



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



2nd Semester Syllabus for BCA Admission Batch 2026
(Tentative)

[illegible]



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



Syllabus and Lesson Plan

Subject Name: **Data Structures**

Credit: 4

Lecture Hours: 45

Subject Code: **BCACC201**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Prof. Dr. Rupam Bhattacharya
2. Prof. Kaustav Sarkar
3. Prof. Sucheta Chandra

Pre-requisite: Fundamental computer knowledge

Relevant Links:

1. Link for Study Material:

<https://drive.google.com/file/d/1I-HsKUMQbQMXKrdFkxs2m6qQOE22oLi-/view>

2. Link for NPTEL Course:

<https://nptel.ac.in/courses/106102064>

3. Link for Coursera Course:

<https://www.coursera.org/learn/data-structures>

4. Link for LinkedIn Learning Course:

[Programming Foundations: Data Structures Online Class | LinkedIn Learning, formerly Lynda.com](#)

COURSE OBJECTIVES:

1. Allow to assess how the choice of data structures and algorithm design methods impacts the performance of programs
2. To choose the appropriate data structure and algorithm design method for a specified application.
3. To solve problems using data structures such as linear lists, stacks, queues, binary trees and binary search trees writing programs for these solutions.
4. To efficiently implement the different data structures and solutions for specific problems.

COURSE OUTCOMES:

CO1: Analyze algorithms for time and computational complexity.

CO2: Select appropriate search techniques (Linear Search, Binary Search, and Hashing) based on the problem's nature.

CO3: Implement and apply Stacks, Queues, and Linked Lists to various problems.

CO4: Use non-linear data structures for search, insertion, and retrieval; evaluate time complexity of balanced and unbalanced trees, and apply these to relevant problems.

Module No	Topic	Sub Topic	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
Module 1	Introduction	Overview of fundamental concepts	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 1 Yeshavant Kanetkar, “Data Structures Through C” Chapter 1	International Academia: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-1-algorithms-and-computation/ Industry Mapping: CLion, Eclipse(IDE), Visual Studio, CLion, Clang	6
	Data Structure	Definition of data structure, Data structure operation	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 1 Yeshavant Kanetkar, “Data Structures Through C” Chapter 1		
	Algorithms	Complexity of Algorithms, Time Space trade off, Asymptotic Notations for Complexity of Algorithms, Sub-algorithms, Role of variables in data structures and algorithms, Importance and types of data in computing	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 1 Yeshavant Kanetkar, “Data Structures Through C” Chapter 2		

Module 2	Arrays	Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear arrays, Inserting and deleting, Multi-dimensional arrays, Matrices, Sparse Matrices	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 3 Yeshavant Kanetkar, “Data Structures Through C” Chapter 3	International Academia: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-2-data-structures-and-dynamic-arrays/ Industry Mapping: CLion, Eclipse(IDE), Visual Studio, CLion, Clang	14
	Linked Lists	Linked Lists, Representation in memory, Traversing, Searching, Memory allocation (Garbage collection, overflow, underflow), Insertion, Deletion, Circular linked lists, Doubly linked lists, Header linked lists	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 7 Yeshavant Kanetkar, “Data Structures Through C” Chapter 5		
	Stacks	Definition, Array representation, Linked representation, Polish notation, Evaluation of Postfix Expressions, Transforming Infix to Postfix Expressions	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 5 Yeshavant Kanetkar, “Data Structures Through C” Chapter 7		
	Queues	Definition, Array representation, Linked representation, Circular queues, Priority Queue, D-Queue	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 6 Yeshavant Kanetkar, “Data Structures Through C” Chapter 8		
Module 3	Trees	Introduction and Definition of Trees, Tree Terminology	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 8 Yeshavant Kanetkar, “Data Structures Through C” Chapter 9	International Academia: 1. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-6-binary-trees-part-1/	10

	Binary Tree	Representing Binary Trees in Memory, Traversing Binary Tree: Preorder traversal, In-order traversal, Post-order traversal, Traversal algorithms using stacks	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 8 Yeshavant Kanetkar, “Data Structures Through C” Chapter 9	2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-7-binary-trees-part-2-avl/ Industry Mapping: CLion, Eclipse(IDE), Visual Studio, CLion, Clang	
	Binary Search Trees	Searching in Binary Search Trees, Inserting in Binary Search Trees, Deleting in a Binary Search Tree	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 8 Yeshavant Kanetkar, “Data Structures Through C” Chapter 9		
	Advanced Tree Structures	AVL trees and implementations, M-trees, B-Trees (definition only)	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 8 Yeshavant Kanetkar, “Data Structures Through C” Chapter 9		
Module 4	Searching	Sequential Search, Binary Search, Indexed Search	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 11 Yeshavant Kanetkar, “Data Structures Through C” Chapter 10	International Academia: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-3-sets-and-sorting/ https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-4-hashing/ https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-5-linear-sorting/	10
	Sorting	Introduction and Notation, Insertion Sort, Selection Sort, Shell Sort, Divide And Conquer, Merge sort for Linked List, Quick sort for Contiguous List.	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 10 Yeshavant Kanetkar, “Data Structures Through C” Chapter 10		
	Hashing	Sparse Tables, Choosing a Hash function, Collision Resolution with Open Addressing, Collision Resolution by Chaining.	G. S. Balujua, “Data Structures Through C (A practical Approach)” Chapter 11		

Module 1: Introduction to data structure and algorithms:

1st Year, Sec A (Faculty Name – Dr. Rupam Bhattacharya, Sucheta Chandra)

1st Year, Sec B (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

1st Year, Sec C (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

Working Day	Lesson Plan Description
Day 1	Overview of fundamental concepts
Day 2	Definition of data structure, Data structure operation
Day 3	Complexity of Algorithms
Day 4	Time-Space Trade-off
Day 5	Asymptotic Notations for Complexity of Algorithms
Day 6	Sub-algorithms
Day 7	Role of variables in data structures and algorithms
Day 8	Importance and types of data in computing

Module 2: Array, linked lists, Stack and queues:

1st Year, Sec A (Faculty Name – Dr. Rupam Bhattacharya, Sucheta Chandra)

1st Year, Sec B (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

1st Year, Sec C (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

Working Day	Lesson Plan Description
Day 9	Definition, Linear arrays, arrays as ADT
Day 10	Representation of Linear Arrays in Memory
Day 11	Traversing Linear arrays, Inserting and deleting
Day 12	Multi-dimensional arrays
Day 13	Matrices, Sparse Matrices
Day 14	Representation in memory, Traversing
Day 15	Searching, Memory allocation (Garbage collection, overflow, underflow)
Day 16	Insertion, Deletion
Day 17	Circular linked lists, Doubly linked lists, Header linked lists
Day 18	Definition, Array representation, Linked representation
Day 19	Polish notation, Evaluation of Postfix Expressions
Day 20	Transforming Infix to Postfix Expressions
Day 21	Definition, Array representation

Day 22	Linked representation, Circular queues
Day 23	Priority Queue, D-Queue

Module 3: Trees:

1st Year, Sec A (Faculty Name – Dr. Rupam Bhattacharya, Sucheta Chandra)

1st Year, Sec B (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

1st Year, Sec C (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

Working Day	Lesson Plan Description
Day 24	Introduction and Definition of Trees
Day 25	Tree Terminology
Day 26	Representing Binary Trees in Memory
Day 27	Traversing Binary Tree: Preorder traversal
Day 28	In-order traversal
Day 29	Post-order traversal, Traversal algorithms using stacks
Day 30	Searching in Binary Search Trees, Inserting in Binary Search Trees
Day 31	Deleting in a Binary Search Tree
Day 32	AVL trees and implementations
Day 33	M-trees
Day 34	B-Trees (definition only)

Module 4: Searching sorting & hashing:

1st Year, Sec A (Faculty Name – Dr. Rupam Bhattacharya, Sucheta Chandra)

1st Year, Sec B (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

1st Year, Sec C (Faculty Name – Dr. Rupam Bhattacharya, Kaustav Sarkar)

Working Day	Lesson Plan Description
Day 35	Sequential Search, Binary Search
Day 36	Indexed Search
Day 37	Introduction and Notation, Insertion Sort
Day 38	Selection Sort, Shell Sort
Day 39	Divide And Conquer, Merge sort for Linked List
Day 40	Quick sort for Contiguous List
Day 41	Sparse Tables, Choosing a Hash function

Day 42	Collision Resolution with Open Addressing
Day 43	Collision Resolution by Chaining
Day 44	Doubt clearing classes
Day 45	Doubt clearing classes

TEXT BOOK:

1. G. S. Balujua, “Data Structures Through C (A practical Approach)”, Dhanpai Rai & Co., 2021
2. Yeshavant Kanetkar, “Data Structures Through C”, BPB Publications, 2014

REFERENCE BOOKS:

1. Seymour Lipschutz, “Data Structures with C”, Schaum’s out Lines, Tata Mc Graw Hill, 2011
2. Aaron M. Tenenbaum, “Data Structures using C”, Prentice Hall of India, 2008
3. Alfred V Aho, John E Hopcroft and Jeffery D Ullman, “Data Structures and Algorithms”, Pearson Education.
4. Samiran Chattopadhyay, Debabrata Ghosh Dastidar and Matagini Chattopadhyay, “Data Structures through C Language”, BPB Publication
5. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 2013

CO-PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	2	2	0	1	2	0	0	0	1	0	0
CO2:	3	3	3	0	2	2	2	0	0	1	0	1
CO3:	3	2	3	3	2	2	1	1	1	1	0	1
CO4:	3	2	2	2	3	1	1	0	0	1	1	1

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	Technical Knowledge and Problem-Solving: Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyse and solve computational problems effectively.
PSO2	Software Design and Development: Demonstrate the ability to design, develop, test, and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	Professional Skills and Ethics: Exhibit effective communication, teamwork, leadership, and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
Mid Term 2		Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2×10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5×6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10×5)	100

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Syllabus and Lesson Plan

Subject Name: **Object Oriented Programming**

Credit: 4

Lecture Hours: 48

Subject Code: **BCACC202**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Dr. Priti Deb
2. Prof. Manab Kumar Das

Pre-requisite: Basics knowledge of programming language, Logic building skills

Relevant Links:

1. Link for Study Material:

<https://drive.google.com/file/d/1NXsykMyKApl-KKpKM5c4OL8RHbVmXwEu/view?usp=sharing>

2. Link for NPTEL Course:

https://onlinecourses.nptel.ac.in/noc21_cs02/preview

3. Link for Coursera Course:

<https://www.coursera.org/courses?query=c%2B%2B>

4. Link for LinkedIn Learning Course:

[Programming Foundations: Data Structures Online Class | LinkedIn Learning, formerly Lynda.com](#)

COURSE OBJECTIVES:

1. To introduce students to a powerful programming language
2. To understand the basic structure of object oriented program
3. To gain knowledge of various programming errors
4. To enable the students to make flowchart and design an algorithm for a given problem
5. To enable the students to develop logics and programs

COURSE OUTCOMES:

CO 1: Students will be able to learn different programming techniques using object-oriented technology.

CO 2 Students will be able to learn how to solve real life problems by implementing data, security, reuse of code, polymorphism etc.

CO 3: Students will be able to learn how to solve real life problems by using pointer, virtual function and FILE handling.

CO 4: Students will be able to learn how to solve real life problems by implementing exception handling and generic programming.

Module No	Topic	Sub Topic	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
Module 1	Introduction of Object Oriented Programming	A look of object oriented programming, Object oriented programming paradigm, Basics of object oriented programming, Benefits of object oriented programming, Object oriented languages, Applications of object oriented programming	Object Oriented Programming with C++. Chapter 1, E-Balagurusamy	International Academia: https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/	8	1. Console based C++ program to display, insert, search and sort elements of an array, prime no, factorial, Fibonacci series, palindrome etc.
	Basic of C++ Programming	Application of C++, A simple C++ program, More C++ statements, An example with Class, Structure of C++ program, Creating a source file, Compiling and linking	Object Oriented Programming with C++. Chapter 2, E-Balagurusamy	Industry Mapping: CLion, Eclipse (IDE), Sublime Text, Atom (Text Editors), Visual Studio Debugger (Debuggers)		
	Introduction of C++ Tokens and	Tokens, Keywords, Identifiers and constants, Basic data types, User	Object Oriented Programming with C++.			

	Keywords	defined data types, Derived data types, Symbolic constants, Type compatibility, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Member dereferencing operators, Memory management operators, Manipulators, Type cast operator, Expressions and their types, Special assignments expressions, Implicit conversions, Operator overloading, Operator precedence, Control structures	Chapter 3, E-Balagurusamy			
	Function	Introduction, The main function, Function prototyping, Call by reference, Return by reference, Inline functions, Default arguments, Const. arguments, Function overloading, Friend and virtual functions, Math library function	Object Oriented Programming with C++. Chapter 4, E-Balagurusamy			
Module 2	Introduction to class and object, Array of Objects, Friend Function	Introduction, Specifying a class, Defining a member functions, A C++ program with class, Making an outside function inline, Nesting a member functions, Private member function, Arrays	Object Oriented Programming with C++. Chapter 5, E-Balagurusamy	International Academia: https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/	12	1. Program based on object, class, and encapsulation property 2. Program based on array of object 3. Program based on various (default, parameterize, copy) constructor 4. Constructor overloading program

		within a class, Memory allocation for objects, Static data members, Static member functions, Arrays of objects, Objects as function arguments, Friendly function, Returning objects, Const member functions, Pointers to member, Local classes.		Industry Mapping: CLion, Eclipse (IDE), Sublime Text, Atom (Text Editors), Visual Studio Debugger (Debuggers)		5. Destructors program 6. Program based on various operator overloading 7. Program based on function overloading 8. Program based on friend function 9. Program based on various type of inheritance
	Constructor and Destructor	Constructors, Parameterized Constructors, Multiple Constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy Constructors, Dynamic Constructors, Constructing two dimensional array, Const objects, Destructors	Object Oriented Programming with C++. Chapter 6, E-Balagurusamy			
	Operator Overloading	Defining operator overloading, Overloading unary operators, Overloading binary operators, Overloading unary operators using friends, Manipulation of string using operators, Rules for Overloading operators, Type conversions	Object Oriented Programming with C++. Chapter 7, E-Balagurusamy			
	Inheritance	Defining derived classes, Single inheritance, Making private member inheritable, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Constructors in derived classes, Member classes: nesting of classes	Object Oriented Programming with C++. Chapter 8, E-Balagurusamy			

Module 3	Pointer and virtual function	Introduction, Pointers, Pointers to objects, this pointer, Pointers to derived classes, Virtual functions, Pure Virtual functions	Object Oriented Programming with C++. Chapter 9, E-Balagurusamy	International Academia: https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/ Industry Mapping: CLion, Eclipse (IDE), Sublime Text, Atom (Text Editors), Visual Studio Debugger (Debuggers)	10	1. Program based on pointer concept 2. Virtual and Pure virtual function programs 3. File and streams based programs
	C++ Streams	C++ streams, C++ stream classes, Unformatted I/O operators, Formatted I/O operations, Managing output with manipulator	Object Oriented Programming with C++. Chapter 10, E-Balagurusamy			
	FILE handling in C++	Classes for File stream operations, Opening and closing a File, Detecting end-of-file, More about Open(); File modes, File pointers and their manipulations, Sequential input and output operations, Updating a File: Random access, Error handling during File operations, Command-line arguments.	Object Oriented Programming with C++. Chapter 11, E-Balagurusamy			
Module 4	Template	Introduction to generic programming, Class templates, Class templates with multiple parameters, Function templates, Function templates with multiple parameters, Overloading of template functions, Member function templates, Non-type template arguments	Object Oriented Programming with C++. Chapter 12, E-Balagurusamy	International Academia: https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/ Industry Mapping: CLion, Eclipse (IDE), Sublime	10	1. Function and class template-based program 2. Program based on various type of exceptions.
	Exception Handling	Introduction of exception, Basics of exception handling,	Object Oriented Programming			

		Exception handling mechanism, Throwing mechanism, Catching mechanism, Rethrowing an exception, Specifying exceptions	with C++. Chapter 13, E-Balagurusamy	<i>Text, Atom (Text Editors), Visual Studio Debugger (Debuggers)</i>		
	Standard Template Library	Components of STL, Containers, Algorithms, Iterators, Application of container classes, Function objects.	Object Oriented Programming with C++. Chapter 14, E-Balagurusamy			

Module 1: Introduction of OOPs:

1st Year, Sec A (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec B (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec C (Faculty Name – Prof. Manab Kumar Das, Dr. Priti Deb)

Working Day	Lesson Plan Description
Day 1	Concept of object oriented programming, Benefits and Application, Introduction of C++,
Day 2	Application of C++, Difference between C and C++, Structure of C++ program
Day 3	Creating a source file, Compiling, and linking, Tokens, keywords, identifiers, constants
Day 4	User defined data types, Derived data types, Variables declaration
Day 5	Dynamic initialization, Reference variables with suitable example
Day 6	Operators in C++, Scope resolution operator, and Member dereferencing operators, Type cast operator
Day 7	Expressions and their types, Special assignments expressions, Implicit conversions
Day 8	Introduction, main function, function prototyping, function declaration
Day 9	Call by value, call by reference, Return by reference, Inline functions
Day 10	Default arguments, Const. arguments, Function overloading
Day 11	Friend and virtual functions, Math library function

Module 2: Class and Object concept, Array of object, friend function, Constructor and Destructor, Operator Overloading, and Inheritance:

1st Year, Sec A (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec B (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec C (Faculty Name – Prof. Manab Kumar Das, Dr. Priti Deb)

Working Day	Lesson Plan Description
Day 12	Introduction, specifying a class, defining a member functions, A C++ program with class
Day 13	Making an outside function inline, nesting a member functions, Private member function
Day 14	Arrays within a class , Memory allocation for objects, Static data members, Static member functions
Day 15	Arrays of objects, Objects as function arguments, Friendly function
Day 16	Returning objects, Const member functions, Pointers to member, Local classes
Day 17	Constructors, Parameterized Constructors explanation with example
Day 18	Multiple Constructors in a class, Constructors with default arguments
Day 19	Dynamic initialization of objects, Copy Constructors, Dynamic Constructors
Day 20	Constructing two-dimensional array, Const objects, Destructors
Day 21	Defining operator overloading, Overloading unary operators,
Day 22	Overloading binary operators, overloading unary operators using friends
Day 23	Manipulation of string using operators, Rules for Overloading operators, Type conversions
Day 24	Defining derived classes, Single inheritance, Making private member inheritable
Day 25	Multilevel inheritance and Multiple inheritance
Day 26	Hierarchical inheritance, Hybrid inheritance, Virtual base classes
Day 27	Abstract classes, Constructors in derived classes, Member classes: nesting of classes

Module 3: Pointer, Virtual function, C++ Streams, and FILE handling in C++:

1st Year, Sec A (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec B (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec C (Faculty Name – Prof. Manab Kumar Das, Dr. Priti Deb)

Working Day	Lesson Plan Description
Day 28	Introduction to pointers, Pointers to objects concept
Day 29	Use of this pointer, Pointers to derived classes, some programming example
Day 30	Virtual functions and Pure Virtual functions with programming example

Day 31	C++ streams, C++ stream classes and its application
Day 32	Unformatted I/O operators
Day 33	Formatted I/O operations, Managing output with manipulator
Day 34	Classes for File stream operations, Opening and closing a File
Day 35	Detecting end-of-file, More about Open();File modes
Day 36	File pointers and their manipulations, Sequential input and output operations
Day 37	Updating a File: Random access, Error handling during File operations, Command-line arguments

Module 4: Template, Exception Handling, and Standard Template Library:

1st Year, Sec A (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec B (Faculty Name – Dr. Priti Deb, Prof. Manab Kumar Das)

1st Year, Sec C (Faculty Name – Prof. Manab Kumar Das, Dr. Priti Deb)

Working Day	Lesson Plan Description
Day 38	Introduction to generic programming, Class templates with suitable example
Day 39	Class templates with multiple parameters, Function templates
Day 40	Function templates with multiple parameters and illustration some program
Day 41	Overloading of template functions
Day 42	Member function templates, non-type template arguments
Day 43	Introduction of exception, Basics of exception handling
Day 44	Exception handling mechanism, Throwing mechanism
Day 45	Catching mechanism, Rethrowing an exception, Specifying exceptions
Day 46	Components of STL, Containers, Algorithms, Iterators
Day 47	Application of container classes, Function objects.
Day 48	Deployment of C++ program to solve real life problems

Learning Resources:

Text Books:				
Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher	
E. Balagurusamy	Object Oriented Programming with C++	Fourth Edition	Tata McGraw Hill	Download eBook
Reference Books:				
Herbert Schildt	C++: The Complete Reference	Fourth Edition	Tata McGraw Hill	Download eBook
List of equipment/apparatus for laboratory experiments:				
SL. No.				
1	Computer with moderate configuration			
2	g++ compiler and other software's as required			
3	C++ compiler (online)	Online compiler-1	Online compiler-2	

CO- PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	2	2	0	0	2	0	0	0	0	0	0
CO2:	3	3	3	0	2	2	2	0	0	0	0	1
CO3:	3	2	3	3	2	2	1	1	1	0	0	1
CO4:	3	2	2	2	3	1	1	0	0	1	1	1

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	Object-Oriented Design and Development: Apply the principles of object-oriented programming such as abstraction, encapsulation, inheritance, and polymorphism to design and develop robust and reusable programs.
PSO2	Problem Solving and Algorithmic Thinking: Use C++ programming constructs, including classes, templates, and STL (Standard Template Library), to analyze problems and implement efficient software solutions.
PSO3	Software Implementation and Debugging Skills: Demonstrate proficiency in developing, testing, and debugging C++ applications that emphasize modularity, code reusability, and maintainability.
PSO4	Application of OOP Concepts in Real-world Scenarios: Integrate object-oriented programming concepts to develop mini-projects or applications addressing real-life problems, showcasing analytical and logical skills.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	----	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
Mid Term 2	---	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30

End Semester Examination	-----	Attempt 10 out of 15 questions; Each question carries 2 marks (2×10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5×6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10×5)	100

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Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur



Syllabus and Lesson Plan

Subject Name: **Computer Architecture**

Credit: 4

Lecture Hours: 48

Subject Code: **BCACC203**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Dr. Priyanka Das
2. Dr. Goldina Ghosh

Pre-requisite: Fundamental concept of Digital Electronics

Relevant Links:

1. Link for Study Material:

https://iemcollege-my.sharepoint.com/:w:/g/personal/pritha_banerjee_iem_edu_in/Ech0dJ7lmzFDiPcEBAAtcmj0BMrP5wQWPi8blHkWiChknUQ?e=A8HVP7

2. Link for Coursera Course:

<https://www.coursera.org/learn/comparch>

3. Link for LinkedIn Learning Course:

<https://www.linkedin.com/learning/introduction-to-it-architecture/it-architecture-overview?u=229219690>

Course Objectives:

1. Basic revision of Boolean algebra and their simplification.
2. To study the Register Transfer Language and Microoperations
3. To introduce the computer registers timing and control, instruction and interrupt cycle.
4. To illustrate the concept Central Processing Unit, Input/Output operations and Memory Management.

Course Outcomes:

CO1: Upon completion of this course, student will be able to understand basic structure of computer and perform computer arithmetic operations

CO2: Ability to understand control unit operations with design memory organization that uses banks for different word size operations

CO3: Understand the concept of register transfer language and basic microoperations

CO4 : Understand the concept of I/O organization and conceptualize instruction level parallelism.

Module number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1	Data Representation	Data type, Complement, Fixed point Representation, Floating point representation, other binary code.	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 4	International Academia: (https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/resources/102_fifties) Industry Mapping: Software: Xilinx Vivado, Icarus Verilog,	10

	Register Transfer and Micro operations.	Register Transfer Language, Register Transfer, Bus and Memory Transfers, Register Transfer Micro-operations, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 5	Hardware: FPGA Kit, Basys3 board	
2	Basic Computer Organization and Design	Instruction code, computer register, computer Instruction, timing and control, Instruction cycle, Memory reference instruction, Input-output and interrupt, complete computer description, Design of basic computer, and design of accumulator logic	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 6	International Standards :(https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/resources/104_microprog/) Industry Mapping: Software: Xilinx Vivado, Icarus Verilog, Hardware: FPGA Kit, Basys3 board	12
	Computer Arithmetic	Introduction, Addition and subtraction, Multiplication algorithm, division algorithm, Floating point arithmetic operation, Decimal arithmetic unit, Decimal arithmetic operation	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 11		

	Programming the Basic Computer	Introduction, Machine Language, Assembly Language, The assembler, Programming loop, Programming arithmetic and logic operation, subroutine, Input Output programming	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 7		
3	Memory Organization	Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 13	International Standards : https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/resources/107_caches/ Industry Mapping: Software: Xilinx Vivado, Icarus Verilog, Hardware: FPGA Kit, Basys3 board	12

	Central Progressing Unit (CPU)	Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC)	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 9		
4	Pipeline and Vector Processing	Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 10	International Standards: (https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/resources/106_pipeline/) Industry Mapping: Software: Xilinx Vivado, Icarus Verilog, Hardware: FPGA Kit, Basys3 board	12

	Input-Output Organization	Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication	Computer System Architecture, M.Morris Mano, PEARSON, Chapter 12		
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Module 1: Data Representation and Register Transfer and Micro operations:

1st Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec C (Faculty Name – Dr. Goldina Ghosh ,Dr. Priyanka Das)

Working Day	Lesson Plan Description
Day 1	Data type, Complement, Fixed point Representation
Day 2	Floating point representation, other binary code.
Day 3	Register Transfer Language
Day 4	Register Transfer, Bus and Memory Transfers
Day 5	Register Transfer Micro-operations
Day 6	Arithmetic Micro-operations
Day 7	Logic Micro-operations
Day 8	Shift Micro-operations

Module 2: Basic Computer Organization and Design, Computer Arithmetic and Programming the Basic Computer

1st Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec C (Faculty Name – Dr. Goldina Ghosh ,Dr. Priyanka Das)

Working Day	Lesson Plan Description
Day 9	Instruction code, computer register, computer Instruction
Day 10	Timing and control, Instruction cycle
Day 11	Memory reference instruction
Day 12	Input-output and interrupt
Day 13	Complete computer description
Day 14	Design of basic computer, and design of accumulator logic
Day 15	Addition and subtraction
Day 16	Multiplication algorithm, division algorithm
Day 17	Floating point arithmetic operation
Day 18	Decimal arithmetic unit
Day 19	Decimal arithmetic operation
Day 20	Machine Language, Assembly Language
Day 21	The assembler, Programming loop
Day 22	Programming arithmetic and logic operation
Day 23	Input Output programming

Module 3: Memory Organization, Central Progressing Unit (CPU)

1st Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec C (Faculty Name – Dr. Goldina Ghosh ,Dr. Priyanka Das)

Working Day	Lesson Plan Description
Day 24	Memory Hierarchy
Day 25	Main Memory and Cache Memory
Day 26	Auxiliary Memory, Associative Memory
Day 27	Virtual Memory, Memory Management Hardware
Day 28	General Register Organization
Day 29	Stack Organization
Day 30	Instruction Formats, Addressing Modes
Day 31	Deleting in a Binary Search Tree
Day 32	Data Transfer and Manipulation
Day 33	Program Control
Day 34	Reduced Instruction Set Computer (RISC)

Module 4: Pipeline and Vector Processing, Input-Output Organization

1st Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priyanka Das)

1st Year, Sec C (Faculty Name – Dr. Goldina Ghosh ,Dr. Priyanka Das)

Working Day	Lesson Plan Description
Day 35	Parallel Processing
Day 36	Pipelining
Day 37	Arithmetic Pipeline
Day 38	Instruction Pipeline
Day 39	Vector Processing, Array Processors
Day 40	Peripheral Devices
Day 41	Input-Output Interface
Day 42	Asynchronous Data Transfer
Day 43	Modes of Transfer
Day 44	Priority Interrupt
Day 45	Direct Memory Access (DMA)
Day 46	Input-Output Processor (IOP)
Day 47	Serial Communication
Day 48	Doubt clearing classes

TEXT BOOK:

1. Computer System Architecture, M.Morris Mano, PEARSON (Chap- 4, 5, 6, 7, 9, 10, 11, 12,13)

REFERENCE BOOKS:

1. Computer Organization & Architecture-Designing for performance, William Stallings, PERSON
2. Computer Architecture & Organization, J.P.Hayes, Tata McGraw Hill

CO- PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	2	2	0	0	2	0	0	0	0	0	0
CO2:	3	3	3	0	2	2	2	0	0	0	0	1
CO3:	3	2	3	3	2	2	1	1	1	0	0	1
CO4:	3	2	2	2	3	1	1	0	0	1	1	1

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	Technical Knowledge and Problem-Solving: Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyse and solve computational problems effectively.
PSO2	Software Design and Development: Demonstrate the ability to design, develop, test, and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	Professional Skills and Ethics: Exhibit effective communication, teamwork, leadership, and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 6 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
Mid Term 2		Attempt 5 out of 6 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2×10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5×6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10×5)	100

Examination Rules & Regulations:

https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9gm3XNaf_qUeSiVTNh5OQ?e=MMQn40



University of Engineering and Management
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University of Engineering & Management, Jaipur



Syllabus and Lesson Plan

Subject Name: **Mathematics for Computing**

Credit: 2

Lecture Hours: 24

Subject Code: **BCAMD201**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Prof. Sreelekha Biswas

Pre-requisite: Basic knowledge in number system and geometry

Relevant Links:

1. Link for Study Material:

https://drive.google.com/file/d/1mrUaclbLNsteephe1q3u67R_r7A7Fcql/view?usp=sharing

2. Link for Coursera Course:

[Probability & Statistics for Machine Learning & Data Science Course \(DeepLearning.AI\) | Coursera](#)

3. Link for LinkedIn Learning Course:

[Statistics Foundations 1: The Basics Online Class | LinkedIn Learning, formerly Lynda.com](#)

4. Link for NPTEL Course:

[NPTEL :: Mathematics - NOC:Probability and Statistics](#)

COURSE OBJECTIVES:

1. To understand and apply Probability concepts.
2. To analyze data using descriptive statistics.
3. To apply inferential statistics for decision-making.
4. To develop problem-solving and critical thinking skills.

COURSE OUTCOMES:

CO1: Students will be able to understand and apply fundamental concepts of probability, including definitions, rules, and theorems, to analyze and interpret real-world situations involving uncertainty.

CO2: Students will be able to develop proficiency in using descriptive and inferential statistical methods to summarize data, make predictions, and draw conclusions based on sample data, including the application of confidence intervals and hypothesis testing.

CO3: Students will be able to gain skills in collecting, organizing, and analyzing data using appropriate statistical techniques and tools, enabling students to effectively communicate results and insights derived from their analyses.

CO4: Students will be able to develop the ability to create and interpret various statistical charts and graphs (such as histograms, pie charts, box plots, and scatter plots) to effectively visualize data trends, patterns, and distributions, enabling informed decision-making based on statistical analysis.

Module number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1	Basics of Probability Theory	Introduction, Introductory Definitions, Classical Definition of Probability, Theorems on Probability & Addition Theorem, Axiomatic definition of Probability, Conditional Probability, Multiplication Rule of Probability, Independent Events, Baye's Theorem.	Basics of Probability Theory, Chapter-3.1, BCA Mathematics Vol-III	International Academia: Introduction to Probability and Statistics Industry Mapping: Matlab	8

2	Collection of Data and Frequency Distribution Charts and Diagram	Introduction, Primary Data, Secondary Data, Method of Collection of Primary Data, Source of Secondary Data, Classification and Tabulation of Data, Tabulation of Data and Statistical table. Statistics and its Related Terms, Frequency Distribution, Diagram, Bar Chart, Pie-Chart, Line Chart, Histogram of a Frequency Distribution, Frequency Polygon, Cumulative Frequency Polygon or Ogive	Collection of Data Chapter-4.1, BCA Mathematics Vol-III Frequency Distribution Charts and Diagram, Chapter-4.2, BCA Mathematics Vol-III	International Academia: Introduction to Probability and Statistics IndustryMapping: Matlab	8
3	Measures of Central Tendency	Introduction, Mean, Arithmetic Mean(AM), Geometric Mean(GM), Harmonic Mean(HM), Median, Mode, Quartiles, Calculation of Quartiles, Deciles, Calculation of Deciles, Percentiles, Calculation of Percentiles.	Measures of Central Tendency, Chapter-4.3, BCA Mathematics Vol-III	International Academia: Introduction to Probability and Statistics IndustryMapping: Matlab	9
4	Measures of Dispersion	Introduction, Classification of Measure of Dispersion, Range, Quartile deviation(Semi inter quartile range), Mean deviation(Mean absolute deviation), Variance and Standard Deviation, Relative Measures of Dispersion	Measures of Dispersion, Chapter-4.4, BCA Mathematics Vol-III	International Academia: Introduction to Probability and Statistics IndustryMapping: Matlab	7

Module 1: Basics of Probability Theory

1st Year, Sec A (Faculty Name – Prof. Sreelekha Biswas)

1st Year, Sec B (Faculty Name – Prof. Sreelekha Biswas)

1st Year, Sec C (Faculty Name – Prof. Sreelekha Biswas)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction, Introductory Definitions, Classical Definition of Probability
2	Theorems on Probability & Addition Theorem-Related Problems
3	Axiomatic definition of Probability, Conditional Probability-Related Problems
4	Multiplication Rule of Probability, Independent Events-Related Problems
5	Baye's Theorem-Related Problems
6	Revision and Practice Class
7	Practice Class
8	Practice Class

Module 2: Collection of Data and Frequency Distribution Charts and Diagram

1st Year, Sec A (Faculty Name: Prof. Sreelekha Biswas)

1st Year, Sec B (Faculty Name: Prof. Sreelekha Biswas)

1st Year, Sec C (Faculty Name: Prof. Sreelekha Biswas)

WORKING DAY	LESSON PLAN – DESCRIPTION
9	Introduction, Primary Data, Secondary Data, Method of Collection of Primary Data, Source of Secondary Data
10	Classification and Tabulation of Data, Tabulation of Data and Statistical table.
11	Statistics and its Related Terms, Frequency Distribution

12	Diagram, Bar Chart, Pie-Chart
13	Line Chart, Histogram of a Frequency Distribution
14	Frequency Polygon, Cumulative Frequency Polygon or Ogive
15	Revision and Practice Class
16	Practice Class

Module 3: Measures of Central Tendency

1st Year, Sec A (Faculty Name: Prof. Sreelekha Biswas)

1st Year, Sec B (Faculty Name: Prof. Sreelekha Biswas)

1st Year, Sec C (Faculty Name: Prof. Sreelekha Biswas)

WORKING DAY	LESSON PLAN – DESCRIPTION
17	Introduction, Mean, Arithmetic Mean(AM), Geometric Mean(GM), Harmonic Mean(HM)
18	Practice Class
19	Median, Mode
20	Practice Class
21	Quartiles, Calculation of Quartiles
22	Deciles, Calculation of Deciles
23	Practice Class
24	Percentiles, Calculation of Percentiles.
25	Revision and Practice Class

Module 4: Measures of Dispersion

1st Year, Sec A (Faculty Name: Prof. Sreelekha Biswas)

1st Year, Sec B (Faculty Name: Prof. Sreelekha Biswas)

1st Year, Sec C (Faculty Name: Prof. Sreelekha Biswas)

WORKING DAY	LESSON PLAN – DESCRIPTION
26	Introduction, Classification of Measure of Dispersion
27	Range, Quartile deviation (Semi inter quartile range)
28	Mean deviation (Mean absolute deviation)
29	Variance and Standard Deviation
30	Relative Measures of Dispersion
31	Practice Class
32	Practice Class

TEXTBOOK:

1. BCA MATHEMATICS, Vol-III, B.K.PAL, K.DAS, Fourth Edition (All Chapters)

REFERENCEBOOKS:

1. Fundamental Treatise on Probability and Statistics, Dr. Arup Mukherjee

CO- PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO2:	3	3	3	0	2	2	2	0	0	0	0	1
CO3:	3	2	3	3	2	2	1	1	1	0	0	1
CO4:	3	2	2	2	3	1	1	0	0	1	1	1

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	Technical Knowledge and Problem-Solving: Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyse and solve computational problems effectively.
PSO2	Software Design and Development: Demonstrate the ability to design, develop, test, and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	Professional Skills and Ethics: Exhibit effective communication, teamwork, leadership, and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	30
Mid Term 2		Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	30

End Semester Examination		Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	100
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