National Curriculum and Credit Framework (NCCF)

Syllabus

for

Bachelor of Computer Application

w.e.f. Academic Session 2023-24

KaziNazrul University

Asansol, Paschim Bardhaman

West Bengal 713340

Semester- I

MAJOR COURSE - 1

Course Name: Introduction to Programming using C

Course Code: BCAMJ101

Course Type: **Major (Theoretical & Practical)**	Course Details:**MJC-1**			L-T-P: **3–0–4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Introduction to computers, Evolution, Generation of Computers, Computers Hierarchy, Different components of computer (CPU, ALU, different types of memory etc.), Number System – Binary, Hexa, Octal, BCD System, Introduction to operating environment.

UNIT II. Introduction to Programming, Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Flowcharts, Types of Programming Methodologies, Introduction to C Programming - Basic Program Structure in C, Variables and Assignments, Input and Output, Selection and Repetition Statements.

UNIT III. Top-Down Design, Predefined Functions, Programmer-defined Function, Local Variable, Recursion - Developing Recursive Definition of Simple Problems and their implementation.

UNIT IV. Introduction to Arrays, Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays.Arrays in Functions, Multi-Dimensional Arrays, Searching in Array.

UNIT V. Pointers - Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Call-By-Value and Call-By-Reference Parameters.

UNIT VI. Structures - Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures, Unions.

UNIT VII. Strings - Declaration and Initialization, Reading and Writing Strings, Arrays of Strings, String and Function, Strings and Structure, Standard String Library Functions.

UNIT VIII. File Handling – File opening modes, use of files for data input and output. merging and copy files.

Practical

UNIT I. Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code, execute and test it. Students should be given assignments on following:

a) To learn elementary techniques involving arithmetic operators and mathematical expressions, appropriate use of selection (if, switch, conditional operators) and control structures.

b) Learn how to use functions and parameter passing in functions, writing recursive programs.

UNIT II. Students should be given assignments on following:

a) Write Programs to learn the use of strings and string handling operations.

b) Problems which can effectively demonstrate use of Arrays. Structures and Union.

c) Write programs using pointers and functions.

d) Write programs to use files for data input and output.

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks) – one from each unit, Viva-voce (5 marks)

ESE Evaluation: Two experiments (10 marks) – one from each unit, Viva-voce (10 marks)

References/ Suggested Readings:

1. Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson.
2. C Programming, Karnighan&Ritchie, PHI
3. Programming through C, Richard Johnsonbaugh and Martin Kalin, Pearson Education
4. Programming in C, B.S. Gottfried, Sahaum Series.
5. Programming in ANSI C, E. Balaguruswami, TMH

MINOR COURSE - 1

Course Name: Financial Accounting

Course Code: BCAMN101

Course Type: **Minor (Theoretical)**	Course Details:**MNC-1**			L-T-P: **4–1–0**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		**70**

Course Content:

Theory

UNIT I: Basic idea of Book Keeping and Accounting: Definition, Nature, Importance, Limitations, Difference between Book Keeping and Accounting. Accounting Principles: Generally Accepted Accounting Principles (GAAP) - Important Accounting Concepts: Proprietary, Entity, Fund, Money Measurement, Accounting Period, Going Concern, Duality, Realization and Accrual; Important Accounting Conventions: Disclosure, Materiality, Consistency, Comparability, Objectivity and Conservatism; Accounting Concept vs. Accounting Convention, Matching Concept, Relation of Accounting Theory with Accounting Practice.

UNIT II: Accounting Process: Journal: Definition, Features, Classification, Journal Entry; ledger: Definition, Classification, Ledger posting; Difference between Journal and Ledger;

UNIT III: Trial Balance: Definition, Importance, Errors, and Preparation of trial balance.

UNIT IV: Cash Book: Definition, Features, Types of Cash Book and Preparation of cash book under Single column method,Double column method,Triple column method and petty Cash Book

UNIT V: Depreciation-Concepts-Features-Causes-Diferent Methods of Depreciation on assets-Practical Problems on Straight line methods, Diminishing balance methods depreciation and Sinking Fund method

UNIT VI: Bad Debt and Provision for bad debt- Concepts-Features-Diference between bad debt and doubtful debt-accounting treatment of bad debt and doubtful debt

UNIT VII: Preparation of Financial Accounts of a profit-making trading Concern with additional information

UNIT VIII: Sectional and Self Balancing Ledgers: Concept of Sectional Balancing, preparation of control accounts. Self-Balancing Ledger: advantages; Recording process; preparation of Adjustment accounts.

References/ Suggested Readings:

1. Accounting Theory, Hendriksen, E.S., Khosla Publishing House, Delhi.
2. Accounting Theory, Lal, J. Himalaya Publishing House, Mumbai.
3. Accounting Theory, Porwal, L.S., Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
4. Accounting Theory and Management Accounting, Sinha, G., Vidyoday Library Pvt. Ltd.
5. Financial Accounting, Goyal, Bhushan Kumar and H.N. Tiwari, Taxmann.
6. Financial Accounting, Kumar, Alok, Singhal Publication.
7. Financial Accounting – Concepts and Applications, Lt Bhupinder, Cengage.
8. Financial Accounting: concept and Applications, Monga, J R, Mayur paper Backs, New Delhi.

MULTIDISCIPLINARY COURSE - 1

Course Name: Information and Media Literacy

Course Code: MDC119

Course Type: **MD (Theoretical)**	Course Details:**MD-1**			L-T-P: **3–0–0**	
Credit: **3**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			15		**35**

Course Content:

Theory

UNIT I. Introduction to Information and Media Literacy: Definition and importance of information and media literacy. Interrelationships between data, information, knowledge, and wisdom; Understanding the role of information and media in society. Information source vs. Information resource; Information society; Exploring the impact of misinformation, disinformation and fake news.

UNIT II. Evaluating Information Sources: Concepts of primary, secondary and tertiary information sources; Parametrs for information authenticity andIdentifying credible sources of information. Assessing the reliability and validity of sources. Recognizing bias and evaluating multiple perspectives. Conducting effective research using library resources: library retrieval, use of large-scale textual search engines, electronic databases (bibliographic & full-text), AI-enabled search tools; Developing critical reading and note-taking skills.

UNIT III. Digital Literacy and Online Research: Developing effective search skills – search strategies, search techniques (Boolean, Relational and Positional search operators); Evaluating and selecting appropriate online resources. Citing and referencing sources accurately – use of open source reference management software. Evaluating and integrating information from various sources. Credibility, reliability, and bias in different types of sources (websites, articles, social media, etc.) Fact-checking and verification techniques.

UNIT IV. Privacy, Security, and Digital Citizenship: Understanding online privacy issues and protecting personal information. Recognizing digital threats and practicing safe online behavior. Promoting responsible digital citizenship and ethical online practices. Understanding the relationship between media, democracy, and civic participation. Promoting media literacy as a tool for active citizenship. Concept of research ethics and academic honour code.

UNIT V. Social Media, Information Sharing and Civic Engagement: Analyzing the impact of social media on information dissemination. Understanding the role of algorithms and filter bubbles. Engaging in responsible sharing and combating misinformation, disinformation and fake news.

References/ Suggested Readings:

1. Media Literacy in the Information Age: Current Perspectives" edited by Christina Spurgeon.
2. Media Literacy: A Reader" edited by David Buckingham
3. Information Literacy: Search Strategies, Tools & Resources for High School Students and College Freshmen" by Susanna Caroselli
4. Media Literacy Education in Action: Theoretical and Pedagogical Perspectives" edited by Belinha S. De Abreu and Paul Mihailidis
5. Information Literacy and Information Skills Instruction: Applying Research to Practice in the 21st Century School Library" by Nancy Pickering Thomas
6. Web Literacy for Educators" by Alan November
7. Information and Media Literacy: The Whole-Student Approach" by Dr. Belinha S. De Abreu

SKILL ENHANCEMENT COURSE - 1

Course Name: Office Automation Software Lab

Course Code: BCASE101

Course Type:SEC **(Practical)**	Course Details:**SEC-1**			L-T-P: **0–0–6**	
Credit: 3	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30		**20**	

Course Content:

Practical

UNIT I. Windows Basics: Introduction of windows OS, navigating the Windows 10 user interface, Creating accounts in Windows, Opening apps and programs, working with files, using the Start button and Start menu, Accessing and using the Action Center, Working with apps and programs on the taskbar, Customizing settings in Windows 10, including backgrounds, screensavers, and more, Using the Settings app and the Control Panel.

UNIT II. MS Word and Google Docs: Overview, creating, saving, opening, importing, exporting, and insertingfiles, formatting pages, paragraphs and sections, indents and outdents, creating lists andnumbering. Headings, styles, fonts and font size, editing, positioning, viewing texts,searching and replacing text, inserting page breaks, page numbers, bookmarks, symbols, anddates. Using tabs and tables, header, footer, and printing,

UNIT III. MS Excel and Google Sheets: Worksheet overview, entering information, worksheet creation, openingand saving workbook, formatting numbers and texts, protecting cells, producing charts, andprinting operations. Application of Excel for obtaining statistical parameters, Mean, Median,Mode, average, co-relation, Regression, Data capturing using Google Forms.

UNITIV. MS PowerPoint or Google Slides: Slide creation with PowerPoint, Presenting shows for corporate and commercial using PowerPoint.

UNIT V. Graphics and Image Editing Software: Overview of graphic design and image editing applications (e.g., Adobe Photoshop, GIMP), Understanding basic image editing techniques (e.g., cropping, resizing, retouching), Creating and manipulating graphics for various purposes.

UNIT VI. Web Browsing and Internet Applications: Navigating web browsers and utilizing essential features, Understanding internet protocols and security considerations, Exploring common internet applications (e.g., email clients, cloud storage, online collaboration tools).

UNIT VII. File Compression and Archiving Software: Introduction to file compression formats (e.g., ZIP, RAR), Compressing and decompressing files and folders, Managing archived files and folders.

Internal (CA) Evaluation: Practical Note Book (15 marks), One experiment (10 marks), Viva-voce (5 marks).

ESE Evaluation: One experiment (10 marks), Viva-voce (10 marks).

References/ Suggested Readings:

1. Introduction to Computers with MS-Office, Leon, TMH
2. Learn Microsoft Office 2019, Linda Foulkes, HP.

Semester- II

MAJOR COURSE - 2

Course Name: Data Structures and Algorithms

Course Code: BCAMJ201

Course Type: **Major (Theoretical & Practical)**	Course Details:**MJC-2**			L-T-P: **3–0–4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Basic concepts- Data, Data Structures, ADT, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis, Linear and Non Linear data structures.

UNIT II. Singly Linked Lists - Operations, Concatenating, Circularly linked lists - Operations for Circularly linked lists, Doubly Linked Lists - Operations. Polynomial and sparse matrix representation using linked list.

UNIT III. Stack- Definition and Operations, Array and Linked Implementations, Applications - Valid Expression Checking (Parenthesis matching), Reversal of string, Infix to Postfix Conversion, Postfix Expression Evaluation, Recursion Implementation.

UNIT IV. Queue - Definition and Operations, Array and Linked Implementations, Applications, Circular Queues - Insertion and Deletion Operations, Priority Queue-Definition and Implementation, Dequeue (Double Ended Queue) - Introduction.

UNIT V. Searching Methods – Linear and Binary.

UNIT VI. Sorting Methods – Bubble, Insertion, Selection, Shell, Using Divide-Conquer Approach (Quick and Merge sort), Comparison of Sorting Methods.

UNIT VII. Trees, Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees, Binary Search tree - Creation, Insertion, Deletion and Search, AVL tree-Definition, Examples, Insertion and Rotations, B tree, B+ tree, Heap- Definition, Min heap, Max heap, Insertion and Deletion. Priority Queue using Heap.

UNIT VIII. Graphs, Graph ADT, Graph Representations, Graph Traversals and Searching,

Practical

Students are required to write and practically execute programs to solve problem using various data structures. The teacher can suitably device problems which help students experiment using the suitable data structures and operations. Some of the problems are indicated below.

1. Write program that uses functions to perform the following:
   a) Creation of list of elements where the size of the list, elements to be inserted and deleted are dynamically given as input.
   b) Implement the operations, insertion, deletion at a given position in the list and search for an element in the list
   c) To display the elements in forward / reverse order
2. Write recursive programs for Factorial, Fibonacci numbers, Towers of Hanoi etc.
3. Write a program to implement stack (using array and linked list). Write a program that demonstrates the application of stack operations (Eg: infix expression to postfix conversion, postfix evaluation).
4. Write programs to implement queue using array and linked list.
5. Write program that implements linear (using array and linked list) and binary search.
6. Write programs of a) Bubble sort b) Insertion Sort c) Selection Sort d) Quicksort etc.
7. Write a program to create a Binary Search Tree and insertion and deletion of node from the tree. Write recursive and non-recursive routines to traverse a binary tree in preorder, inorder and postorder.

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks), Viva-voce (5 marks)

ESE Evaluation: Two experiments (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures and Algorithm Analysis in C, 2nd edition, M. A. Weiss, Pearson.
3. Data structures,Lipschutz: Schaum's outline series, Tata McGraw-Hill
4. Data Structure through C in Depth, S.K. Srivastava and DeepaliSrivastava, B.P.B Publication.

MINOR COURSE - 2

Course Name: Cost Accounting

Course Code: BCAMN201

Course Type: **Minor (Theoretical)**	Course Details:**MNC-2**			L-T-P: **4–1–0**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
			30		**70**

Course Content:

Theory

UNIT I. Introduction Meaning, scope, objectives and advantages of cost accounting; Cost centre and Cost Unit, Difference between financial and cost accounting, Limitation of Cost accounting, Classifications of cost.

UNIT II: Elements of cost and cost sheet.

UNIT III. Materials: Material/inventory control techniques. Accounting and control of purchases, storage and issue of materials. Inventory systems, EOQ, Various levels of stocks, Methods of pricing of materials issues — FIFO, LIFO, Simple Average method, Weighted average method and base stock method.

UNIT IV: Labour: Accounting and Control of labour cost. Time-keeping and time-booking. Concept of idle time, over time, labour turnover and fringe benefits. Methods of wage payment, Time Rate, Piece Rate, and Incentive schemes- Halsey, Rowan, Requisites of Good Wages Incentive Plan;

UNIT-V: Overheads: Classification, allocation, apportionment and absorption of overheads, Under- and over- absorption; Causes and treatment of Under- and over- absorption, Machine Hour Rate.

UNIT VI. Budgetary Control: Definition, features, importance, Classification Zero based Budgeting and Responsibility Accounting, Preparation of Cash Budget and Flexible Budget.

UNIT VII. Marginal Costing-concept of marginal cost and marginal costing; Assumptions, Cost-volume-profit analysis; Break-even analysis-using mathematical and graphical approaches, Profit-volume ratio, angle of incidence, margin of safety.

UNIT VIII: Standard Costing: Standard Costing and Variance Analysis: Meaning of standard cost and standard costing; advantages, limitations and applications; Variance Analysis – Material Variances and Labour Variances.

References/ Suggested Readings:

1. Cost Accounting-principles and practice, Arora, M.N., Vikas Publishing House, New Delhi.
2. Fundamentals of Cost Accounting, Jhamb, H. V., Ane Books Pvt Ltd, New Delhi.
3. Cost Accounting, Lal, Jawahar., and Srivastava, Seema, McGraw Hill Publishing Co., New Delhi.
4. Fundamentals of Cost Accounting, Singh, Surender, KitabMahal, Allahabad/New Delhi.
5. Management and Cost Accounting, Drury, Colin,Thomson Learning.
6. Cost Accounting: A Managerial Emphasis, Horngren, Charles T., George Foster and Srikant M. Dattar. Prentice Hall of India Ltd., New Delhi.
7. Cost Accounting: Principles and Methods, Jain, S.P., and Narang, K.L., Kalyani Publishers, Jalandhar.

SKILL ENHANCEMENT COURSE - 2

Course Name: Web Designing with HTML, CSS

Course Code: BCASE201

Course Type: SEC **(Practical)**	Course Details:**SEC-2**			L-T-P: **0–0–6**	
Credit: 3	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30		**20**	

Course Content:

Practical

Students are directed to do a minor project based on the contents of the course below (UNIT I to UNIT X) for internal and ESE evaluation.

UNIT I. Introduction to Web Design: Understanding the role and importance of web design, Exploring the components of a web page, Overview of web design principles and best practices.

UNIT II. Introduction to HTM: Understanding the structure and syntax of HTML, Working with HTML tags, attributes, and elements, Creating a basic web page using HTML.

UNIT III. HTML Document Structure: Defining the document type and character encoding, Organizing content with headings, paragraphs, lists, and tables, Incorporating images, links, and multimedia elements.

UNIT IV. HTML Forms and Input Validation: Creating forms for user input, Utilizing different form elements (e.g., text fields, checkboxes, radio buttons), Implementing form validation using HTML attributes.

UNIT V. Introduction to CSS: Understanding the purpose and benefits of CSS, Working with CSS selectors, properties, and values, Applying CSS styles to HTML elements.

UNIT VI. Styling Text and Typography: Formatting text using CSS properties (e.g., font-family, font-size, color), Applying text effects (e.g., bold, italic, underline), Customizing typography using Google Fonts and other resources.

UNIT VII. Box Model and Layouts: Understanding the box model concept, Controlling element dimensions, padding, margins, and borders, Creating different layout structures (e.g., fixed, fluid, responsive).

UNIT VIII. CSS Flexbox and Grid: Introduction to CSS Flexbox for flexible page layouts, Utilizing CSS Grid for advanced grid-based layouts, Creating responsive designs with media queries.

UNIT IX. Styling Links, Navigation, and Menus: Customizing link styles and states, Creating navigation menus using HTML lists and CSS, Implementing dropdown menus and responsive navigation patterns.

UNIT X. CSS Transitions and Animations: Creating smooth transitions between CSS states, Adding animations to elements using key frames and CSS properties, Incorporating CSS animation libraries and frameworks.

Internal (CA) Evaluation: Minor Project Report (15 marks), Demonstration of the minor project (10 marks), Viva-voce (5 marks).

ESE Evaluation: Presentation of the minor project (10 marks), Viva-voce (10 marks).

References/ Suggested Readings:

1. HTML & CSS: design and build websites, John Duckett, John Wiley & Sons, Inc.
2. Beginning Responsive Web Design with HTML5 and CSS3, Jonathan Fielding, Apress.

Semester- III

MAJOR COURSE - 3

Course Name: Object Oriented Programming with C ++

Course Code: BCAMJ301

Course Type: **Major (Theoretical & Practical)**	Course Details:**MJC-3**			L-T-P: **3–0–4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I: **Principles of Object Oriented Programming (OOP)**: Software Evaluation, A Look at Procedure Oriented Programming, OOP Paradigm, Basic Concepts of OOP, Benefits of OPP, Application of OOP.

UNIT II: Introduction to C++: What is C++, A simple C++ Program, More C++ statements, Structure of C++ Program. Tokens, Expression and controls Structures, Keywords, Identifiers and Constants, C++ data types, Variables: Declaration, Dynamic initialization of variables, Reference variables, Operators in C++ : Scope resolution operator, Member deferencing Operators, Memory Management Operators, Manipulators, Type cast operators, Expressions and Control Structures. Functions The main() function, Function Prototyping, Call by reference, Return by reference, Inline function.

UNIT III: Classes and Objects: Introduction, Specifying a Class, Defining member Functions, Nesting of Member functions, Private member functions, Memory Allocation for Objects, Static Data members, Static Member Functions, Arrays within a Class, Arrays of Objects, Objects as Function Arguments, Friendly Functions, Returning Objects.

UNIT IV: Pointers: Declaration and initializing, Manipulation of pointers, Pointers to objects, this pointers, Arrays of Pointers to Objects.

UNIT V. Constructors and Destructors: Constructors, Parameterized Constructors, Multiple Constructors in a class, Copy constructor, Destructors.

UNIT VI. Polymorphisms: Function Overloading, Operator overloading, Overloading Unary Operators, Overloading Binary Operators, Type Conversions.

UNIT VII: Inheritance: Introduction, Defining Derived Classes, Single inheritance, Multiple inheritance, Hierarchical inheritance, Multilevel inheritance, Hybrid inheritance, Virtual Base Classes, Constructor in Derived Classes, Pointers to Derived Classes, Static and dynamic binding, Virtual Functions, Pure Virtual Functions.

UNIT VIII: **I/O Operations and Files**: C++ Stream Classes, Unformatted I/O Operations, Formatted I/O operations, Classes for File Streams, Opening and Closing a File : open() and close() functions, Manipulators of File Pointers, Sequential Input and output Operations, Error handling in File Operations.

UNIT IX. Exception Handling: Benefits of Exception Handling, Throwing an Exception, the Try Block, Catching an Exception, Exception Objects, Exception Specifications, Rethrowing an Exception, Uncaught Exceptions.

UNIT X. Templates: Class Templates and Function Templates, simple generic classes and generic function, simple example programs. Introduction to Standard Template Library (STL).

Practical

Students are required to understand the object-oriented concepts using C++. They are required to practice the concepts learnt in the theory. Some of the programs to be implemented are listed as follows:

1. Number of vowels and number of characters in a string.
2. Write a function called zeros maller() that is passed with two introduce arguments by reference and set the smaller of the number to zero. Write a main() program to access this function.
3. Demonstration of Class, Constructors, destructors, input and output functions, Objects
4. Demonstration of array of object.
5. Demonstration of friend functions.
6. Demonstration of operator overloading.
7. Demonstration of inheritance.
8. Using this pointer to return a value (return by reference).
9. Demonstration of virtual function.
10. Demonstration of static function.
11. Accessing a particular record in a student's file.
12. Demonstration of exception handling.
13. Demonstration of class template and function template

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks), Viva-voce (5 marks).

ESE Evaluation: Two experiments (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. E.Balagurusamy, Object Oriented Programming through C++, TMH.
2. Lafore Robert, Object Oriented Programming in Turbo C++, Galgotia Publications.
3. Herbert Schildt, C++: The Complete Reference, McGraw Hill.
4. B. Stroutstrup, The C++ Programming Language, 3rd Edition, Pearson Education.
5. Ashok N Kamthane, Programming in C++, Pearson.

MAJOR COURSE - 4

Course Name: Digital Logic and Computer Organization

Course Code: BCAMJ302

<table>
<tr><td rowspan="2">Course Type: Major (Theoretical & Practical)</td><td colspan="3" rowspan="2">Course Details:MJC-4</td><td colspan="2">L-T-P: 3–0–4</td></tr>
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<tr><td rowspan="3">Credit: 5</td><td rowspan="3">Full Marks: 100</td><td colspan="2">CA Marks</td><td colspan="2">ESE Marks</td></tr>
<tr><td>Practical</td><td>Theoretical</td><td>Practical</td><td>Theoretical</td></tr>
<tr><td>30</td><td>15</td><td>20</td><td>35</td></tr>
</table>

Course Content:

Theory

Unit I: Introduction to Computer-Definition of Computer System; Evolution of Computer – a brief history; Classification of computer; Generation of Computers.

Unit II: Computer System Architecture – Definition of Hardware; Basic units of Computer System; CPU – Control Unit, ALU; System Buses, Memory module – Primary Memory, Secondary Memory, Cache Memory, Virtual Memory – definition, classification, features and functions; measuring unit of memory – Bit, Byte, KB, MB, GB; Input Devices – Keyboard, Mouse, Scanner, Output Devices – Monitor, Printer.

Unit III: Introduction to Number System – Positional number systems; Binary, Octal, Hexadecimal and Decimal number systems; conversion of a number in one system to the other; Representation of signed numbers- signed magnitude, one's complement, 2's complement representation techniques, Merits of 2's complement representation scheme; Various binary codes- BCD, excess -3, Gray code; Binary arithmetic- addition, subtraction, multiplication and division of unsigned binary numbers.

Unit IV: Introduction to Software – Definition of Software; Classification of Software; Introduction to Operating System – Definition of OS; Application Softwares, Functions of OS, basic concept of different type of OS- batch processing OS, Multitasking OS, Multi-user OS, Network OS.

Unit V: Logic gates: Basic logic operations- logical sum(or), logical product (AND), complementation (not), Anti coincidence (EX-OR)and coincidence (EX-NOR) operations: Truth tables of Basic gates; Boolean Variables and Expressions; Demorgan's theorem; Universal gates- NAND and NOR; Boolean expressions Simplification- Algebraic technique, Karnaugh map technique, 3 variable and 4 variable Karnaugh map.

Unit VI: Combinational Circuits: Half adder, full adder, binary magnitude comparator, adder/subtractor circuits, multiplexer and demultiplexer circuits, BCD adder/subtractor; ALU; parity generators, code converters, priority encoders, PLAs.

Unit VII: Sequential circuits: flip- flops, - RS, clocked RS, D, JK, T flip-flops,: Race condition, Master Slave JK: Registers, Universal Shift Registers; Counters- Binary, decade; modulo-r divider; Practical IC's; Sequential Machine design.

Unit VIII: Basic Computer Organization and Design: Overview of computer architecture; Von Neumann architecture and its components; CPU, memory, input/output units; Instruction cycle, fetch-decode-execute; Data transfer and control signals

Unit IX: Processor Design and Control Unit: Basic structure of the CPU; Processor design: Control unit, Arithmetic and Logic Unit (ALU); Control unit design: Hardwired vs. Microprogrammed; Instruction set architecture (ISA); RISC vs. CISC processors; Pipelining concepts: Basic, instruction-level parallelism.

Practical

Unit I: Study on the characteristic of AND, OR, NAND, NOR, EX-OR, EX-NOR gates.

Unit II: Design of different combinational circuit such as half adder/subtractor, full adder/subtractor, decoder/encoder, priority encoder, multiplexer, demultiplexer, magnitude comparator etc.

Unit III: Study on the characteristic of different flip-flops-JK, RS, T, D etc.

Unit IV: Design and implementation of different sequential circuit such as shift register, counter-decimal, ripple etc.

CA (Internal) Evaluation: Laboratory Note Book (15 marks), Two Experiments (10 marks) Viva-voce (5 marks).

ESE Evaluation: Two Experiments (10 marks), Viva-voce (10 marks).

References/ Suggested Readings:

1. M. Morris Mano, Digital Logic, Pearson.
2. D.P. Leach, A.P. Malvino and G. Saha, Digital Principles and Applications, McGraw-Hill.
3. Modern Digital Electronics: R.P. Jain, Tata McGraw Hill.

MINOR COURSE - 3

Course Name: Introduction to Algebra and Trigonometry

Course Code: BCAMN301

Course Type: **Minor (Theoretical)**	Course Details:**MNC-3**			L-T-P: **4–1–0**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**30**	**-**	**70**

Course Content:

Theory

Unit I. Set: Sets and their representations,Finite and Infinite sets,Empty set. Power set. Equal sets. Subsets.Properties of Complement Sets.Venn diagrams. Difference of sets.Complement of a set.Universal set. Subsets of a set of real numbers especially intervals (with notations).Union and Intersection of sets and Practical Problems based on sets.

Relations and Functions: Defination,Types of relations: reflexive, symmetric, transitive and equivalence relations. Injective,surjective and bijective functions.

Unit II. Complex Number: Conjugate of a complex number, modulus of a complex Number, geometrical representation of complex number, De Moivre's theorem, nth roots of a complex number.

UNIT III. Permutations & Combinations: Fundamental Principle of counting. Factorial n. (n!) Permutations and combinations, derivation of formulae and their connections, simple applications.

UNIT IV. Matrices: Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operations on matrices: Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

Unit V. Determinants: Determinant of a square matrix (up to 3 x 3 matrices), minors, co-factors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix,Cramer’s rule.

Unit VI. Modern algebra: Introduction to Group, Ring, Field, integral domain with simple examples.
Theory of equations: Polynomials, Division algorithm, Fundamental theorem of classical algebra (Proof not required),Descartes rule of sign and their application, Relation between roots and coefficients; symmetric function of roots, Transformation of polynomial equation, Cardon's solution of cubic equation

Unit VII. Sequence and series: Arithmetic Progression (A.P.), Arithmetic Mean (A.M.), Geometric Progression (G.P.), Geometric Mean (G.M,) relation between A.M. & G.M., Arithmetic-Geometric Progression Series (AGP series), infinite G.P. and its sum.

Unit VIII. Vector Algebra: Scalars & vectors, vector addition, linear combination of vectors, condition of colinearity of three points, scalar and vector products, scalar triple product and vector triple product.

Unit IX. Trigonometry Basics: Positive and negative angles, Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin^2 x + \cos^2 x = 1$, for all x.

Unit X. Signs of Trigonometric Functions: Signs of trigonometric functions**,** domain, range and sketch their graphs.

Unit XI. Trigonometry Expressions: Expressing $\sin(x \pm y)$ and $\cos(x \pm y)$ in terms of $\sin x$, $\cos x$, $\sin y$ and $\cos y$, Deducing identities like the following: $\tan(x \pm y)$, $\cot(x \pm y)$, sin x+sin y, cos x+cos y,sin x- sin y, cos x-cos y. Identities related to sin2x, cos2x, tan2x, sin3x, cos3x and tan3x.

References/ Suggested Readings:

1. J. G. Chakravorty & P. R. Ghosh, Advanced Higher Algebra, U. N. Dhur and Sons Private Limited, 2019.
2. J. G. Chakravorty & P. R. Ghosh, Vector Analysis: Vector Algebra & Vector Calculus, U. N. Dhur and Sons Private Limited, 1967.
3. M. K. Sen, Shamik Ghosh & Parthasarathi Mukhopadhyay, Topics in Abstract Algebra, Universities Press, 2022.
4. Gilbert Strang; Introduction to Linear Algebra (5th Edition); Wellesley-Cambridge Press, 2019.
5. K. Hoffman, R. Kunze, Linear algebra, Prentice Hall India Learning Pvt. Ltd., 2015.
6. W.S. Burnside and A.W. Panton, Theory of equations, Dublin University Press Series, S. Chand and Company Pvt. Ltd., 1986.
7. H.S. Hall, S.R. Knight, Elementary Trigonometry, G. K. Publications.

Semester- IV

MAJOR COURSE - 5

Course Name: Operating System

Course Code: BCAMJ401

Course Type: **Major (Theoretical & Practical)**	Course Details:**MJC-5**			L-T-P: **3–0–4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Introduction to Operating System: What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems; Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems.

UNIT II. Operating System Organization and Process Characterization: Processor and User Modes, Kernels, System Calls and System Programs, System View of the Process and Resources, Process Abstraction, Process Hierarchy, Threads, Threading Issues, Thread Libraries; Process Scheduling, Non-Pre-emptive and Preemptive Scheduling Algorithms.

UNIT III. Process Management: Deadlock, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock, Deadlock Handling Approaches: Deadlock Prevention, Deadlock Avoidance and Deadlock Detection and Recovery.

UNIT IV. Inter Process Communication and Synchronization: Concurrent and Dependent Processes, Critical Section, Semaphores, Methods for Inter-process Communication; Process Synchronization, Classical Process Synchronization Problems: Producer-Consumer, Reader-Writer.

UNIT V. Memory Management: Physical and Virtual Address Space; Memory Allocation Strategies– Fixed and -Variable Partitions, Paging, Segmentation, Virtual Memory; Page Replacement Algorithms.

UNIT VI. File and I/O Management, Disk Scheduling, OS security: Directory Structure, File Operations, File Allocation Methods, Device Management, Pipes, Buffer, Shared Memory, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK), Security Policy Mechanism, Protection, Authentication and Internal Access Authorization.

UNIT VII. Android Operating System: Introduction to Android Operating System, Android Development Framework, Android Application Architecture, Android Process Management and File System.

Practical

UNIT I. Students are required to write and practically execute programs to solve following problems using C programming language.

1. WRITE A PROGRAM (using fork() and/or exec() commands) where parent and child execute: a) same program, same code. b) same program, different code. c) before terminating, the parent waits for the child to finish its task.
2. WRITE A PROGRAM to report behavior of Linux kernel including kernel version, CPU type and model. (CPU information)
3. WRITE A PROGRAM to report behavior of Linux kernel including information on configured memory, amount of free and used memory. (memory information)
4. WRITE A PROGRAM to print file details including owner access permissions, file access time, where file name is given as argument.
5. WRITE A PROGRAM to copy files using system calls.
6. Write programs to implement scheduling algorithms (FCFS, Round Robin, SJF, SRJF)
7. Write program to implement non-preemptive priority based scheduling algorithm.
8. Write program to implement preemptive priority based scheduling algorithm.
9. Write program to calculate sum of n numbers using thread library.
10. Write a program to implement first-fit, best-fit and worst-fit allocation strategies.

UNIT II. UNIX and Shell Scripts

1. External and internal commands of UNIX
2. What is shell and various type of shell, Various editors present in unix/linux
3. Different modes of operation in vi editor
4. What is shell script, Writing and executing the shell script
5. Shell variable (user defined and system variables)
6. System calls, Using system calls
7. Pipes and Filters
8. Decision making in Shell Scripts (If else, switch), Loops in shell
9. Functions
10. Utility programs (cut, paste, join, tr, uniq utilities), Pattern matching utility (grep).

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks) – one from each unit, Viva-voce (5 marks).

ESE Evaluation: Two experiments (10 marks) – one from each unit, Viva-voce (10 marks).

References/ Suggested Readings:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. Sumitabha, Das, Unix Concepts and Applications, Tata McGraw-Hill Education.

4. Nemeth Synder and Hein, Linux Administration Handbook, Pearson Education, 2nd Edition ,2010.
5. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Unix Network Programming, The sockets Networking API, Vol. 1, 3rd Edition, 2014.
6. Yashavant Kanetkar , UNIX Shell Programming, BPB Publication.
7. Kernighan and Pike, The Unix Programming Environment, Prentice-Hall.

MAJOR COURSE - 6

Course Name: Database Management System

Course Code: BCAMJ402

Course Type: **Major (Theoretical & Practical)**	Course Details:**MJC-6**			L-T-P: **3–0–4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

Unit I. Introduction: Basic Concept, Drawbacks of File Management; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas and Instances; Database Languages; Database Users, DBA; Data Dictionary; Functional Components of a DBMS.

Unit II. ER Model: Entity, Attributes and Relationship; Structural Constraints; Keys (candidate, super, foreign, primary); Weak & strong Entity Set; ER Diagram; Specialization and Generalization; Constraints of Specialization and Generalization; Aggregation.

Unit III. Relational Model: Basic Concepts of Relational Model; Relational Algebra, introduction to Tuple Relational Calculus.

Unit IV. SQL: DDL, DCL, DML commands, aggregate functions, create a database table, create relationships between database tables, modify and manage tables, queries, create view.

Unit V. Integrity Constraints: Domain Constraints, Referential Integrity.

Unit VI. Relational Database Design: Problems of Un-Normalized Database; Functional Dependencies, Derivation Rules, Closure of FD Set, Membership of a Dependency, Canonical Cover; Decomposition to 1NF, 2NF, 3NF or BCNF Using FDs; Lossless Join Decomposition & Dependency Preservation.

Unit VII. Transaction Processing: ACID properties, concurrency control

Practical

Students are required to practice the concepts learnt in the theory by designing and querying a database for a chosen organization (Like Library, Transport etc). The teacher may devise appropriate weekly lab assignments to help students practice the designing , querying a database in the context of example database. Some indicative list of experiments is given below.

Experiment 1: E-R Model Analyze the organization and identify the entities , attributes and relationships in it. . Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial keys, if any.

Experiment 2: Concept design with E-R Model Relate the entities appropriately. Apply cardinalities for each relationship. Identify strong entities and weak entities (if any).

Experiment 3: Relational Model Represent all the entities (Strong, Weak) in tabular fashion. Represent relation ships in a tabular fashion.

Experiment 4: Normalization Apply the First, Second and Third Normalization levels on the database designed for the organization

Experiment 5: Practicing DDL commands,Creating databases, How to create tables, altering the database, dropping tables and databases if not required. Try truncate, rename commands etc.

Experiment 6: Practicing DML commands on the Database created for the example organization DML commands are used to for managing data within schema objects. Some examples: ● SELECT - retrieve data from the a database ● INSERT - insert data into a table ● UPDATE - updates existing data within a table ● DELETE - deletes all records from a table, the space for the records remain

Experiment 7: Querying practice queries (along with sub queries) involving ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.

Experiment 8: Querying (continued…) Practice queries using Aggregate functions (COUNT, SUM, AVG, and MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks), Viva-voce (5 marks)

ESE Evaluation: Two experiments (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education,2010.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.
5. Ullman, Principles of Database Systems, Galgotia Publications.

MINOR COURSE - 4

Course Name: Introduction to Calculus and Differential Equation

Course Code: BCAMN401

Course Type: **Minor (Theoretical)**	Course Details:**MNC-4**			L-T-P: **4–1–0**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**30**	**-**	**70**

Course Content:

Theory

Unit I. Differential Calculus: Limit of a function and continuity. Fundamental properties of continuous functions (proofs not required).
Derivative: Differentiation of powers of x, Differentiation of exp and log x, differentiation of trigonometric functions, Rules for finding derivatives, Different types of differentiation, logarithmic differentiation, differentiation by substitution, differentiation of implicit functions, differentiation from parametric equation. Differentiation from first principles.Second order derivatives.
Successive differentiation. Leibnitz's theorem.
Rolle's theorem, Mean-Value theorems—Lagrange's and Cauchy's.
Partial Derivatives.Euler's theorem on homogeneous functions of two variables.
Application of derivatives:Maxima-Minima, Determining Increasing and Decreasing Functions.

Unit II. Integral Calculus: Integration of standard Functions, rules of Integration, More formulas in integration, Definite integrals and their elementary properties. Area of a simple curves using definite integral.

Unit III. Differential equations: First order differential equations, practical approach to Differential equations, first order and first degree differential equations, separation of variable, homogeneous equations. Linear equations, Bernoulli's equation, Exact Differential Equations, Integrating factors. Oblique and orthogonal trajectories, equations of first order but not first degree, Clairaut's form, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, method of variation of parameters.

References/ Suggested Readings:

1. Das and Mukherjee, Differential Calculus, Dhar and Sons. Pvt. Ltd.
2. Das and Mukherjee, Integral Calculus and Differential Equations, Dhar and Sons. Pvt. Ltd.
3. Chakravorty and Ghosh, Differential Equations, Dhar and Sons. Pvt. Ltd.

SKILL ENHANCEMENT COURSE - 3

Course Name: Reasoning and Aptitude

Course Code: BCASE401

<table>
<tr><td>Course Type: SEC
(Theoretical)</td><td colspan="2">Course Details: SEC-3</td><td colspan="2">L-T-P: 3–0–0</td></tr>
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50</td><td colspan="2">CA Marks</td><td colspan="2">ESE Marks</td></tr>
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<tr><td>-</td><td>15</td><td>-</td><td>35</td></tr>
</table>

Course Content:

Theory

UNIT I. Quantitative Ability (Basic Mathematics): Number Systems, LCM and HCF, Decimal Fractions, Simplification, Square Roots and Cube Roots, Average, Problems on Ages, Surds & Indices, Percentages, Problems on Numbers.

UNIT II. Quantitative Ability (Applied & Engineering Mathematics), Logarithm, Permutation and Combinations, Probability, Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Time & Work, Ratio and Proportion, Area, Mixtures and Allegation.

UNIT III. Data Interpretation, Data Interpretation, Tables, Column Graphs, Bar Graphs, Line Charts, Pie Chart, Venn Diagrams.

UNIT IV. Logical Reasoning (Deductive Reasoning), Analogy, Blood Relation, Directional Sense, Number and Letter Series, Coding – Decoding, Calendars, Clocks, Venn Diagrams, Seating Arrangement, Syllogism, Mathematical Operations.

References/ Suggested Readings:

1. R S Agarwal, A Modern Approach To Verbal & Non Verbal Reasoning, S Chand Publishing.
2. R S Agarwal, Quantitative aptitude for Competitive examination, S Chand Publishing.
3. Abhijit Guha, Quantitative Aptitude by Competitive Examinations. McGraw Hill Education.
4. B.S. Sijwalii and Indu Sijwali, A New Approach to REASONING Verbal & Non-Verbal, Arihant Publications.

Internal (CA) Evaluation: To be decided by the college/institution.

ESE Evaluation: 35 MCQs to be answered from 40 MCQs given.

Semester-V

MAJOR COURSE - 7

Course Name: Microprocessor and Computer Architecture

Course Code: BCAMJ501

Course Type: **Major (Theoretical+Practical)**	Course Details: **MJC-7**			L-T-P: **3-0-4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Microprocessor the Brain of the computer. Functional units of Microprocessor. General & Special purpose register: AC, PC, SP, DR, DAR, MAR, Flags, B-C,D-E,H-L pairs, PSW.

UNIT II. 8-bit microprocessor architecture; 8085 pin description.

UNIT III. Programmers model of 8085, addressing modes of 8085; Instruction set of 8085; Assembly language program for 8085.

UNIT IV. Introduction to 8086 microprocessor: 16-bit registers, segmented memory architecture.

UNIT V. Memory and I/O Systems: Peripheral Devices, I/O Interface, Data Transfer Schemes, Program Control, Interrupt, DMA Transfer, I/O Processor. Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Cache Memory, Associative Memory, Interleave, Virtual Memory, Cache Mapping Techniques, Memory Management.

UNIT VI. Parallel Processing: Parallel Processing Basics: Using multiple functional units or processors to perform tasks simultaneously to increase computational speed. Flynn's Classification: Computer architectures categorized into SISD (Single Instruction, Single Data), SIMD (Single Instruction, Multiple Data), MISD (Multiple Instruction, Single Data), and MIMD (Multiple Instruction, Multiple Data). Types of Parallel Computers: Array processors, systolic arrays, and associative processors.

UNIT VII. Vector Processing: Vector Processing Basics: Performing operations on multiple data elements simultaneously using vector instructions. Vector Instructions: Include arithmetic operations (addition, subtraction, multiplication, division), logical operations, and load/store operations. Vector Registers: Packing multiple data elements into a single register for efficient processing.

UNIT VIII. Pipelining and Parallel Processing: Pipelining: Breaking down operations into sequential sub-operations that can overlap in execution. Pipeline Speedup: Increasing throughput by performing operations concurrently across multiple pipeline stages.

Practical

UNIT I: Microprocessor: Programming should be developed using 8085 assembly language.

1. Addition of Two 8-bit Numbers
2. Subtraction of Two 8-bit Numbers
3. Addition of Two 16-bit Numbers
4. Find the Largest/Smallest Number in an Array
5. Count Number of Zeros in an Array
6. Sum of Array Elements
7. Data Transfer from One Block to Another
8. Exchange Contents of Two Memory Locations
9. Check Whether a Number is Even or Odd
10. Reverse an Array

UNIT II. Computer Architecture

1. Create a fetch routine of the instruction cycle.
2. Create a machine based on the given architecture (Register Sets, Memory, Instruction format and basic computer instructions).
3. Matrix Multiplication in Computer Architecture
4. Analyze the performance impact of pipelining: Considering how pipelining affects instruction throughput.
5. Identify and handle data hazards: Managing dependencies between instructions in a pipeline.

Internal (CA) Evaluation: Practical Note Book (15 marks), One experiment (10 marks) from UNIT II, Viva-voce (5 marks).

ESE Evaluation: One experiment (10 marks) from UNIT I, Viva-voce (10 marks)

References/ Suggested Readings:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, PENRAM.
2. Barry B. Brey, The Intel Microprocessors:Architecture, Programming and Interfacing. Pearson Education.
3. Walter A Triebel, Avtar Singh, The 8088 and 8086 Microprocessors Programming, Interfacing, Software,Hardware, and Applications. PHI.
4. Computer System Architecture, M. Morris Mano, 3rd Edition, Prentice Hall.
5. Computer Architecture: A Quantitative Approach, John L. Hennessy, David A. Patterson, 4th Edition.

MAJOR COURSE - 8

Course Name: Computer Networks

Course Code: BCAMJ502

Course Type: **Major (Theoretical+Practical)**	Course Details: **MJC-8**			L-T-P: **3-0-4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Introduction to Computer Networks and Networking Elements: Network Definition, Network Topologies, Network Classifications, Network Protocol, Layered Network Architecture, Overview of OSI Reference Model, Overview of TCP/IP Protocol Suite, Hub, Switch (Managed and Unmanaged), Routers.

UNIT II. Data Communication Fundamentals and Techniques: Analog and Digital Signal, Data-Rate Limits, Digital to Digital Line Encoding Schemes, Pulse Code Modulation, Parallel and Serial Transmission, Digital to Analog Modulation - Multiplexing Techniques-FDM, TDM, Transmission Media, Transmission mode.

UNIT III. Networks Switching Techniques and Access Mechanisms: Circuit Switching, Packet Switching- Connectionless Datagram Switching, Connection Oriented Virtual Circuit Switching; Dial-Up Modems, Digital Subscriber Line, Cable TV for Data Transfer.

UNIT IV. Data Link Layer Functions and Protocol: Error Detection and Error Correction Techniques, Data-Link Control- Framing and Flow Control, Error Recovery Protocols-Stop and Wait ARQ, Go-Back-N ARQ, Point to Point Protocol on Internet.

UNIT V. Multiple Access Protocol and Network Layer: CSMA/CD Protocols, Ethernet LANS; Connecting LAN and Back-Bone Networks- Repeaters, Hubs, Switches, Bridges, Router and Gateways, Networks Layer Functions and Protocols, Routing, Routing Algorithms, Network Layer Protocol of Internet - IP Protocol, Internet Control Protocols.

UNIT VI. Transport Layer and Application Layer Functions and Protocols: Transport Services- Error and Flow Control, Connection Establishment and Release- Three Way Handshake, Overview of Application Layer Protocol, Overview of DNS Protocol; Overview of WWW & HTTP Protocol.

Practical

UNIT I. Network Devices and Configuration

1. Identification of network devices like hub, switch, modem etc.
2. Use of ping, tracert/traceroute, ipconfig/ifconfig, route, and arp utilities.
3. Configure LAN
4. Configure IP static routing.
5. Configure IP routing using RIP.

UNIT II. All programs should be developed in C/ C++ / Java / Python

1. Simulate Cyclic Redundancy Check (CRC) error detection algorithm for noisy channel.
2. Simulate Hamming-code based error detection & correction algorithm for noisy channel.
3. Simulate and implement stop and wait protocol for noisy channel.
4. Simulate and implement go back N sliding window protocol.
5. Simulate and implement selective repeat sliding window protocol.
6. Simulate and implement MST construction (Prim's, Kruskal's) for Ethernet
7. Simulate and implement the various routing algorithms (RIP, Distance-Vector routing, Dijkstra's, Bellman-Ford, Floyd-Warshall, Flooding)
8. Socket Programming.

Internal (CA) Evaluation: Practical Note Book (15 marks), One experiments from Unit I (10 marks), Viva-voce (5 marks)

ESE Evaluation: One experiment from Unit II (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM Publishing Company Ltd.
2. A. S. Tanenbaum: Computer Networks, Fifth edition, PHI Pvt. Ltd 2011
3. William Stallings:Data and Computer Communications, Eight Edition, Pearson.
4. Larry L. Peterson, Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann Publishers In.

MAJOR COURSE - 9

Course Name: Core Java

Course Code: BCAMJ503

Course Type: **Major (Theoretical+Practical)**	Course Details: **MJC-9**			L-T-P: **3-0-4**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Introduction to Java: Java Architecture and Features, Compiling and Executing a Java Program, Variables, Constants, Keywords, Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Type Conversion and Type Casting, Decision Making Constructs (Conditional Statements and Loops) and Nesting, Java Methods (Definition, Scope, Passing and Returning Arguments, Built-in Java Class Methods).

UNIT II. Arrays, Strings and I/O:Creating and Using Arrays (One-Dimensional and Multi-Dimensional), Referencing Arrays Dynamically, The Java *String* Class, Creating and Using String Objects, Manipulating Strings, String Immutability and Equality, Passing Strings to and from Methods, *StringBuffer* Class, Simple I/O using *System.out* and *Scanner*Class, Byte and Character Streams, Reading and Writing from Console and Files.

UNIT III. Object-Oriented Programming Overview: Principles of Object-Oriented Programming, Defining and Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables and Methods, Objects as Parameters, Final Classes, *Object* Class, Garbage Collection.

UNIT IV. Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Annotations (Metadata):Inheritance (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending Interfaces and Packages, Package and Class Visibility, Using Standard Java Packages *(util, lang, io)*, Wrapper Classes, Enumerations, Autoboxing and Unboxing, Annotations.

UNIT V. Java Collection Classes: Collection interfaces: Collection, List, Set, Map. Implementation classes: ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap.- Operations: Adding, removing, iterating over elements.

UNIT VI. Exception Handling, Threading: Exception Types, Uncaught Exceptions, Built-in Exceptions, Creating Your Own Exceptions, The *Thread* Class and Runnable Interface, Creating Single and Multiple Threads, Thread Prioritization, Synchronization and Communication, Suspending and Resuming Threads.

Practical

Students are required to implement object-oriented paradigm using JAVA. Below is the list of some of the experiments.

1. Program on strings: Check the equality of two strings, Reverse a string.

2. Program using loops: to find the sum of digits of a given number, display a multiplication table, display all prime numbers between 1 to 1000.

3. Program to demonstrate all math class functions.

4. Program on files: to copy a file to another file using stream classes of java IO package.

5. Program to demonstrate method over-riding and overloading

6. Programs on inheritances.

7. Multi-threaded programming.

8. Implement a method to find the most frequent element in a List.

9. Remove duplicates from a List while preserving order.

10. Exception handling

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks), Viva-voce (5 marks)

ESE Evaluation: Two experiments (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. E. Balagurusamy, Programming with Java, Tata McGraw Hill.
2. John R. Hubbard,Programming with JAVA, Schaum's Series.
3. Herbert Schildt, The Complete Reference Java 2, Tata McGraw Hill.
4. David A. Watt, Deryck Brown, Java Collections: An Introduction to Abstract Data Types, Data Structures and Algorithms, John Wiley & Sons, Inc.

MINOR COURSE - 5

Course Name: Introduction to Geometry and Probability-Statistics

Course Code: BCAMN501

<table>
<tr><td>Course Type: Minor (Theoretical)</td><td colspan="2">Course Details: MNC-5</td><td colspan="2">L-T-P: 4-1-0</td></tr>
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<tr><td>-</td><td>30</td><td>-</td><td>70</td></tr>
</table>

Course Content:

Theory

Unit I. Analytical two-dimensional Geometry:

Slope of lines and angle between two lines. Various form of equations of line: Parallel to Axes, Point-Slope form, Slope intercept form, two-point form, intercept form. Translation and rotation of rectangular axes, invariants, general equation of second degree in two variables---reduction to standard forms and classification. Plane polar equations of straight line, circle, ellipse, parabola and hyperbola.

Unit II: Three-Dimensional Geometry:

Co-ordinates in space, Direction cosines, Angle between two lines, Projection of Join of two points on a Plane, Equations of Plane, straight line in space, Conditions for a line to lie on a plane, Conditions for two lines to be coplanar, Shortest Distance between two lines.

Unit III. Probability:

Random experiment, sample space, mutually exclusive events, equally likely events. Definition of probability--Classical and axiomatic approaches. Addition rule for two events, Independence of events, conditional probability, multiplication rule. Bayes' theorem and its applications, Boole inequality. Joint experiment, independent trial, Bernoulli's trial, Binomial law.

Unit IV. Random variables and Probability distributions:

Random variable, Distribution function (discrete and continuous) with their properties, probability mass function and probability density function. Mean and variance of a random variable. Discrete probability distributions—Binomial and Poisson distributions, Continuous distributions—Uniform, Normal and Cauchy distribution.

Unit V. Analysis of Univariate data:

Construction of frequency distribution, Graphical presentation of data---histograms, frequency polygon and cumulative frequency curves. Measure of central tendency—Arithmetic mean, Geometric mean, median and mode and their properties. Measures of dispersion—Range, quartile deviation, mean deviation, and standard deviation.

Unit VI. Sampling and Statistical inference

Sampling distribution of binomial, poisson and normal population**.** Estimation of parameters for binomial, poisson and normal populations**.** Method of finding confidence intervals for Normal population.

References/ Suggested Readings:

1. S. Narayan and P. K. Mittal, *Analytical Solid Geometry*, S. Chand & Company Pvt Ltd.,India.
2. P K Jain and K. Ahmed, *Textbook of Analytical Geometry of Two Dimensions*, New Age International Publishers.
3. P K Jain and K. Ahmed, *Textbook of Analytical Geometry of Three Dimensions*, New Age International Publishers
4. A.N.Das, *Analytical Geometry of Two and Three Dimensions*, New Central Book Agency.
5. R.M. Khan, *Analytical Geometry of Two and Three Dimensions and Vector Analysis*, New Central Book Agency.
6. N G. Das, *Statistical Methods* (Vol. I & II)— Mc Graw Hill.
7. A. Goon, M. Gupta, B. DasGupta, *Fundamentals of Statistics*– (Vol. I & II)—World Press.
8. P C. Biswal, *Probability and Statistics*, PHI Learning
9. D. Bhattacharya and S. Roychowdhury, *Probability and Statistical Inference (Theory and Practice)*, U.N. Dhur & Sons Pvt. Ltd.
10. D. Biswas, *Probability and Statistics*, New Central Book Agency.
11. A. Mukherjee, *Fundamental treatise on Probability and Statistics*, Sreetara Prakashan.
12. Md. I. Haque, *An Introduction to Probability and Statistics*, Techno World.

Semester-VI

MAJOR COURSE - 10

Course Name: Data Mining

Course Code: BCAMJ601

Course Type: **Major (Theoretical)**	Course Details: **MJC-10**			L-T-P: **4-1-0**	
Credit: **5**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**30**	**-**	**70**

Course Content:

Theory

UNIT I. Introduction to data mining (DM): Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database - Issues in DM – KDD Process

UNIT II. Data Pre-processing: Data summarization, data cleaning, data integration and transformation, data reduction, data discretization and concept hierarchy generation, feature extraction, feature transformation, feature selection, introduction to Dimensionality Reduction, CUR decomposition.

UNIT III. Concept Description: Mining Frequent Patterns, Associations and Correlations: What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons, Basic concept, efficient and scalable frequent item-set mining methods, mining various kind of association rules, from association mining to correlation analysis, Advanced Association Rule Techniques, Measuring the Quality of Rules.

UNIT IV. Classification and Prediction: Classification vs. prediction, Issues regarding classification and prediction, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree based Algorithms, Neural Network based Algorithms, Rule-Based Algorithms, Combining Techniques, accuracy and error measures, evaluation of the accuracy of a classifier or predictor. Linear and nonlinear regression, Logistic Regression.

UNIT V. Cluster Analysis: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering - K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering – Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Strengths and Weakness; Outlier Detection, Clustering high dimensional data, clustering Graph and Network data.

UNIT VI. Web mining and other data mining: Introduction to Web Mining, Web content mining, Web usage mining, Web Structure mining, Web log structure and issues regarding

web logs, Spatial Data Mining, Temporal Mining, And Multimedia Mining. Applications of Distributed and parallel Data Mining.

UNIT VII. ROC Analysis, Data Mining Trends, Big Data, Data Analytics.

References/ Suggested Readings:

1. Arun K Pujari, Data Mining Techniques, Universities Press.
2. J. Han, M. Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann.
3. M. Kantardzic, Data mining: Concepts, models, methods and algorithms, John Wiley & Sons Inc.
4. M. Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education.
5. Ning Tan, Vipin Kumar, Michael Steinbanch Pang, Introduction to Data Mining, Pearson Education.

MAJOR COURSE - 11

Course Name: Software Engineering

Course Code: BCAMJ602

<table>
<tr><td>Course Type: Major (Theoretical)</td><td colspan="2">Course Details: MJC-11</td><td colspan="2">L-T-P: 4-1-0</td></tr>
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<tr><td>-</td><td>30</td><td>-</td><td>70</td></tr>
</table>

Course Content:

Theory

UNIT I: Introduction: Software engineering discipline – evolution and impact, Program vs S/W, Emergence of S/W engineering (Introduction to Control based design, Data structure-oriented design, data flow-oriented design, object-oriented design).

UNIT II: Software life cycle: Usefulness, Life cycle Model -Classical water fall model, Iterative waterfall model, prototype model, spiral model, comparative study of different models.

UNIT III: Software Requirement Specification: Role of system analyst, Need, Components and characteristic of SRS, Problems without a SRS, SRS document for Simple problems.

UNIT IV: Software Matrices: Halstead matrix, volume, size, difficulty, Effort estimation.

UNIT V: Software design: Cohesion & Coupling, S/W design Approach - Function oriented approach (DFD, Structure chart, Transformation of DFD into Structure chart), Object oriented approach (UML diagram, Use case model, class diagram, Interaction diagram)

UNIT VI: Coding: Coding standards, Code review - Code Walk through, Code Inspection, Clean room testing.

UNIT VII: Testing: Unit Testing (Driver and Stub Module, Black box testing [Equivalence class Partitioning and Boundary value analysis], White box testing [Statement coverage, Edge/branch coverage, condition coverage, path coverage, cyclomatic complexity]), Integration Testing (Big bang, Top down, Bottom up, Mixed approach), Verification and Validation of Software.

UNIT VIII: Maintenance: Characteristics, Types (corrective, adaptive and perfective), Software maintenance process model (Reverse engineering cycle followed by forward engineering model).

UNIT IX: Software Project Management: Introduction, Project planning, SPMP document; Metrics for project size estimation: Introduction, LOC, FP; Project Estimation Techniques: Introduction, Expert Judgment Technique, Software Metrics: LOC, KLOC, PM, Delphi Cost Estimation, Introduction to the Rayleigh curve, COCOMO (Basic, Intermediate, Complete); Scheduling: Introduction, WBS, Activity Network, CPM, Gantt Charts, PERT Charts; Organization & Team Structure; Staffing; Risk Management; Software Configuration Management.

References/ Suggested Readings:

1. R. G. Pressman, Software Engineering, TMH
2. Sommerville, Ian, Software Engineering, Pearson Education
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publications.
4. Pfleeger, Shari Lawrence, Software Engineering Theory and Practice, Second Edition, Prentice- Hall 2001.
5. Object Oriented & Classical Software Engineering (Fifth Edition), SCHACH, TMH.

MAJOR COURSE - 12

Course Name: Web and Internet Technology

Course Code: BCAMJ603

<table>
<tr><td>Course Type: Major (Theoretical+Practical)</td><td colspan="2">Course Details: MJC-12</td><td colspan="2">L-T-P: 3-0-4</td></tr>
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<tr><td>30</td><td>15</td><td>20</td><td>35</td></tr>
</table>

Course Content:

Theory

UNIT I. Introduction to Internet: Evolution of Internet, concept of Intranet and Internet, Applications of Internet, Types of Connectivity such as dial – up, leased, VSAT. etc., Internet Server and Clients module in various Operating Systems, TCP/IP, Introduction to RFC, Addressing in Internet – IP and Domains, major features of IP, IP datagram, major IP services, IP source routing, value of the transport layer, TCP, major features of TCP, passive and active operation, Internet Service Providers.

UNIT II. E-mail and List-servers: E-mail Networks, E-mail protocols (X.400, SMTP, UUCP), Format of an E- mail message, Description of E-mail Headers, E- mail contents and encoding, E-mail routing, List servers, E-mail clients, POP-3, IMAP-4.

UNIT III. File Transfer Protocol: Introduction to FTP, public domain Software, Types of FTP Servers, FTP clients, Common Commands.

UNIT IV. Telnet: Telnet protocol, Server daemon, Telnet clients, Terminal emulation, Usenet and Internet Relay Chat Introduction to World Wide Web: Evolution of WWW, Basics Features, WWW Browsers, WWW servers, HTTP & URL's

UNIT V. WWW Browsers: Basic features, Bookmarks, history. Progress indicators, Personalization of Browsers, Printing displayed pages and forms, Saving Web pages, Netscape Communicators, Internet Explorer, Search and Downloads.

UNIT VI. Web Publishing: Technology Overview, Web site planning, where to host your Web site, Multiple sites on one server, Maintaining a Web site, Publishing tools.

UNIT VII. Search Engines: Technology overview, Popular Search Engines, how to register a Web site on search engines.

UNIT VIII. Internet Security: Overview of Internet Security threats, Firewalls, Malware and its type, Introduction to AAA.

Practical

Students are directed to do a minor project based on the contents of the course below (UNIT I to UNIT IV) for internal and ESE evaluation.

UNIT I. HTML: Introduction to HTML and HTML5, HTML Tags, Formatting and Fonts, Commenting Code, Anchors, Backgrounds, Images, Hyperlinks, Lists, Tables, Frames, HTML Forms.

UNIT II. JavaScript: Syntax, Variables, Values, Data Types, Data Types, Expressions and Operators, Control structures, Error handling, Throwing errors, Numbers, Strings, Arrays.

UNIT III. PHP: Introduction to PHP**,** Server-sidescripting, Role of web server software, PHP comments, variables, echo and print, PHP operators, data types,branchingstatements, Loops, Arrays, PHP functions, PHP form, passing information between pages, $_GET, $_POST, $_REQUEST., String functions, include and require, session and cookie management, Error handling in PHP, Object Oriented Programming using PHP.

UNIT IV. PHP with MYSQL: Introduction to MySQL, datatypes, SQL commands- CREATE, UPDATE, INSERT, DELETE, SELECT, PHP functions for MySQL connectivity and operation- mysql_connect, mysql_select_db, mysql_query, Updation and deletion of data using PHP, Displaying data from MySQL in webpage.

Internal (CA) Evaluation: Minor Project Report (15 marks), Demonstration of the minor project (10 marks), Viva-voce (5 marks).

ESE Evaluation: Presentation of the minor project (10 marks), Viva-voce (10 marks).

References/ Suggested Readings:

1. D.E.Comer, Internetworking with TCP/IP, PHI.
2. N.P. Gopalan and J. Akilandeswari, Web Technology: A Developer's Perspective, PHI.
3. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI.
4. P.J. Deitel & H.M. Deitel, Internet and World Wide Web How to program, Pearson.
5. Ivan Bayross, HTML, DHTML, JavaScript, Pearl & CGI, Fourth Revised Edition, BPB Publication.
6. RasmusLerdorf and Kevin Tatore, Programming PHP,Shroff Publishers & Distributors Pvt.Ltd.
7. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi, Beginning PHP, Wiley Publishing, In.
8. Robin Nixon, Learning Php, MySQL & JavaScript: A Step-By-Step Guide To Creating Dynamic Websites, O'REILLY.

MAJOR COURSE - 13

Course Name: Programming in Python

Course Code: BCAMJ604

Course Type: **Major (Theoretical+Practical)**	Course Details: **MJC-13**			L-T-P: **3-0-4**	
Credit: 5	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Introduction: The Python Language, the Python Standard Library and Extension Modules, Python Implementation, Python Development and Versions, Installation from Source Code and Binaries, the Python Interpreter.

UNIT II. Core Python Language and Built: Data Type, Variable, Expression and Operators, Numeric Operations, Sequence Operations, Dictionary Operations, The print statement, Conditional Statements, Looping, Control flow Statements.

UNIT III. Functions: Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions. Lists and Tuple: Introduction to List and Tuple, Accessing List and Tuple, Operations, working with List and Tuple, Function and Methods.

UNIT IV. Dictionaries: Working with dictionaries, properties and functions. Module: Importing Module, Math Module, Random Module, Package, Composition and the Distribution Utility.

UNIT V. Object Oriented Programming Concept: Class and Object, Attribute, Inheritance, Overloading and Overriding, Data Hiding, Meta classes.

UNIT VI. Exception handling: What is an exception? various keywords to handle exceptions such try, except, else, finally, raise.

UNIT VII. Regular Expressions: Concept of regular expression, various types of regular expressions, using match function.

UNIT VIII. Graphical User Interface Programming in Python (using Tkinter/wxPython/Qt): GUI concept, Advantages of GUI, and Introduction to GUI library, Layout management, events and bindings, fonts, colours, drawing on canvas (line, oval, rectangle, etc.) Widgets such as: frame, label, button, check button, entry, list box, message, radio button, text, spin box etc.

UNIT IX. File Handling in Python: Introduction to File Handling, Types of Files (Text files and Binary files), File modes (read, write, append, update), Opening and closing files using open() and close(), Reading from files (read(), readline(), readlines()), Writing to files (write(), writelines()), File pointer and tell() and seek() methods, Working with statement (context manager), Handling CSV and text files, Basic file and directory operations using os and os.path modules, File-related exceptions.

Practical

The students are required to verify their ability to use core programming basics and program design with functions using Python programming language. The teacher shall program to strengthen the practical expertise of the students. The following is an indicative list of programs that can be practised.

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format "Sat Oct 11 02:26:23 IST 2020"
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to construct the different pattern, using a nested for loop, like

```
*
* *
* * *
* *
 *
```

10. Write a Python script that prints prime numbers less than 20.
11. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
12. Write a python program to define a module and import a specific function in that module to another program.
13. Write a Python class to convert an integer to a roman numeral.
14. Write a Python class to reverse a string word by word.

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks), Viva-voce (5 marks)

ESE Evaluation: Two experiments (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. Alex Martelli, Python in a Nutshell, Oreilly Publication.
2. Allen Downey, Think Python, Green Tea Press.
3. Wesley J. Chun, Core Python Programming, Pearson Education.
4. Mark Lutz, Learning Python, Oreilly Publication.
5. Kenneth A. Lambert, Fundamentals of Python: First Programs, Course Tech. Inc.

SUMMER INTERNSHIP- 1

Course Name: Summer Internship

Course Code: SI601

<table>
<tr><td>Course Type: SI
(Practical)</td><td colspan="2">Course Details: SI-1</td><td colspan="2">L-T-P: 0-0-4</td></tr>
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</table>

Overview:
Computer Application proposes a Summer Internship Program keeping in view their feasible options/opportunities, to provide students with hands-on learning experiences, in alignment with the NCCF. NCCF emphasizes experiential learning, skill development, and multidisciplinary approaches, making internships a crucial component of higher education.

Duration:
Minimum 4 weeks programme (60 hours).

Mode:
Onsite training or Online training or blending (onsite and online both) mode

Key Areas of Internship:

- Software Development: Web/App Development (React, Node.js, Android)
- Database Management (SQL, MongoDB)
- Artificial Intelligence (AI) and Machine Learning (ML)
- Data Science (Python, ML, AI)
- Bioinformatics
- Generative AI
- Cyber Security (Ethical Hacking, Cloud Computing)

Evaluation:

- On completion of the Summer Internship Programme, the students will submit a report with relevant photographs and an Authenticated Certificate jointly signed by the Supervisor/Mentor and the Head of the Institution.
- The report is to be signed by the Supervisor/Mentor with official seal.
- A viva-voce will be conducted by the Department with one Faculty acting as Internal Examiner and one External Examiner appointed from University
- The following Marks distribution is to be followed for evaluation
  CA: Submission of report: 20 marks, Demonstration: 10 marks.
  ESE: Presentation: 10 marks, Viva Voce: 10 marks

Collaboration:
The college/institute is free to take initiative to approach any organization/HEI/research institute/centres/industry from the relevant domain of Computer Application. Apart from these, the College/institute may consider other suitable/appropriate sectors for its students.