy, Cache memory - Organization, mapping techniques, replacement algorithms, Main memory - RAM, ROM, DRAM, SRAM.	**11**

	Virtual Memory: Concept of virtual memory, Paging and segmentation, Page replacement algorithms. **Memory Interfacing:** Memory interfacing with the CPU, Memory-mapped I/O, Direct Memory Access (DMA). **Secondary Storage:** Magnetic storage - Hard disks, magnetic tapes, Optical storage - CDs, DVDs, Solid-state drives (SSD).	
4	**Advanced Concepts in Computer Architecture:** **Pipelining:** Introduction to pipelining, Pipeline performance, Hazards in pipelining: Structural, data, and control hazards, Techniques to resolve hazards. **Parallel Processing:** Parallelism in uniprocessor systems, Multi-core processors, Flynn's taxonomy - SISD, SIMD, MISD, MIMD. **Input-Output Organization:** I/O interface, I/O communication techniques - Programmed I/O, Interrupt-driven I/O, and DMA, Bus structures and bus arbitration.	**13**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the basic structure and functions of computer systems, including number systems, data representation, and fundamental arithmetic operations used in computer architecture.	**K2**
CO2	Describe the design and operation of the CPU and control unit, including instruction formats, execution cycles, RISC vs. CISC architectures, and various instruction set architectures.	**K2**
CO3	Explain the organization and hierarchy of memory systems, including cache, virtual memory, memory interfacing, and secondary storage technologies.	**K2**
CO4	Grasp advanced computer architecture concepts, including pipelining, parallel processing, I/O organization, and emerging computer architectures.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer System Architecture	Mano M Morris	Pearson Education	3rd Edition 2017
2	Computer Organization and Architecture: Designing for Performance	William Stallings	Pearson Education	11th Edition 2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Organization	Carl Hamacher, Zvonks Vranesic, Safea Zaky	McGraw Hill, India	5th Edition 2009
2	Structured Computer Organization	Andrew S. Tanenbaum, Todd Austin	Pearson Education	6th Edition 2016
3	Computer Architecture: A Quantitative Approach	John L. Hennessy, David A. Patterson	Morgan Kaufmann	6th Edition 2017

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs83/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs61/preview
3	https://onlinecourses.nptel.ac.in/noc21_cs37/preview
4	https://nptel.ac.in/courses/106106166

SEMESTER S2

DATA STRUCTURES

Course Code	**BCPCT204**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCT105: Structured Programming using C	Course Type	Theory

Course Objectives:

1. To understand the fundamental concepts of data structures and algorithms.
2. To develop problem-solving skills using different data structures.
3. To learn the implementation and application of various data structures like stacks, queues, linked lists, trees, and graphs.
4. To implement, analyse, and compare the efficiency of basic searching algorithms and various sorting algorithms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Introduction to Data Structures and Algorithms:** **Introduction to Data Structures:** Definition and classification of data structures, Types of data structures, Operations on data structures. **Algorithm Analysis:** Introduction to algorithms, Time and Space complexity, Big O, Big Ω, and Big Θ notations, Best, average, and worst-case complexities. **Arrays:** Representation of linear arrays in memory, Array operations - traversal, insertion, deletion, Multi-dimensional arrays and their applications, sparse matrices. **Pointers:** Dynamic memory allocation and de-allocation, Self-Referential Structures, Polynomial Representation. **Strings:** String manipulation and operations, Common string functions.	**12**
2	**Linear Data Structures:** **Linked Lists:** Introduction to linked lists, Types of linked lists - Singly linked list, Doubly linked list, Circular linked list, Operations on linked lists - Insertion, Deletion, Traversal, Searching, Applications of linked lists. **Stacks:** Introduction and applications of stacks, Implementation using arrays and linked lists, Stack operations – push and pop, Applications of stack - Infix to Postfix conversion, Postfix evaluation, Recursive function calls.	**11**

	Queues: Introduction and applications of queues, Types of queues - Simple queue, Circular queue, Deque, Priority queue, Implementation using arrays and linked lists, Queue operations - enqueue, dequeue, Applications of queues.	
3	**Non-Linear Data Structures:** **Trees:** Introduction to trees, Terminologies - node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth. Binary trees - Types, properties, and traversal methods (in-order, pre-order, post-order). Binary Search Trees (BST) - Insertion, Deletion, Searching. AVL trees - Properties. **Graphs:** Introduction to graphs and their types, Graph representation - Adjacency matrix, Adjacency list, Graph traversal algorithms - Depth-First Search (DFS), Breadth-First Search (BFS), Minimum spanning tree algorithms - Prim's algorithm and Kruskal's algorithm, Shortest path algorithm - Dijkstra's algorithm.	**11**
4	**Searching and Sorting Algorithms:** Basic searching algorithms - Linear search and Binary search. Sorting algorithms - Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, and their complexities.	**10**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Implement basic data structures such as arrays, pointers, strings etc, use algorithmic analysis techniques and apply dynamic memory management to solve real-world computational problems.	**K3**
CO2	Apply linear data structures such as linked lists, stacks, and queues to implement and solve practical problems.	**K3**
CO3	Design non-linear data structures such as trees and graphs by implementing operations like insertion, deletion, and traversal in binary trees and binary search trees, to solve real-world problems involving hierarchical data and network structures.	**K3**
CO4	Implement basic searching algorithms and various sorting algorithms to optimize data organization and retrieval processes.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Data Structures	Reema Thareja	Oxford University Press	3rd Edition 2023
2	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed.	W.H. Freeman & Co Ltd	2nd Edition 2018

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Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT Press	3rd Edition 2009
2	Data Structures with C, Schaum's Outlines Series	Seymour Lipschutz	Tata McGraw Hill	2nd Edition 2014
3	Data Structures	R. Venkatesan, S. Lovelyn Rose	Wiley India Pvt. Ltd. Publications	2nd Edition 2019

4	Data Structures Through C	Yashwant Kanetkar	BPB Publication	9th Edition 2010
5	Data Structures Through C in Depth	S.K. Srivastava, Deepali Srivastava	BPB Publication	2nd Edition 2021
6	An Introduction to Data Structures with Applications	Tremblay J.P, Sorenson P.G	Tata McGraw Hill	2nd Edition 2002

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.swayam2.ac.in/nou23_cs13/preview
2	https://nptel.ac.in/courses/106102064
3	https://archive.nptel.ac.in/courses/106/106/106106127/
4	https://archive.nptel.ac.in/courses/106/105/106105085/

SEMESTER S2

OBJECT ORIENTED PROGRAMMING USING JAVA

Course Code	**BCPCT205**	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCT105: Structured Programming using C	Course Type	Theory

Course Objectives:

1. To familiarize the Java programming environment, syntax, and core constructs such as data types, variables, operators, control statements, and arrays.
2. To apply object-oriented programming concepts like classes, objects, inheritance, polymorphism, method overloading and method overriding.
3. Learn to work with packages, interfaces, exception handling, multithreading, input/output operations, and file handling for building robust and efficient Java applications.
4. Explore Java's built-in libraries, including string handling and the Collections Framework, to manage data and perform complex operations efficiently.

SYLLABUS

Module No.	Syllabus Description	Contact Hours (44 Hrs)
1	**Introduction:** The History and Evolution of Java, Java programming Environment and Runtime Environment, Development Platforms, How Java Impacted the Internet, Java Virtual Machine (JVM), Java Compiler, Bytecode, Java Applet, Servlets. **Data Types, Variables, Literals, Operators, Control Statements.** **Arrays:** One-Dimensional Arrays, Multidimensional Arrays, Irregular Arrays. **Object Oriented Programming in Java:** Class Fundamentals, Declaring Objects, Object Reference, Introduction to Methods, Constructors, this Keyword, Garbage Collection. **Methods and Classes:** Method Overloading, Using Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Static Members, Final Variables, Nested and Inner Classes, The String Class, Command Line Arguments, Variable Length Arguments, Local Variables.	**12**

2	**Inheritance:** Super Class, Sub Class, The keyword super, protected members, Calling Order of Constructors, Method Overriding, the Object class, Dynamic Method Dispatch, Abstract Classes and Methods, using final with Inheritance. **Packages and Interfaces:** Packages, Packages and Member Access, Importing Packages, Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods	**11**
3	**Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws and finally. **Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads. **Input/Output:** I/O Basics, Reading Console Input, Writing Console Output, PrintWriter Class, Working with Files, Object Streams, and Serialization.	**11**
4	**String Handling Library:** String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying Strings, Data conversion using valueOf(), Comparison of StringBuffer and String. **Collections Framework Library:** Collections overview, Collection Interfaces – List, Set, Queue, Deque, Collections Classes – ArrayList, LinkedList, Accessing a Collection via an Iterator.	**10**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**10**	**12.5**	**12.5**	**40**

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions		
Part A	**Part B**	**Total**
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Apply Java programming fundamentals, including object-oriented principles, control structures, data types, and arrays, to design and implement functional and efficient Java applications.	**K3**
CO2	Apply inheritance and interface concepts in Java to design and implement modular and extensible applications, utilizing superclass-subclass relationships, method overriding, abstract classes, and interface methods for effective code organization and reusability.	**K3**
CO3	Develop programs using exception handling techniques, multithreaded programming, and I/O operations in Java to create robust, concurrent, and data-driven applications, managing runtime errors effectively and handling file and stream operations.	**K3**
CO4	Utilize Java's String handling library and Collections Framework to efficiently perform string operations, manage and manipulate data using various collection types, and implement effective data structures for application development.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Java: The Complete Reference	Herbert Schildt	Tata McGraw Hill	12th Edition 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Programming JAVA a Primer	Balagurusamy E.	McGraw Hill	5th Edition 2014
2	Java How to Program, Early Objects	Paul Deitel, Harvey Deitel	Pearson Education	11th Edition 2018
3	Introduction to Java Programming	Y. Daniel Liang	Pearson Education	7th Edition 2013
4	Core Java: An Integrated Approach	R Nageswara Rao	Dreamtech Press	2016
5	Java in A Nutshell	Flanagan D.	O'Reilly	5th Edition 2005
6	Head First Java	Sierra K.	O'Reilly	2nd Edition 2005

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs43/preview

SEMESTER S2

DATA STRUCTURES LAB

Course Code	BCPCL206	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:4:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCL106: Structured Programming Lab	Course Type	Lab

Course Objectives:

1. To provide hands-on experience in implementing and applying fundamental data structure operations in C.
2. To implement and manipulate linear data structures and related operations in C, enabling students to effectively solve problems involving data structures and to understand their applications in real-world scenarios.
3. To provide practical experience in implementing and manipulating tree data structures using C, to enhance students' understanding of tree structures and their applications in data organization and retrieval.
4. To provide hands-on experience in implementing and analyzing fundamental searching and sorting algorithms in C, focusing on their efficiency and performance in managing and organizing data.

Experiment No.	Experiments
1	**Array Operations:** Write a C program to perform the following operations on a one-dimensional array: (i) Traverse and print all elements (ii) Insert an element at a specific position (iii) Delete an element from a specific position (iv) Search for an element in the array and return its index.
2	**Multi-Dimensional Arrays:** Implement a C program to perform matrix addition and matrix multiplication using two-dimensional arrays.
3	**String Manipulation:** Write a C program to perform various string operations without using built-in string functions: (i) Find the length of a string (ii) Compare two strings (iii) Concatenate two strings (iv) Reverse a string (v) Check if a string is a palindrome.
4	**Recursion - Factorial Calculation:** Implement a recursive function in C to calculate the factorial of a given number.
5	**Recursion - Fibonacci Series:** Write a C program to generate the Fibonacci series up to a given number using both recursive and iterative methods.
6	**Recursion - Towers of Hanoi:** Implement the Towers of Hanoi problem using recursion in C. The program should print the steps involved in moving disks from the source to the destination peg.

7	**Dynamic Memory Allocation:** Write a C program to dynamically allocate memory for a one-dimensional array using malloc(). Perform insertion and deletion operations on the array. Deallocate the memory once operations are complete.
8	**Structures and Unions:** Define a structure in C to store information about a student (Name, Roll Number, Marks in three subjects). Write a program to input data for multiple students and calculate the total and average marks for each student. Also, demonstrate the use of unions in storing the same information.
9	**Polynomial Representation:** Implement a C program to represent a polynomial using a self-referential structure (linked list).
10	**Pointer Arithmetic and Array Operations:** Write a C program that demonstrates pointer arithmetic to access elements of a one-dimensional array. The program should perform basic operations like traversal, updating an element, and printing the array in reverse order using pointers.
11	**Singly Linked List Implementation:** Write a C program to create a singly linked list. Implement the following operations: (i) Insertion of a node at the beginning, end, and at a specific position (ii) Deletion of a node from the beginning, end, and from a specific position (iii) Traversal of the linked list to display all elements.
12	**Doubly Linked List Implementation:** Implement a doubly linked list in C. Your program should support the following operations: (i) Insertion of a node at the beginning, end, and at a specific position (ii) Deletion of a node from the beginning, end, and from a specific position (iii) Traversal of the list in both forward and reverse directions.
13	**Circular Linked List Implementation:** Create a circular linked list in C. Implement the following operations: (i) Insertion of a node at the end of the list (ii) Deletion of a node from the beginning of the list (iii) Traversal of the circular linked list.
14	**Linked List Searching:** Write a C program to search for an element in a singly linked list. If the element is found, return its position; otherwise, display a message indicating that the element is not present.
15	**Application of Linked Lists - Polynomial Addition:** Implement a C program to represent two polynomials as singly linked lists. Write a function to add the two polynomials and display the resulting polynomial.
16	**Stack Implementation Using Arrays:** Write a C program to implement a stack using arrays. Perform the following stack operations: (i) Push an element onto the stack (ii) Pop an element from the stack (iii) Display the top element of the stack (iv) Check if the stack is empty or full.
17	**Stack Implementation Using Linked Lists:** Implement a stack using a singly linked list in C. Write functions to perform the push and pop operations, and display the elements of the stack.
18	**Infix to Postfix Conversion:** Write a C program to convert an infix expression to a postfix expression using a stack. Display the postfix expression.

19	**Postfix Expression Evaluation:** Implement a C program to evaluate a postfix expression using a stack. The program should read a postfix expression as input and calculate the result.
20	**Queue Implementation Using Arrays:** Write a C program to implement a simple queue using arrays. Implement the following queue operations: (i) Enqueue an element (ii) Dequeue an element (iii) Display the front and rear elements of the queue (iv) Check if the queue is empty or full.
21	**Circular Queue Implementation:** Implement a circular queue using arrays in C. Write functions to perform the enqueue, dequeue, and display operations. Ensure that the circular queue handles the wrap-around condition.
22	**Deque Implementation Using Linked Lists:** Write a C program to implement a double-ended queue (Deque) using a doubly linked list. Implement the following operations: (i) Insertion at both ends (front and rear) (ii) Deletion from both ends (front and rear) (iii) Display the elements from front to rear.
23	**Binary Tree Creation and Traversal:** Write a C program to create a binary tree and perform the following traversal methods: (i) In-order traversal (ii) Pre-order traversal (iii) Post-order traversal (iv) Display the elements of the binary tree using each traversal method.
24	**Height and Depth of a Binary Tree:** Write a C program to calculate the height (maximum depth) of a binary tree. Additionally, calculate and display the depth of each node in the tree.
25	**Level Order Traversal of a Binary Tree:** Implement a C program to perform a level-order traversal (breadth-first traversal) of a binary tree. Display the nodes at each level.
26	**Linear Search Implementation:** Write a C program to implement the linear search algorithm. The program should: (i) Search for a key in an unsorted array (ii) Return the index of the key if found, otherwise return -1 (iii) Count the number of comparisons made during the search.
27	**Binary Search Implementation:** Implement the binary search algorithm in C. The program should: (i) Search for a key in a sorted array (ii) Return the index of the key if found, otherwise return -1 (iii) Count the number of comparisons made during the search.
28	**Bubble Sort Implementation:** Write a C program to implement the bubble sort algorithm. The program should: (i) Sort an array of integers in ascending order (ii) Display the number of swaps and comparisons made during the sorting process.
29	**Insertion Sort Implementation:** Implement the insertion sort algorithm in C. The program should: (i) Sort an array of integers in ascending order (ii) Display the number of comparisons and shifts made during the sorting process.
30	**Selection Sort Implementation:** Write a C program to implement the selection sort algorithm. Your program should: (i) Sort an array of integers in ascending order (ii) Display the number of comparisons and swaps made during the sorting process.

31	**Quick Sort Implementation:** Implement the quick sort algorithm in C. Your program should: (i) Sort an array of integers in ascending order (ii) Display the array after each partition step.
32	**Merge Sort Implementation:** Write a C program to implement the merge sort algorithm. Your program should: (i) Sort an array of integers in ascending order (ii) Display the array after each merge operation.

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

Algorithm/Design/Procedure	Program/Code Efficiency	Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- ***Submission of Record:*** *Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Implement fundamental data structure concepts and operations in C, including array manipulations, string handling, recursion techniques, dynamic memory management, and the use of structures, unions, and pointers.	**K3**
CO2	Implement and manage various types of linked lists, stacks, and queues using C, demonstrating proficiency in applying these data structures to solve complex computational problems.	**K3**
CO3	Design and implement binary trees in C, and effectively display the tree structure and node information to solve problems involving hierarchical data.	**K3**
CO4	To implement linear and binary search algorithms, as well as various sorting algorithms in C, effectively evaluating their performance in terms of comparisons, swaps, and shifts to optimize data handling and organization.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Data Structures	Reema Thareja	Oxford University Press	3rd Edition 2023
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1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT Press	3rd Edition 2009
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No.	**Link ID**
1	https://onlinecourses.swayam2.ac.in/nou23_cs13/preview
2	https://nptel.ac.in/courses/106102064
3	https://archive.nptel.ac.in/courses/106/106/106106127/
4	https://archive.nptel.ac.in/courses/106/105/106105085/

Continuous Assessment (25 Marks):

1. **Preparation and Pre-Lab Work (7 Marks)**
   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (7 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (6 Marks)**
   - Quality of Reports: Clarity, completeness, and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.
4. **Viva Voce (5 Marks)**
   - Oral Examination: Ability to explain the experiment, results, and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for End Semester Examination (50 Marks):

1. **Procedure/Design/Algorithm (10 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
   - Creativity and logic in algorithm and/or interface design.
2. **Program/Code Efficiency (15 Marks)**
   - Correctness of the program or procedure which leads to the output or result.
   - Efficiency of the code or procedure.
3. **Quality of Output (10 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.

- Analysis and Interpretation: Validity of inferences drawn from the program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related question.
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

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SEMESTER S2

OBJECT ORIENTED PROGRAMMING LAB

Course Code	**BCPCL207**	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:4:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCL106: Structured Programming Lab	Course Type	Lab

Course Objectives:

1. To familiarize the Java programming environment, syntax, and core constructs such as data types, variables, operators, control statements, and arrays.
2. To apply object-oriented programming concepts like classes, objects, inheritance, polymorphism, method overloading and method overriding.
3. Learn to work with packages, interfaces, exception handling, multithreading, input/output operations, and file handling for building robust and efficient Java applications.
4. Explore Java's built-in libraries, including string handling and the Collections Framework, to manage data and perform complex operations efficiently.

Experiment No.	Experiments
1	**Basic Java Program Structure:** Write a simple Java program that prints "Hello, World!" to understand the structure of a Java program, including class declaration, main method, and basic syntax.
2	**Data Types and Type Conversion:** Create a Java program that demonstrates the use of different primitive data types (int, float, char, boolean) and performs type conversion (implicit and explicit) between them.
3	**Arithmetic and Relational Operators:** Write a Java program that takes two integer inputs from the user and demonstrates the use of arithmetic and relational operators by performing and displaying the results of various operations.
4	**Bitwise and Logical Operators:** Develop a Java program to demonstrate the use of bitwise operators (AND, OR, XOR) and logical operators (&&, ||) with integer inputs.
5	**Ternary Operator and Assignment Operator:** Create a Java program that uses the ternary operator to find the maximum of two numbers and demonstrate the use of various assignment operators.
6	**Grade Calculation:** Create a Java program that accepts a student's score and uses nested if-else statements to assign a grade (A, B, C, D, or F) based on the score.
7	**Day of the Week:** Develop a Java program that takes an integer (1-7) from the user and uses a switch statement to print the corresponding day of the week (e.g., 1 = Sunday, 2 = Monday, etc.).

8	**Prime Number Check:** Create a Java program that uses a for loop to check whether a given number is prime or not.
9	**Reverse a Number:** Develop a Java program that takes an integer input and uses a while loop to reverse the digits of the number and print the result.
10	**Sum of Natural Numbers:** Write a Java program that uses a do-while loop to calculate and print the sum of the first N natural numbers, where N is provided by the user.
11	**Multidimensional Arrays:** Develop a Java program to create a 3x3 matrix, perform matrix addition, and print the resulting matrix.
12	**Creating and Using a Simple Class:** Write a Java program to create a class named Rectangle with attributes for length and width. Include methods to calculate the area and perimeter. Create objects of the class and demonstrate these methods.
13	**Using Constructors and this Keyword:** Develop a Java program to create a Student class with attributes like name, age, and rollNumber. Implement a parameterized constructor that uses the ***this*** keyword to initialize the attributes.
14	**Method Overloading:** Write a Java program that defines a class Calculator with overloaded methods named multiply. Implement methods that multiply two integers, two doubles, and three integers. Demonstrate method overloading by calling each version.
15	**Returning Objects from Methods:** Create a Java program where a class ComplexNumber represents complex numbers. Implement a method add that takes another ComplexNumber object, adds it to the current object, and returns a new ComplexNumber object as the result.
16	**Recursion in Methods:** Write a Java program to calculate the factorial of a number using a recursive method.
17	**Nested and Inner Classes:** Develop a Java program that creates a class Outer with a nested static class Inner and a non-static inner class InnerNonStatic. Demonstrate accessing the members of both inner classes.
18	**Passing Objects as Parameters:** Develop a Java program with a class Point that represents a point in 2D space. Implement a method distance that takes another Point object as a parameter and calculates the distance between the two points using the distance formula.
19	**Static Methods and Variables:** Write a Java program that defines a class Counter with a static variable count that keeps track of the number of objects created. Include a static method getCount to return the current count. Create multiple objects and display the count after each creation.
20	**Simple Inheritance and Method Overriding:** Write a Java program that demonstrates simple inheritance by creating a base class Person and a derived class Employee. Override a method in the derived class and show dynamic method dispatch using a base class reference.
21	**Calling Superclass Constructors:** Write a Java program that defines a base class Animal with a constructor that takes a string name. Create a derived class Dog that

	calls the superclass constructor using super and adds additional behavior. Demonstrate the order of constructor calls.
22	**Abstract Classes and Methods:** Develop a Java program that defines an abstract class Shape with an abstract method calculateArea. Implement two subclasses Circle and Rectangle, each providing its own implementation of calculateArea. Instantiate objects of these subclasses and calculate the area.
23	**Protected Members and Method Overriding:** Write a Java program with a base class BankAccount that has a protected member balance and a method deposit. Create a subclass SavingsAccount that overrides the deposit method to include interest calculation. Demonstrate the use of protected members in inheritance.
24	**Creating and Using Interfaces:** Create a Java program that defines an interface Shape with methods to calculate the area and perimeter. Implement this interface in classes Circle and Rectangle, and demonstrate polymorphism by using the interface reference to call the methods.
25	**Multiple Inheritance using Interfaces:** Write a Java program that demonstrates multiple inheritance using interfaces. Create two interfaces Printable and Showable, each with a method print() and show() respectively. Then, create a class Document that implements both interfaces and provides definitions for the methods. Instantiate the Document class and call both methods.
26	**Basic Exception Handling:** Write a Java program that demonstrates basic exception handling by using a try-catch block to handle an ArithmeticException when dividing a number by zero.
27	**Multiple catch Clauses:** Create a Java program that demonstrates multiple catch clauses by catching both ArrayIndexOutOfBoundsException and NumberFormatException in a single try block.
28	**Creating Multiple Threads:** Develop a Java program that creates multiple threads (e.g., 3 threads) to perform different tasks simultaneously, such as printing different messages or performing different calculations.
29	**File Handling:** Write a Java program that reads data from a file using FileInputStream and writes the same data to another file using FileOutputStream.
30	**String Manipulation:** Develop a Java program that demonstrates various string operations such as concatenation, substring, and comparison using methods like concat(), substring(), and compareTo(). Also, demonstrate the difference between String and StringBuffer by modifying the string using both classes.
31	**Using ArrayList:** Write a Java program that demonstrates the use of ArrayList to store a collection of integers. Perform operations like adding elements, removing elements, and iterating through the list using an Iterator.
32	**Using LinkedList:** Create a Java program that uses LinkedList to implement a simple queue. Perform operations like enqueue (adding elements at the end), dequeue (removing elements from the front), and iterate through the queue.

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Algorithm/Design/Procedure	Program/Code Efficiency	Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- ***Submission of Record:*** *Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Apply Java programming fundamentals, including object-oriented principles, control structures, data types, and arrays, to design and implement functional and efficient Java applications.	**K3**
CO2	Apply inheritance and interface concepts in Java to design and implement modular and extensible applications, utilizing superclass-subclass relationships, method overriding, abstract classes, and interface methods for effective code organization and reusability.	**K3**
CO3	Develop programs using exception handling techniques, multithreaded programming, and I/O operations in Java to create robust, concurrent, and data-driven applications, managing runtime errors effectively and handling file and stream operations.	**K3**
CO4	Utilize Java's String handling library and Collections Framework to efficiently perform string operations, manage and manipulate data using various collection types, and implement effective data structures for application development.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Java: The Complete Reference	Herbert Schildt	Tata McGraw Hill	12th Edition 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Programming JAVA a Primer	Balagurusamy E.	McGraw Hill	5th Edition 2014
2	Java How to Program, Early Objects	Paul Deitel, Harvey Deitel	Pearson Education	11th Edition 2018
3	Introduction to Java Programming	Y. Daniel Liang	Pearson Education	7th Edition 2013
4	Core Java: An Integrated Approach	R Nageswara Rao	Dreamtech Press	2016
5	Java in A Nutshell	Flanagan D.	O'Reilly	5th Edition 2005
6	Head First Java	Sierra K.	O'Reilly	2nd Edition 2005

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_cs43/preview

Continuous Assessment (25 Marks):

1. **Preparation and Pre-Lab Work (7 Marks)**
   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (7 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (6 Marks)**
   - Quality of Reports: Clarity, completeness, and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.

- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**
   - Oral Examination: Ability to explain the experiment, results, and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for End Semester Examination (50 Marks):

1. **Procedure/Design/Algorithm (10 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
   - Creativity and logic in algorithm and/or interface design.
2. **Program/Code Efficiency (15 Marks)**
   - Correctness of the program or procedure which leads to the output or result.
   - Efficiency of the code or procedure.
3. **Quality of Output (10 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.
   - Analysis and Interpretation: Validity of inferences drawn from the program output.
4. **Viva Voce (10 Marks)**
   - Ability to explain the experiment, procedure results and answer related question.
   - Proficiency in answering questions related to theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
   - Completeness, clarity, and accuracy of the lab record submitted