

**Guru Jambheshwar University of Science & Technology**



**Scheme of Examination for Under-Graduate Programmes  
Bachelor of Computer Applications (BCA): SCHEME D  
(For affiliated College Only)**

according to

**Curriculum Framework for Under-Graduate Programmes  
As per NEP-2020 (Multiple Entry-Exit, Internships and Choice Based  
Credit System)**

**Scheme of Examination for Undergraduate programmes**

**Subject: BCA**

**According to**

**Curriculum Framework for Undergraduate Programmes  
as per NEP 2020 (Multiple Entry-Exit, Internships and Choice Based Credit  
System)**

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# Scheme of Examination for Undergraduate programmes

## Subject: BCA

Sem	Course Type	Course Code	Nomenclature of PAPER	Credits	Contact hours	Internal Marks	End term marks	Total Marks	Duration of Exam (T+P)
1st	CC-A1	C24-CAP-101	Computer Fundamental and Problem solving through C	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B1	C24-CAP-102	Logical Organization of Computer	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C1	C24-CAP-103	Web Technologies	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M1	C24-CAP-104	Mathematical Foundations for Computer Science - I	2	2	15	35	50	2
	MDC-1	To be taken From Pool							
	SEC-1	To be taken From Pool							
	VAC-1	To be taken From Pool							
2nd	CC-A2	C24-CAP-201	Object Oriented Programming using C++	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B2	C24-CAP-202	Data Structure and applications	3	3	20	50	70	3
			Practical	1	2		20	30	3
	CC-C2	C24-CAP-203	Operating system	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M2	C24-CAP-204	Mathematical Foundations for Computer Science- II	2	2	15	35	50	2
	MDC-2	To be taken From Pool							
	SEC-2	To be taken From Pool							
	VAC-2	To be taken From Pool							
	AEC-2	To be taken From Pool							

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3rd	CC-A3	C24-CAP-301	Java Programming	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B3	C24-CAP-302	Linux and Shell programming	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C3	C24-CAP-303	Data Base Technologies	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M3	To be taken From Pool		2	2	15	35	50	2
	MDC-3	To be taken From Pool							
	SEC-3	To be taken From Pool							
	AEC-3	To be taken From Pool							
4th	CC-A4	C24-CAP-401	Cloud Computing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B4	C24-CAP-402	Front end Development	3	3	20	50	70	3
			Practical	1	2		20	30	3
	CC-C4	C24-CAP-403	Computer Graphics	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M4(V)	To be taken From Pool		2	2	15	35	50	2
	VAC-3	To be taken From Pool							
	AEC-4	To be taken From Pool							

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3rd	CC-A3	C24-CAP-301	Java Programming	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B3	C24-CAP-302	Linux and Shell programming	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C3	C24-CAP-303	Data Base Technologies	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M3	To be taken From Pool		2	2	15	35	50	2
	MDC-3	To be taken From Pool							
	SEC-3	To be taken From Pool							
	AEC-3	To be taken From Pool							
4th	CC-A4	C24-CAP-401	Cloud Computing	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B4	C24-CAP-402	Front end Development	3	3	20	50	70	3
			Practical	1	2		20	30	3
	CC-C4	C24-CAP-403	Computer Graphics	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M4(V)	To be taken From Pool		2	2	15	35	50	2
	VAC-3	To be taken From Pool							
	AEC-4	To be taken From Pool							

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5th	CC-A5	C24-CAP-501	Software Engineering	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B5	C24-CAP-502	Back-end Development	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-C5	C24-CAP-503	Network and Data Communications technologies	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M5(V)	To be taken From VOC Pool		2	2	15	35	50	2
	SEC5	Project/Internship @ 4 Credits							
6th	CC-A6	C24-CAP-601	Programming Using Python	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-B6	C24-CAP-602	Advanced Web development	3	3	20	50	70	3
			Practical	1	2		20	30	3
	CC-C6	C24-CAP-603	Artificial Intelligence	3	3	20	50	70	3
			Practical	1	2	10	20	30	3
	CC-M6	To be taken From Pool		2	2	15	35	50	2
	CC-M6(V)	To be taken From VOC Pool							

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Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	I		
Name of the Course	Computer fundamental and Problem Solving through C		
Course Code	C24-CAP-101		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE/PC/AEC/ VAC)	CC		
Level of the course (As per Annexure-I )	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. learn the basics of computer fundamentals</li> <li>2. under stand C, data types and input/output statements, different types of operators, their hierarchies</li> <li>3. implement programs using arrays and strings.</li> <li>4. get familiar with advanced concepts like structures, union etc. in C language.</li> </ol> <p>5*. to implement the programs based on various concepts of C.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))	Time: 3 Hrs.(T), 3Hrs.(P)		

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## Part B- Contents of the Course

### Instructions for Paper- Setter

Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four units selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Computer Fundamentals: Characteristics of Computers, Strengths and Limitations of Computers, Classification of Computers, Functional, Application software, Utility software Memory: Primary Memory, Secondary Memory, Types of storage devices, Operating System: Definition, Functions, Features of Operating System Threats: Physical & non-physical threats, Virus, Worm, Trojan, Spyware, Keyloggers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking.	10
II	Overview of C, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant. Input/output formatted function; Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy; Arithmetic Expressions, Evaluation of Arithmetic Expression, Decision making with if statement, ifelse statement, nested if statement, else-if ladder, switch and break statement, Looping Statements: for, while, and do-while loop, jumps in loops.	10
III	Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation. Functions: definition, prototype, function call, passing arguments to a function: call by value; call by reference, recursive functions. Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate etc., Search for a Substring.	10
IV	Pointers in C: Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays. User defined data types: Structures - Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; difference between Structure and Union.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems: 1. To read radius of a circle and to find area and circumference 2. To read three numbers and find the biggest of three 3. To check whether the number is prime	25



4. To read a number, find the sum of the digits, reverse the number and check it for palindrome
5. To read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
6. To read percentage of marks and to display appropriate message (Demonstration of else-if ladder)
7. To find the roots of quadratic equation
8. To read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
9. To remove Duplicate Element in a single dimensional Array
10. To perform addition and subtraction of Matrices
11. To remove Duplicate Element in a single dimensional Array
12. To find factorial of a number
13. To generate Fibonacci series
14. To find the length of a string without using built in function
15. To find factorial of a number
16. To demonstrate string functions
17. To read, display and add two m x n matrices using functions
18. To read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters

#### Suggested Evaluation Methods

##### Internal Assessment:

##### > Theory

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 10

##### > Practicum

- Class Participation: 5
- Seminar/Demonstration/Viva-voce/Lab records etc.: 5
- Mid-Term Exam: NA

**End Term Examination:**  
A three hours exam for both theory and practicum.

#### Part C-Learning Resources

##### Recommended Books/e-resources/LMS:

- Gottfried, Byron S., Programming with C, Tata McGraw Hill.
- Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill.
- Jeri R. Hanly & Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley.
- Yashwant Kanetker, Let us C, BPB.
- Rajaraman, V., Computer Programming in C, PHI.
- Yashwant Kanetker, Working with C, BPB.

\*Applicable for courses having practical component.



Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	I		
Name of the Course	Introduction to Web Technologies		
Course Code	C24-CAP-102		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE/PG/AEC/ VAC)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. learn the basics of web development.</li> <li>2. understand different types of web pages and websites.</li> <li>3. implement HTML and CSS for web page designing.</li> <li>4. Understand the design of web crawlers and search engines.</li> </ol> <p>5*. implement the programs based on various concepts of web development.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	

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## Part B- Contents of the Course

### Instructions for Paper- Setter

Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four units selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Introduction to Internet and World Wide Web (WWW); Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers; Hypertext Transfer Protocol, URLs; Searching, Search Engines and Search Tools. Web Publishing: Hosting website; Internet Service Provider; Planning and designing website; Web Graphics Design, Steps For Developing website	10
II	Creating a Website and Introduction to Markup Languages (HTML and DHTML), HTML Document Features & Fundamentals, HTML Elements, Creating Links; Headers; Text styles; Text Structuring; Text color and Background; Formatting text; Page layouts, Images; Ordered and Unordered lists; Inserting Graphics; Table Creation and Layouts; Frame Creation and Layouts; Working with Forms and Menus; Working with Radio Buttons; Check Boxes; Text Boxes, HTML5	10
III	Introduction to CSS (Cascading Style Sheets): Features, Core Syntax, Types, Style Sheets and HTML, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Positioning, and other useful Style Properties; Features of CSS3.	10
IV	The Nature of JavaScript: Evolution of Scripting Languages, JavaScript-Definition, Programming for Non-Programmers, Introduction to Client-Side Programming, Enhancing HTML Documents with JavaScript. Static and Dynamic web pages	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• Create a web page using an ordered list and an unordered list.</li> <li>• Design a web page to show your institute with hyperlinks.</li> <li>• Create your resume on an HTML page.</li> <li>• Create a web page and divide the web page into four frames.</li> </ul> In one frame create three links that will display different <ul style="list-style-type: none"> <li>• HTML forms in the remaining three frames respectively.</li> <li>• Create a web page to show the college record in the form of a table.</li> <li>• Write an HTML code to add internal CSS on a webpage</li> <li>• Design a blog-style personal website. Design a web page to display your college with hyperlinks.</li> </ul>	25



- Write a JavaScript function to calculate the sum of two numbers.
- Write a JavaScript program to find the maximum number in an array.
- Write a JavaScript function to check if a given string is a palindrome (reads the same forwards and backward).
- Write a CSS file and attach it to any 3 HTML webpages.
- Use Div and span in a page and color two words with the same colors.
- Using HTML, CSS create a styled checkbox with animation on state change
- Design a web page that is like a compose page of e-mail. It should have:
  - o Text boxes for To, CC, and BCC respectively.
  - o Text field for the message.
  - o Send button.
  - o Option for selecting a file for attachment
- After clicking the send button a new page should open with the display message "Message has been sent".

#### Suggested Evaluation Methods

##### Internal Assessment:

###### > Theory

- Class Participation: 5
- Seminar/presentation/assignment/quiz/class test etc.: 5
- Mid-Term Exam: 10

###### > Practicum

- Class Participation: 5
- Seminar/Demonstration/Viva-voce/Lab records etc.: 5
- Mid-Term Exam: NA

**End Term Examination:**  
A three hours exam for both theory and practicum.

#### Part C-Learning Resources

##### Recommended Books/e-resources/LMS:

- Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
- Ramesh Bangia, Multimedia and Web Technology, Firewall Media.
- Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill
- Wendy Willard, HTML Beginners Guide, Tata McGraw-Hill.
- Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI
- David Flanagan, JavaScript: The Definitive Guide: The Definitive Guide.
- Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.

\*Applicable for courses having practical component.

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Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	I		
Name of the Course	Logical Organization of Computer		
Course Code	C24-CAP-103		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE/PC/AEC/ VAC)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Basic Knowledge of Mathematics (10 <sup>th</sup> Level)		
Course Learning Outcomes(CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. understand number systems, error detecting correcting code and representations of numbers in a computer system.</li> <li>2. understand computer arithmetic and Boolean algebra and simplification of Boolean expressions.</li> <li>3. understand working of logic gates and design various combinational circuits using these logic gates.</li> <li>4. understand working of different types of flip-flops and design different types of registers.</li> </ol> <p>5*. to understand the practical aspects of logical organization of computer.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
<b>Max. Marks:100(70(T)+30(P))</b> <b>Internal Assessment Marks:30(20(T)+10(P))</b> <b>End Term Exam Marks: 70(50(T)+20(P))</b>		<b>Time: 3 Hrs.(T), 3Hrs.(P)</b>	

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## Part B- Contents of the Course

### Instructions for Paper- Setter

Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four units selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Number Systems: Binary, Octal, Hexadecimal etc. Conversions from one number system to another, BCD Number System. BCD Codes: Natural Binary Code, Weighted Code, Self-complementing Code, Cyclic Code. Error Detecting and Correcting Codes. Character representations: ASCII, EBCDIC and Unicode. Number Representations: Integer numbers - sign-magnitude, 1's & 2's complement representation. Real Numbers normalized floating point representations.	10
II	Binary Arithmetic: Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division using 1's and 2's Complement representations, Addition and subtraction with BCD representations. Boolean Algebra: Boolean Algebra Postulates, basic Boolean Theorems, Boolean Expressions, Boolean Functions, Truth Tables, Canonical Representation of Boolean Expressions: SOP and POS, Simplification of Boolean Expressions using Boolean Postulates & Theorems, Karnaugh-Maps (up to four variables), Handling Don't Care conditions.	10
III	Logic Gates: Basic Logic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR etc. Their symbols, truth tables and Boolean expressions. Combinational Circuits: Design Procedures, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexers, Demultiplexers, Decoder, Encoder, Comparators, Code Converters.	10
IV	Sequential Circuits: Basic Flip- Flops and their working. Synchronous and Asynchronous Flip –Flops, Triggering of Flip- Flops, Clocked RS, D Type, JK, T type and Master-Slave Flip-Flops. State Table, State Diagram and State Equations. Flip-flops characteristics & Excitation Tables. Sequential Circuits: Designing registers –Serial-In Serial-Out (SISO), Serial-In Parallel-Out (SIPO), Parallel-In Serial-Out (PISO) Parallel-In Parallel-Out (PIPO) and shift registers.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:	25



<p><b>Number System:</b></p> <ul style="list-style-type: none"> <li>• Problems based on Number System and their conversion.</li> <li>• Programs based on Number System conversion.</li> </ul> <p><b>Binary Arithmetic</b></p> <ul style="list-style-type: none"> <li>• Problems based on Binary Arithmetic. Programs based on Binary Arithmetic.</li> <li>• Problems based on Boolean Expression and their simplification</li> </ul> <p><b>Logic Gates</b></p> <ul style="list-style-type: none"> <li>• Understanding working of logic Gates.</li> </ul> <p><b>Combinatorial Circuits:</b></p> <ul style="list-style-type: none"> <li>• Designing and understanding various combinational circuits.</li> </ul> <p><b>Sequential Circuits:</b></p> <ul style="list-style-type: none"> <li>• Designing and understanding various sequential circuits.</li> </ul>	
<b>Suggested Evaluation Methods</b>	
<p><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 5</li> <li>• Mid-Term Exam: NA</li> </ul>	<p><b>End Term Examination:</b></p> <p>A three hours exam for both theory and practicum.</p>
<b>Part C-Learning Resources</b>	
<p><b>Recommended Books/e-resources/LMS:</b></p> <ul style="list-style-type: none"> <li>• M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd.</li> <li>• V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall.</li> <li>• Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.</li> <li>• Nicholas Carter, Schaum's Outlines Computer Architecture, Tata McGraw-Hill.</li> </ul>	

\*Applicable for courses having practical component.

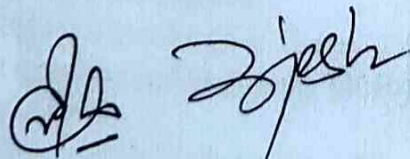
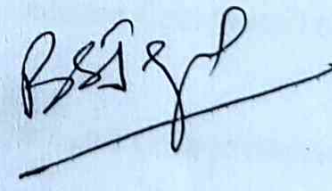
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Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	I		
Name of the Course	Mathematical Foundations for Computer Science-I		
Course Code	C24-CAP-104		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE /PC/AEC/ VAC)	CC-M		
Level of the course (As per Annexure-I)			
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After learning this course student will be able:</p> <ol style="list-style-type: none"><li>1. Gain the knowledge fundamental concepts of Discrete mathematics like: Sets, Relations, Functions, Propositional Logic. Understand various concepts of matrices and determinants, and acquire the cognitive skills to apply different operations on matrices and determinants. Define the fundamental concepts of Discrete mathematics like: Sets, Relations, Functions, Propositional Logic.</li><li>2. Express a logic sentence in terms of predicates, quantifiers and logical connectives.</li><li>3. Apply the rules of inference and contradiction for proofs of various results</li></ol>		
Credits	Theory	Practical	Total
	2	0	2
Contact Hours	2	0	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks:35		Time: 2 Hrs.(T)	



## Part B-Contents of the Course

### Instructions for Paper- Setter

Examiner will set a total of five questions. Out of which first question will be compulsory carry 15 Mark Remaining four questions will be set from two units selecting two questions from each unit. Examination will be of two-hours duration. Except First question all questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt three questions in all, selecting one question from each unit.

Unit	Topics	Contact Hours
I	Sets and Relations: Definition of sets, subsets, complement of a set, universal set, intersection and union of sets, De-Morgan's laws, Cartesian products, Equivalent sets, Countable and uncountable sets, Minset, Partitions of sets, Simple Applications. Definition of Relation, Properties of Relations, Equivalence Relation, Partial Order Relation, POSET, Lattice. Function: Domain and Range, Types of Functions, Composite and Inverse Functions.	12
II	Algebra of Logic: Proposition logic, basic logic, Logical Connectives, truth tables, tautologies, contradiction, Logical implication, Logical equivalence, Normal forms, Theory of Inference and deduction. Predicate Calculus: Predicates and quantifiers.  Algebra of Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint and Inverse of a matrix. Determinants: Definition, Minors, Cofactors, Properties of Determinants, Applications of determinants in finding area of triangle, Solving a system of linear equations.	12

### Suggested Evaluation Methods

<b>Internal Assessment:</b> <b>&gt; Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 4</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 4</li> <li>• Mid-Term Exam: 7</li> </ul>	<b>End Term Examination:</b> <b>A 2 hours exam</b>
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## Part C-Learning Resources

### Text /Reference Books:

- C. Y. Young (2021). Algebra and Trigonometry. Wiley.
- S.L. Loney (2016). The Elements of Coordinate Geometry (Cartesian Coordinates) (2<sup>nd</sup> Edition). G.K. Publication Private Limited.
- C.C. Pinter (2014). A Book of Set Theory. Dover Publications.
- A. Tussy, R. Gustafson and D. Koenig (2010). Basic Mathematics for College Students (4<sup>th</sup> Edition). Brooks Cole
- Kenneth H. Rosen, Discrete Mathematics and Its Applications, Tata McGraw-Hill, Fourth Edition.
- Seymour Lipschutz and Marc Lipson, Theory and Problems of Discrete Mathematics, Schaum Outline Series, McGraw-Hill Book Co, New York.
- Searle, Shayle R., and Andre I. Khuri. Matrix algebra useful for statistics. John Wiley & Sons, 2017.



Session: 2024-25			
Part A - Introduction			
Subject	BCA		
Semester	II		
Name of the Course	Object Oriented Programming using C++		
Course Code	C24-CAP-201		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE /PC/AEC/ VAC)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. learn the input/output statements and functions in C++.</li> <li>2. get familiar with OOPS concepts along with constructors and destructors in C++ language.</li> <li>3. Learn the various concepts of operator overloading and inheritance.</li> <li>4. get familiar with concepts of virtual functions and exception handling in C++ language.</li> </ol> <p>5*. implement the programs based on various concepts of C++.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
<b>Max. Marks:100(70(T)+30(P))</b> <b>Internal Assessment Marks:30(20(T)+10(P))</b> <b>End Term Exam Marks: 70(50(T)+20(P))</b>		Time: 3 Hrs.(T), 3Hrs.(P)	

*Dr. Jyesh* *Bisht*



## Part B-Contents of the Course

### Instructions for Paper- Setter

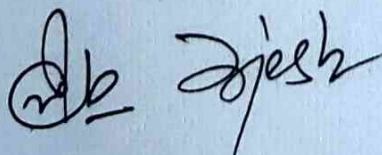
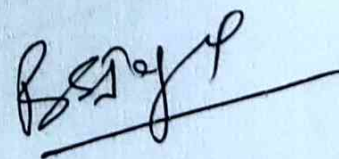
Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four units selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit. Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	<b>Input Output in C++:</b> Unformatted and Formatted I/O Operations. I/O using insertion and extraction operators and streams in C++. <b>Functions:</b> Declaration and Definition, return values, arguments, passing parameters by value, call by reference, call by pointer, Recursion, Inline Functions, Function overloading. Pointers, structures, and union in C++.	10
II	<b>Object-oriented features of C++:</b> Class and Objects, Data hiding & encapsulation, abstraction, Data Members and Member Functions, accessing class members, empty class, local class, global class, Scope Resolution Operator and its Uses, Static Data Members, Static Member Functions, Structure vs Class, Friend function and friend class. <b>Constructors and Destructors:</b> Constructors, Instantiation of objects, Default constructor, Parameterized constructor, Copy constructor and its use, Destructors, Dynamic initialization of objects.	10
III	<b>Operator Overloading:</b> Overloading unary and binary operators: arithmetic operators, manipulation of strings using operators. <b>Inheritance:</b> Derived class, base class, Accessing the base class member, Inheritance: multilevel, multiple, hierarchical, hybrid; Virtual base class, Abstract class.	10
IV	Virtual Functions, pure virtual functions; Polymorphism & its types <b>Exception Handling in C++:</b> exception handling model, exception handling constructs - try, throw, catch, Order of catch blocks, catching all exceptions, Nested try blocks, handling uncaught exceptions.	10
V*	<b>Practicum:</b> Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• Write a program that accepts principle, rate, and time from the user and prints the simple interest.</li> <li>• Write a program to swap the values of two variables.</li> <li>• Write a program to check whether the given number is even or odd (using?: ternary operator).</li> <li>• Write a program to check whether the given number is positive or negative (using?: ternary operator).</li> <li>• Write a program that inputs three numbers and displays the largest number using the ternary operator.</li> <li>• WAP to initialize data members of the class using the constructor.</li> </ul>	25



<p>values.</p> <ul style="list-style-type: none"> <li>• Create a class called cube with the data members Length, Breadth, Height</li> </ul> <p>Members functions:</p> <ul style="list-style-type: none"> <li>o To accept the details.</li> <li>o To calculate the volume of the cube.</li> <li>o To display the details.</li> </ul> <ul style="list-style-type: none"> <li>• WAP to calculate the sum using constructor overloading.</li> <li>• WAP to demonstrate the use of destructor.</li> <li>• Create a C++ Program to show the order of constructor and destructor.</li> <li>• C++ Program to Find the Number of Vowels, Consonants, Digits, and White Spaces in a String</li> <li>• C++ Program to Multiply Two Matrices by Passing Matrix to Function</li> <li>• Increment ++ and Decrement -- Operator Overloading in C++ Programming</li> <li>• C++ Program to Add Two Complex Numbers</li> <li>• C++ Program to Show Function Overriding</li> <li>• C++ Program to Show Polymorphism in Class</li> <li>• C++ Program to Show Function Overloading</li> <li>• C++ Program to Show Inheritance</li> </ul>	
<b>Suggested Evaluation Methods</b>	
<p><b>Internal Assessment:</b></p> <p>&gt; <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>&gt; <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 5</li> <li>• Mid-Term Exam: NA</li> </ul>	<p><b>End Term Examination:</b> A three hours exam for both theory and practicum.</p>
<b>Part C-Learning Resources</b>	
<p><b>Text /Reference Books:</b></p> <ul style="list-style-type: none"> <li>• Herbert Schildt, C++, The Complete Reference, Tata McGraw-Hill</li> <li>• Robert Lafore, Object Oriented Programming in C++, SAMS Publishing</li> <li>• Bjarne Stroustrup, The C++ Programming Language, Pearson Education</li> <li>• Balaguruswami, E., Object Oriented Programming in C++, Tata McGraw-Hill.</li> <li>• Richard Johnson, An Introduction to Object-Oriented Application Development, Thomson Learning.</li> </ul>	

\*Applicable for courses having practical component.

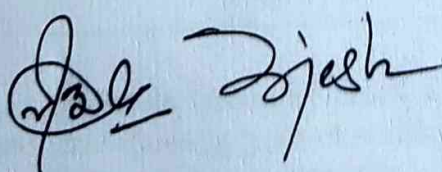
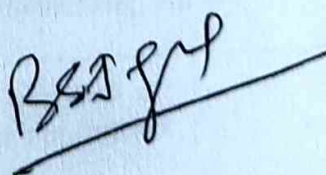





Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	II		
Name of the Course	Data Structure and applications		
Course Code	C24-CAP-202		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE /PC/AEC/ VAC)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"><li>1. learn the basics of web development.</li><li>2. understand different types of web pages and websites.</li><li>3. implement HTML and CSS for web page designing.</li><li>4. Understand the design of web crawlers and search engines.</li></ol> <hr/> <p>5*. implement the programs based on various concepts of web development.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	



## Part B-Contents of the Course

### Instructions for Paper- Setter

Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four units selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt five questions in all, selecting one question from each unit.

Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration.

Unit	Topics	Contact Hours
I	Data Structure Definition, Data Type vs. Data Structure, Classification of Data Structures, Data Structure Operations, Applications of Data Structures. Algorithm Specifications: Performance Analysis and Measurement (Time and Space Analysis of Algorithms- Average, Best and Worst Case Analysis). Arrays: Introduction, Linear Arrays, Representation of Linear Array in Memory, Two Dimensional and Multidimensional Arrays, Sparse Matrix and its Representation, Operations on Array: Algorithm for Traversal, Selection, Insertion, Deletion and its implementation.	10
II	String Handling: Storage of Strings, Operations on Strings viz., Length, Concatenation, Substring, Insertion, Deletion, Replacement, Pattern Matching Linked List: Introduction, Array vs. linked list, Representation of linked lists in Memory, Traversing a Linked List, Insertion, Deletion, Searching into a Linked list, Type of Linked List.	10
III	Stack: Array Representation of Stack, Linked List Representation of Stack, Algorithms for Push and Pop, Application of Stack: Polish Notation, Postfix Evaluation Algorithms, Infix to Postfix Conversion, Infix to Prefix Conversion, Recursion. Introduction to Queues: Simple Queue, Double Ended Queue, Circular Queue, Priority Queue, Representation of Queues as Linked List and Array, Applications of Queue. Algorithm on Insertion and Deletion in Simple Queue and Circular Queue. Priority Queues	10
IV	Tree: Definitions and Concepts, Representation of Binary Tree, Binary Tree Traversal (Inorder, postorder, preorder), Binary Search Trees – Definition, Operations viz., searching, insertions and deletion; Searching and Sorting Techniques, Sorting Techniques: Bubble sort, Merge sort, Selection sort, Quick sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• Write a program that uses functions to perform the following operations on an array i) Creation ii) Insertion iii) Deletion iv) Traversal.</li> <li>• Write a program that uses functions to perform the following operations on strings i) Creation ii) Insertion iii) Deletion iv) Traversal.</li> <li>• Write a program that uses functions to perform the following operations on a singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.</li> </ul>	25



<p>a doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal</p> <ul style="list-style-type: none"> <li>• Write a program that implement stack (its operations) using i) Arrays ii) Linked list(Pointers).</li> <li>• Write a program that implements Queue (its operations) using i) Arrays and ii) Linked lists (Pointers).</li> <li>• Write a program that implements the following sorting i) Bubble sort ii) Selection sort iii) Quick sort.</li> <li>• Write programs for various types of tree traversals</li> </ul>	
<b>Suggested Evaluation Methods</b>	
<p><b>Internal Assessment:</b></p> <ul style="list-style-type: none"> <li>➤ <b>Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> </li> <li>➤ <b>Practicum</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 5</li> <li>• Mid-Term Exam: NA</li> </ul> </li> </ul>	<p><b>End Term Examination:</b> A three hours exam for both theory and practicum.</p>
<b>Part C-Learning Resources</b>	
<p><b>Text /Reference Books:</b></p> <ul style="list-style-type: none"> <li>• Seymour Lipschutz, Data Structures, Tata McGraw- Hill Publishing Company Limited,</li> <li>• Schaum's Outlines.</li> <li>• Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Data Structures Using C, Pearson Education.</li> <li>• Trembley, J.P. And Sorenson P.G., An Introduction to Data Structures with Applications, McGraw-Hill.</li> <li>• Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Addison- Wesley</li> </ul>	

\*Applicable for courses having practical component.

*Sh. Jyoti* *B. S. S. S.*



Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	II		
Name of the Course	Concepts of Operating Systems		
Course Code	C24-CAP-203		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE /PC/AEC/ VAC)	CC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. understand the basic concepts of operating systems and their services along with process management.</li> <li>2. understand the concept of process scheduling and acquire knowledge of process synchronization.</li> <li>3. learn about memory management and virtual memory concepts.</li> <li>4. learn to work with directory structure and security aspects.</li> </ol> <hr/> <p>5*. implement the programs based on the operating system.</p>		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5
Max. Marks:100(70(T)+30(P)) Internal Assessment Marks:30(20(T)+10(P)) End Term Exam Marks: 70(50(T)+20(P))		Time: 3 Hrs.(T), 3Hrs.(P)	

*[Handwritten signatures]*



## Part B-Contents of the Course

### Instructions for Paper- Setter

The examiner will set a total of nine questions. Out of which, the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate will have to attempt five questions, selecting one from each unit. First question will be compulsory. The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

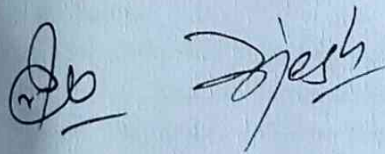
Unit	Topics	Contact Hours
I	Introductory Concepts: Operating System, Functions and Characteristics, Historical Evolution of Operating Systems, Operating System Structure. Types of Operating System: Real-time, Multiprogramming, Multiprocessing, Batch processing. Operating System Services, Operating System Interface, Service System Calls, and System Programs. Process Management: Process Concepts, Operations on Processes, Process States, and Process Control Block. Inter-Process Communication.	10
II	CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling, Algorithm Evaluation. Synchronization: Critical Section Problem, Semaphores, Classical Problem of Synchronization, Monitors. Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.	10
III	Memory Management Strategies: Memory Management of Single-user and Multiuser Operating Systems, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.	10
IV	Implementing File System: File System Structure, File System Implantation, File Operations, Type of Files, Directory Implementation, Allocation Methods, and Free Space Management. Disk Scheduling algorithm - SSTF, Scan, C- Scan, Look, C-Look. SSD Management.	10
V*	Practicum: Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• Working with various operating systems, and performing different operations using operating systems.</li> <li>• Write a program to print file details including owner access permissions, and file access time, where file name is given as argument.</li> <li>• Write a program to copy files using system calls.</li> <li>• Write a program to implement the FCFS scheduling algorithm.</li> <li>• Write a program to implement the Round Robin scheduling algorithm.</li> </ul>	25

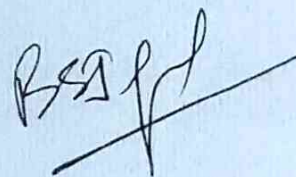


Session: 2024-25

Part A - Introduction

Subject	BCA		
Semester	II		
Name of the Course	Mathematical Foundations for Computer Science-II		
Course Code	C24-CAP-204		
Course Type: (CC/MCC/MDC/CCM/DSEC/VOC/DSE /PC/AEC/ VAC)	CC-M		
Level of the course (As per Annexure-I)			
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLO):	<p>After learning this course student will be able:</p> <ol style="list-style-type: none"> <li>1. Gain the knowledge of concepts and related terminology of probability and statistics including random variables, expectations, probability distributions, measures of central tendency, correlation, tests etc.</li> <li>2. Solve the different problems of probability and statistics.</li> <li>3. Compile and integrate the knowledge of probability and statistics to solve the real world problems. Probability and Statistics Detailed contents</li> </ol>		
Credits	Theory	Practical	Total
	2	0	2
Contact Hours	2	0	2
Max. Marks:50 Internal Assessment Marks:15 End Term Exam Marks:35		Time: 2 Hrs.(T)	







## Part B-Contents of the Course

### Instructions for Paper- Setter

Examiner will set a total of five questions. Out of which first question will be compulsory carry 15 marks. Remaining four questions will be set from two units selecting two questions from each unit. Examination will be of two-hours duration. Except First question all questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. Candidate will have to attempt three questions in all, selecting one question from each unit.

Unit	Topics	Contact Hours
I	Measure of Central Tendency: Overview of Mean, Arithmetic Mean, Geometric Mean, Harmonic Mean Median and Mode. Measure of Dispersion: Standard Deviation, Variance, Range, Percentile, Quartile, Interquartile Range, Moments and Moments Generating Functions.	12
II	Probability: Definition and various approaches of probability, Addition theorem, Boole inequality, Conditional probability and multiplication theorem, Independent events, Bayes theorem and its applications. Random variable and probability functions: Definition and properties of random variables, Discrete and continuous random variables, Probability mass and density functions, Distribution function. Concepts of bivariate random variable: joint, marginal and conditional distributions. Correlation and regression, Rank correlation, Correlation coefficient,	12

### Suggested Evaluation Methods

#### Internal Assessment:

##### > Theory

- Class Participation: 4
- Seminar/presentation/assignment/quiz/class test etc.: 4
- Mid-Term Exam: 7

**End Term Examination:**  
**A 2 hours exam**

### Part C-Learning Resources

#### Text /Reference Books:

- M. Spiegel, Probability and Statistics, Schaum Outline Series.
- S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand Pub., New Delhi.
- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).

