National Curriculum and Credit Framework (NCCF)

Syllabus

for

Major, Minor and Skill Enhancement Courses

of

Bachelor of Computer Application

w.e.f. Academic Session 2023-24

KaziNazrul University

Asansol, PaschimBardhaman

West Bengal 713340

Semester- I

Course Name: Programming in 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

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;

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

UNIT III. Cash Book: Definition, Features, Types of Cash Book and Preparation of cash book; Bank Reconciliation Statement: Definition, Causes of Preparation of Bank Reconciliation Statement, Preparation of Bank Reconciliation Statement.

UNIT IV. Preparation of Financial Statements of a profit-making trading firm with additional information, Preparation of Financial Statements of a not for profit organisation. Preparation of Financial Statements of a Company.

UNIT V. 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.

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

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.

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; Difference between financial and cost accounting, Limitation, Cost concepts and classifications- Elements of cost; preparation of Cost sheet.

UNIT II. Elements of Cost: Material and Labour; 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, Replacement, Standard Cost; Physical Verification-Perpetual and Periodical System, ABC Analysis, VED, JIT, Material Turnover Ratio; 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; Overheads: Classification, allocation, apportionment and absorption of overheads, Under- and over-absorption; Causes and treatment of Under- and over- absorption, Machine Hour Rate,

UNIT III. Methods of Costing; Job Costing-Features, Procedures, Advantages; Batch Costing-Features, Economic Batch Production; Contract Costing-Features, Accounting Procedures, Profit on Incomplete Contracts; Process costing (excluding inter process profit and W-I-P Valuation)-Features-Process Loss and Gains, Normal Loss, Abnormal Loss and Abnormal Gain.

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

UNIT V. Marginal Costing & Standard Costing: 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; 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.

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.

UNITX. 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.

Learning Outcome based Curriculum Framework (LOCF)

For

Choice Based Credit System (CBCS)

Syllabus

BACHELOR OF COMPUTER APPLICATION

w.e.f. Academic Session 2022-23

Kazi Nazrul University

Asansol, Paschim Bardhaman

West Bengal 713340

Semester- I

Course Name: Computer Fundamentals and Digital Logic

Course Code: BCAC101

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

References/ Suggested Readings:

1. U. Rajaraman and N. Adabala, Fundamentals of Computers, PHI.
2. P. K. Sinha and Preeti Sinha, Computers Fundamentals, BPB Publications.
3. Sanders H. Donald, Computer Concepts and Applications, McGraw-Hill.
4. M. Morris Mano, Digital Logic, Pearson.
5. D.P. Leach, A.P. Malvino and G. Saha, Digital Principles and Applications, McGraw-Hill.
6. Modern Digital Electronics: R.P. Jain, Tata McGraw Hill.

Practical

Unit I: MS Windows: Windows 7 and higher version, Desk top cell user interface action, icon on desktop, closing windows, renaming icons, resizing windows(maximizing and minimizing), control panel.

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

Unit III: MS Excel: Worksheet overview, entering information, worksheet creation, opening and saving workbook, formatting numbers and texts, protecting cells, producing charts, and printing operations. Application of Excel for obtaining statistical parameters, Mean, Median, Mode, average, co-relation, Regression.

Unit IV: MS Access: Introduction, understanding databases, creating tables, queries, forms, reports, adding graphs to your reports.

Unit V: PowerPoint: Slide creation with PowerPoint.

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

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

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

Unit IX: 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) – one from UNIT I-V and another from UNIT VI-IX., Viva-voce (5 marks).

ESE Evaluation: Two Experiments (10 marks) – one from UNIT I-V and another from UNIT VI-IX., Viva-voce (10 marks).

References/ Suggested Readings:

1. A. Leon and M. Leon, Introduction to Computers with MS-Office, TMH.
2. M. Morris Mano, Digital Logic, Pearson.

Course Name: Programming in C

Course Code: BCAC102

<table>
<tr><td>Course Type: Core
(Theoretical+Practical)</td><td colspan="2">Course Details: CC-2</td><td colspan="2">L-T-P: 4-0-4</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: Problem Solving: Flow Charts, Decision Tables and Pseudo code.

Unit II: Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language, Problem analysis, Need for programming languages.

Unit III: Introduction to C: Over view of C, Basic Structure, Character sets, Keywords, Identifiers, Constants, Variables, Data Types, Program Structure, loops and variables, Introduction to pointer.

Unit IV: Operators: Arithmetic, Relational, Logical and Assignment; Increment, Decrement and Conditional, Operator.

Unit V: Precedence and Associations; Expressions. Expression evaluation and type conversion. Formatted input and output.

Unit VI: Statements: Assignment, Initialization, Decision making, looping and control structures, Array, String, String handling functions, Functions – Arguments passing, Return values and their types, recursion. Enumerated data types. Structures. Arrays of structures. Arrays within structures, Union.

Unit VII: Pointers: Declaration and initialization, accessing variables through pointer, pointer arithmetic, Pointers and arrays, Pointers and String, Pointer to Functions and Structures, Dynamic Memory Allocation.

Unit VIII: File handlings: Opening, Closing, I/O operations. Storage classes in C, Bitwise operators in C.

References/ Suggested Readings:

1. B.S. Gottfried, Programming in C, TMH.
2. E. Balaguruswami, Programming in ANSI C, TMH.
3. Karnighan and Ritchie, C Programming, PHI.

Practical

Unit I: Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code, execute and test it.

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

Unit III: Learn how to use functions and parameter passing in functions, writing recursive programs.

Unit IV: Write Programs to learn the use of strings and string handling operations.

Unit V: Problems which can effectively demonstrate use of Arrays. Structures and Union.

Unit VI: Write programs using pointers.

Unit VII: Write programs to use files for data input and output.

Unit VIII: Write programs to implement sorting and searching algorithms.

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. E. Balaguruswami, Programming in ANSI C, TMH.
2. Y. Kanetkar, Let us C, BPB Publications.
3. Y. Kanetkar, Understanding Pointers In C & C++, BPB Publications.

Course Name: Mathematics -I

Course Code: BCAGE101

<table>
<tr><td>Course Type: GE
(Theoretical)</td><td colspan="2">Course Details: GEC-1</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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<tr><td>….</td><td>15</td><td>….</td><td>35</td></tr>
</table>

Course Content:

Theory

Unit I: Abstract Algebra: Sets, Union and Intersection, Complement, Mapping, Composition, notion of a Group, Ring, Field with simple examples.

Unit II: Complex Numbers: Modulus and amplitude, Euler's formula, De Moiver's theorem.

Unit III: Theory of equations: Polynomials, Division algorithm, Fundamental theorem of classical algebra (Proof not required), Descartes rule of sign and its application, Relation between roots and coefficients; symmetric function of roots, Transformation of polynomial equation, Cardan's solution of cubic equation,

Unit IV: Permutation and Combinations: Simple problems.

Unit V:Linear Algebra: Matrices, Addition and Multiplication of Matrices, Determinants, Inverse of a Matrices; Solution of system of linear equations in three variables by Cramer's rule and matrix inversion methods, Vector spaces, Subspaces, Bases and Dimensions, Co-ordinates, Linear Transformation, The Algebra of Linear Transformations.

Unit VI: Vector Algebra: Scalars and 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 VII: Analytical Two Dimensional Geometry: Translation and rotation of rectangular axes, invariants, general equation of second degree, Reduction to standard forms and classification. Plane polar equations of a straight line, circle and conic.

References/ Suggested Readings:

1. S. K. Mapa, Higher Algebra (Abstract and Linear), Levant.
2. S. K. Mapa, Higher Algebra (Classical), Levant.
3. Maity and Ghosh, Vector Analysis, New Central Book Agency.
4. R. M. Khan, Analytical Geometry of Two and Three Dimension, New Central Book Agency.
5. Lipschutz and Lipson, Discrete Mathematics, McGraw Hill Education.
6. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

Semester- II

Course Name: Operating System

Course Code: BCAC201

<table>
<tr><td colspan="2">Course Type: Core (Theoretical+Practical)</td><td colspan="2">Course Details: CC-3</td><td colspan="2">L-T-P: 4-0-4</td></tr>
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<tr><td>Practical</td><td>Theoretical</td><td>Practical</td><td>Theoretical</td></tr>
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</table>

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, 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. (Introduction to Android Operating System) Introduction to Android Operating System, Android Development Framework, Android Application Architecture, Android Process Management and File System.

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.

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

Course Name: Data Structure

Course Code: BCAC202

<table>
<tr><td colspan="2">Course Type: Core
(Theoretical+Practical)</td><td colspan="2">Course Details: CC-4</td><td colspan="2">L-T-P: 4-0-4</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. Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis, Linear and Non Linear data structures, Singly Linked Lists-Operations, Concatenating, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations. Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

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

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

UNIT V. 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, Priority Queue- Definition and Implementation, Heap- Definition, Min heap, Max heap, Insertion and Deletion.

UNIT VI. Static Hashing- Introduction, Hash tables, Hash functions, Overflow Handling.

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. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill

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 a program to implement stack data structure and basic operations on it (Insertion, deletion). Write a program that demonstrates the application of stack operations (Eg: infix expression to postfix conversion, postfix evaluation).
3. Write a program to implement queue data structure and basic operations on it (Insertion, deletion, find length) and code at least one application using queues.
4. Write program that implements linear and binary search methods of searching for an elements in a list.
5. Write and trace programs to understand the various phases of sorting elements using the methods a) Bubble sort b) Insertion Sort c) Quicksort etc.
6. Write a program to create a Binary search tree and insert and delete from the tree. Write recursive and non-recursive routines to traverse a binary tree in preorder, inorder and postorder.
7. Write programs for recursion (Eg. Fibonacci numbers, Towers of Hanoi).

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. Data Structures Using C and C++. Y. Langsam, M.J. Augenstein and A.M. Tanenbaum. PHI Pvt. Ltd.
2. Data Structure through C in Depth. S.K. Srivastava and Deepali Srivastava, B.P.B Publication.

Course Name: Accounting & Costing

Course Code: BCAGE201

Course Type: GE **(Theoretical)**	Course Details: **GEC-2**			L-T-P: 5**-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Basic Accounting concept and Conventions including Objectives, Advantages and Limitation of Accounting, preparation of Journal, Ledger, Cash Book, Trial balance.

UNIT II. Preparation of financial statements of Trading and Non- Trading Concern.

UNIT III. Basic Cost Concepts, Cost Classification; Preparation of Cost Sheet, Material Cost Accounting, Labour cost Accounting and Overhead cost Accounting.

UNIT IV. Budget and Budgetary Control including Zero-Base Budgeting, Responsibility Accounting and Preparation of Cash Budget and Flexible Budget and C-V-P analysis.

References/ Suggested Readings:

1. Modern Accountancy. Amitabha Mukherjee & Mohammed Hanif; Tata McGraw-Hill.
2. Accountancy. Basu and Das. Rabindra Library.
3. Principles and Practice of Cost Accounting. A. K. Bhattacharya. PHI.

Semester- III

Course Name: Object Oriented Programming with C ++

Course Code: BCAC301

<table>
<tr><td>Course Type: Core
(Theoretical+Practical)</td><td colspan="2">Course Details: CC-5</td><td colspan="2">L-T-P: 4-0-4</td></tr>
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Course Content:

Theory

UNIT I. Basics: Introduction to Object Oriented Programming and its Basic Features, Basic Components of C++, Characteristics of Object-Oriented Language, Structure of a C++ Program, Flow Control Statements in C++, Functions - Scope of Variables, Inline Functions, Recursive Functions, Pointers to Functions, C++ Pointers, Arrays, Dynamic Memory Allocation and De-Allocation

UNIT II. Differences Between Object Oriented and Procedure Oriented Programming, Abstraction, Overview of Object-Oriented Programming Principles, Encapsulation, C++ Classes, Objects, User Defined Types, Constructors and Destructors, this Pointer, Friend Functions, Data Abstraction,.

UNIT III. Polymorphism, Static and Dynamic Bindings, Function Overloading, Operator Overloading, Type Conversion.

UNIT IV. Class Inheritance, Base and Derived Classes, Base and Derived Class, Dynamic Binding through Virtual Functions, Pure Virtual Functions, Virtual Base Class, Abstract Classes, Virtual Destructors

UNIT V. Stream Classes Hierarchy, Stream I/O, File Streams, Overloading the Extraction and Insertion Operators, Error Handling during File Operations, Formatted I/O.

UNIT VI. 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 VII. 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.

Course Name: Computer Organization and Architecture

Course Code: BCAC302

Course Type: **Core (Theoretical+Practical)**	Course Details: **CC-6**			L-T-P: **5-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Data Representation and Basic Computer Arithmetic - Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers.

UNIT II. Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Microoperations, Logic Microoperations, Shift Microoperation.

UNIT III. Basic Computer Organization: Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer.

UNIT IV. Processor and Control Unit: Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, RISC, CISC, Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards. Introduction to Parallelism.

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.

References/ Suggested Readings:

1. M. Morris Mano, Computer System Architecture, Prentice Hall.
2. David A. Patterson and John L. Hennessey, Computer Organization and Design, Morgan Kauffman / Elsevier.
3. Floyd, Digital Fundamentals, Pearson Education.
4. William Stallings, Computer Organization and Architecture, Prentice Hall.

Course Name: Database Management System

Course Code: BCAC303

<table>
<tr><td colspan="2">Course Type: Core
(Theoretical+Practical)</td><td colspan="3">Course Details: CC-6</td><td colspan="2">L-T-P: 4-0-4</td></tr>
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</table>

Course Content:

Theory

UNIT I. Basic Database Concepts, Terminology, and Architecture; Types of Database Management Systems. Differences between Relational and other Database Models. Data Modelling: Relations, Schemas, Constraints, Queries, and Updates; Conceptual vs. Physical Modelling; Entity Types, attributes, ER Diagrams.

UNIT II. SQL Data Definition: Specifying Tables, Data Types, Constraints; Simple SELECT, INSERT, UPDATE, DELETE Statements; Complex SELECT Queries, including Joins and Nested Queries; Actions and Triggers; Views; Altering Schemas.

UNIT III. Relational Algebra: Definition of Algebra; Relations as Sets; Operations: SELECT, PROJECT, JOIN, etc. Normalization Theory and Functional Dependencies, 2NF, 3NF, BCNF, 4NF, 5NF;

UNIT IV. Indexing: Files, Blocks, and Records, Hashing; RAID; Replication; Single-Level and Multi-Level Indexes; B-Trees and B+-Trees. Basics of Transactions, Concurrency and Recovery.

UNIT V. DATABASE PROGRAMMING: Embedded SQL; Dynamic SQL, Avoiding Injection Attacks; Stored Procedures;

UNIT VI. BIG DATA: Motivations; OLAP vs. OLTP; Batch Processing; Map Reduce and Hadoop; Spark;

Practical

Students are required to practice the concepts learnt in the theory by designing and querying a database for a chosen organization (Like Library, Banking, 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: Installation of Mysql/Postgresql/SQL Server/Oracle

Experiment 6: Practicing DDL commands. Creating databases, How to create tables, altering the database, dropping tables and databases. Try truncate, rename commands etc.

Experiment 7: 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 or few records from a table.

Experiment 8: Querying practice queries (along with sub queries) involving ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.

Experiment 9: Practice queries using Aggregate functions (COUNT, SUM, AVG, and MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Experiment 10: Triggers - Work on Triggers. Creation of, insert trigger, delete trigger, update trigger.

Internal (CA) Evaluation: Practical Note Book (15 marks), Experiment (10 marks) – Experiment 1 to Experiment 5, Viva-voce (5 marks)

ESE Evaluation: Experiment (10 marks) – Experiment 6 to Experiment10, Viva-voce (10 marks)

References/ Suggested Readings:

1. Elmasri's and Navathe's Fundamentals of Database Systems. Addison-Wesley
2. Raghu Ramakrishnan, Johannes Gehrke, Data base Management Systems, McGraw Hill Education
3. Silberschatz, Henry. F. Korth, S. Sudarshan, Data base System Concepts, McGraw Hill Education
4. A. Majumdar and P. Bhattacharyya, Database Management Systems, McGraw Hill Education.

Course Name: Mathematics -II

Course Code: BCAGE301

<table>
<tr><td colspan="2">Course Type: GE
(Theoretical)</td><td colspan="2">Course Details: GEC-3</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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</table>

Course Content:

Theory

UNIT I. Differential Calculus: Limit of a function and continuity. Fundamental properties of continuous functions (proofs not required); Derivative and Differential-Geometric meaning, Rules of Differentiation. Successive differentiation.Rolle's theorem, Mean-Value theorems, Taylor's and Maclaurin's theorems with Cauchy's and Lagrange's forms of remainder; Taylor's series. Functions of several variables.Partial Derivatives.Total Differential.Euler's theorem on homogeneous functions of two variables. Application of differential calculus (tangents, normals, curvature, asymptotes).

UNIT II. Integral Calculus: Rules of Integration of Indefinite Integrals, Solution of Definite Integrals and their elementary properties. Idea of improper integrals. Application of integral calculus (evaluation of area, lengths of plane curves).

UNIT III. Differential Equations: order, degree, solution and formation of a differential equation.ODE of first order and first degree, Exact equations, Integrating factors, Linear equations, Bernoulli's equations, Standard techniques of solving second order linear ordinary differential equations with constant coefficients. Cauchy's and Legendre's Linear Differential Equations with variable coefficients.

UNIT IV. Sequence and Series: Bounded and unbounded sequences, Convergence or divergence of a sequence, Behavior of monotone sequences, Algebra of convergent sequences, Cauchy sequence, Cauchy's general principle of convergence, Infinite series, it's convergence and sum, series with positive terms and standard tests of convergence (without proofs), Alternating Series, Leibniz Test, Absolute convergence, Rearrangement of absolutely convergent series, Test of convergence of Abel and Dirichlet (without proofs).

References/ Suggested Readings:

1. Das and Mukherjee, Differential Calculus, N. Dhur & Sons Pvt. Ltd.
2. Das and Mukherjee, Integral Calculus, N. Dhur & Sons Pvt. Ltd.
3. Ghosh and Maity, An Introduction to Analysis (Differential Calculus), New Central Book Agency (P) Ltd.
4. Ghosh and Maity, An Introduction to Analysis (Integral Calculus), New Central Book Agency (P) Ltd.
5. Ghosh and Maity, An Introduction to Differential Equations, New Central Book Agency (P) Ltd.
6. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

Course Name: Reasoning & Aptitude

Course Code: BCASE301

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

Course Name: Core Java

Course Code: BCAC401

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<tr><td>Course Type: Core
(Theoretical+Practical)</td><td colspan="2">Course Details: CC-8</td><td colspan="2">L-T-P: 4-0-4</td></tr>
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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. 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

UNIT I. Java Essentials, Execution and Compilation, Data types, Variables, Control Statements, Standard Input/ Output.

UNIT II. Constructors, Encapsulation, Abstraction, Inheritance, Polymorphisms, JAVA Packages.

UNIT III. Exception Handling, Wrapper Classes, Autoboxing, Multi-thread Programming.

UNIT IV. Applets, Event Handling, AWT.

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 Java to package classes.

5. Program to demonstrate method over-riding and overloading

6. Programs on inheritances.

7. Multi-threaded programming.

8. Exception hand;ing

9. Java Applets.

10. Event 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.

Course Name: Computer Networks

Course Code: BCAC402

Course Type: **Core (Theoretical+Practical)**	Course Details: **CC-9**			L-T-P: **5-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**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.

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.

Course Name: Web and Internet Technology

Course Code: BCAC403

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<tr><td>Course Type: Core (Theoretical+Practical)</td><td colspan="2">Course Details: CC-10</td><td colspan="2">L-T-P: 4-0-4</td></tr>
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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 Chart 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 V) 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. CSS: The need for CSS, Introduction to CSS, Basic syntax and structure, Inline Styles, Embedding Style Sheets, Linking External Style, Backgrounds, Manipulating Text, Margins and Padding, Positioning using CSS.

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

UNIT IV. PHP**:** Introduction to PHP**,** Server side scripting, Role of web server software, PHP comments, variables, echo and print, PHP operators, data types , Branching statements, 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 V. 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. Rasmus Lerdorf 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.

Course Name: Mathematics -III

Course Code: BCAGE401

Course Type: **GE** **(Theoretical)**	Course Details: **GEC-3**			L-T-P: **5-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Probability and Statistics:
Random experiments. Simple and compound events. Event space. Classical and frequency definitions of probability and their drawbacks. Axioms of Probability. Statistical regularity. Multiplication rule of probabilities. Bayes' theorem. Independent events. Independent random experiments. Independent trials. Bernoulli trials and binomial law. Poisson trials. Random variables .Probability distribution. Distribution function. Discrete and continuous distributions. Binomial, Poisson, and Normal distribution.

Collection and presentation of data: Frequency distribution. Measures of central tendency. Measures of dispersion.

Bivariate Frequency Distributions (scatter Diagram, Correlation coefficient and its properties, regression lines, correlation index and correlation ratio, rank correlation).

Random sampling: Expectations and standard error of sampling mean. Expectation and standard error of sampling proportions.

UNIT II. Numerical Methods and Algorithms:

Error: Introduction, types of error - relative, absolute, percentage, round-off.

Solution of Algebraic and Transcendental Equations: Bisection, Newton-Raphson, Regula-Falsi and Secant method.

Interpolation and approximation: Newton's forward interpolation and Newton's backward interpolation, Lagrange's interpolation.

Evaluation of Integrals: Trapezoidal and Simpson's 1/3 rules.

Solution of System of linear equations: Gaussian elimination, Gauss Seidel method.

Solution of Ordinary different equations: Euler's, Taylor's series, Runge-Kutta (order-2 and 4).

References/ Suggested Readings:

1. N. G. Das, Statistical Methods Vol 1, McGraw Hill Education India.
2. N. G. Das, Statistical Methods Vol 2, McGraw Hill Education India.
3. Goon, Gupta, Dasgupta, Fundamentals of Statistics, World Press.

4. C Xaviers, C Language and Numerical Methods, New Age International.
5. S. A. Mollah, Numerical Analysis and Computational Procedures, Books & Allied Ltd.
6. Amritava Gupta and Subhas Ch. Bose, Introduction to Numerical Analysis, ACADEMIC PUBLISHERS.
7. R K Jain, S R K Iyengar, M K Jain, Numerical Methods For Scientific & Engineering Computation, New Age International.

Course Name: Value and Ethics of Profession

Course Code: BCASE401

Course Type: **SE** **(Theoretical)**	Course Details: **SE-2**			L-T-P: **4-0-0**	
Credit: **4**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Introduction to Ethical Theories Consequentiality and Non-consequentiality theories, Hedonism, Utilitarianism, Virtue Ethics, Ethical Relativism, Ethical Naturalism

UNIT II. Ethics and Morality Ethics and Morals, Ethics in Indian Tradition, Building character in workplace, Moral and Ethical Judgement: Cannons of ethics, Ethics of duty, Ethics of responsibility

UNIT III. Ethics and Environment Rapid technological growth and depletion of resources, Sources of energy, Energy crisis, Reports of Club of Rome, Environmental degradation, Environmental Regulations, Environmental Ethics, Eco- friendly technologies, Sustainable Development, Important and recent national and international conventions on environment, Appropriate Technology Movement of Schumacher: Later developments.

UNIT IV. Technology and Developing Nations- Technology transfer Problems of technology transfer, Stages of technology transfer, Problems of technology transfer, Technology Impact Assessment, Problems of man machine interaction, Impact of Assembly line, Automation, Corporate Social Responsibility.

UNIT V. Ethics of Profession Attributes of a profession, Science, Technology and Engineering as Knowledge and as Social and Professional Activities, Engineering profession: Ethical issues in engineering practice, Conflicts between business demands and professional

ideals, Social and ethical responsibilities of Technologists, Codes of professional ethics, Whistle blowing and beyond. Case studies.

UNIT VI. Profession and Human Values Value Crisis in contemporary society, Nature of values: Value Spectrum of a 'good' life, Psychological values: Integrated personality; mental health, Societal values: The modern search for a 'good' society, justice, democracy, secularism, rule of law; values in Indian Constitution, Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity.

References/ Suggested Readings:

1. Biswanath Ghosh, Ethics in Management and Indian Ethos, Vikas Publishing.
2. Sumita Manna, Values and Ethics in Business and Profession, PHI Publishing .
3. S. Balachandran, K.R. Raja and B.K. Nair, Ethics, Indian Ethos and Management, Shroff Publishers and Distributors Pvt. Ltd.

Semester- V

Course Name: Software Engineering

Course Code: BCAC501

Course Type: **Core (Theoretical+Practical)**	Course Details: **CC-11**			L-T-P: **4-0-4**	
Credit: 6	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I: Software Engineering fundamentals: Definition of software, Software lifecycle, Comparison between software life cycles and hardware life cycles, program, software product, software engineering; Define Software process, software project, software product; Software engineering: A layered technology; Software engineering paradigm. Software life cycle models: Classical waterfall model, Iterative waterfall model, Prototyping model, Evolutionary model, Iterative model, Spiral Model, RAD model .

UNIT II: Feasibility Study and its importance; Cost Benefit Analysis; Requirements analysis and specifications: Introduction, Data & Fact Gathering Techniques, SRS, Good and Bad SRS.

UNIT III: Design: Introduction, Classification of design activity(Preliminary design, Detailed design), Cohesion & Coupling, Approaches to Software Design(Function oriented design, Object oriented design), Structured Analysis, Structured Design, DFD, Structured Chart, Data Dictionary, Introduction to ERDs;

Introduction to CASE Tools; Introduction to UML; Introduction to User Interface Design.

UNIT IV: Coding: Introduction to Coding, Coding standards and guidelines; Debugging: Introduction to Debugging, Debugging approaches; Software Testing: Introduction to testing, Verification &Validation, Unit testing, Black- box testing, White- Box testing, Grey Box Testing, Integration testing, System testing, Performance testing, Mutation Testing, Path Testing with Cyclomatic complexity.

UNIT V: Software Reliability: Introduction to Software Reliability, Reliability Metrics; Software Quality Assurance, Software Quality, ISO 9000, SEI CMM; Software Maintenance: Introduction, Types of Maintenance; Software Reuse.

UNIT VI: 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, COCOMO (Basic, Intermediate, Complete); Scheduling: Introduction, WBS, Activity Network, CPM, Gantt Charts, PERT Charts; Organization &Team Structure; Staffing; Risk Management; Software Configuration Management.

Practical

UNIT I. Development of problem statement.

UNIT II. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.

UNIT III. Preparation of Software Configuration Management and Risk Management related documents.

UNIT IV. Study and usage of any Design phase CASE tool

UNIT V. Performing the Design by using any Design phase CASE tools.

UNIT VI. Develop test cases for unit testing and integration testing

UNIT VII. Develop test cases for various white box and black box testing techniques.

Students are directed to prepare a project report of the following sample projects (any one decides by the institution) considering above seven units:

1. Passport automation System
2. Online Exam Registration
3. Stock Maintenance System
4. Online course reservation system
5. E-ticketing
6. Credit Card Processing
7. E-book management System.
8. Recruitment system

Internal (CA) Evaluation: Project Report (20 marks), Viva-voce (10 marks).

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

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.

Course Name: Minor Project and Entrepreneurship

Course Code: BCAC502

<table>
<tr><td>Course Type: Core (Practical)</td><td colspan="2">Course Details: CC-12</td><td colspan="2">L-T-P: 0-0-12</td></tr>
<tr><td rowspan="3">Credit: 6</td><td rowspan="3">Full Marks: 100</td><td colspan="2">CA Marks</td><td colspan="2">ESE Marks</td></tr>
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<tr><td>60</td><td>….</td><td>40</td><td>…..</td></tr>
</table>

Course Content:

Practical

Students are directed to do a minor project and prepare the project report considering UNIT I to UNIT VIII below. Students are also directed to prepare an entrepreneurship plan considering UNIT IX to UNIT XII below.

UNIT I. Project Management Concepts: Concept and Characteristics of a Project, Types of Projects, Project Management (Need, Knowledge Areas, Project Manager, Project Management Triangle, Project Scope and Scope Creep, Importance of Project Management).

UNIT II. Project Management Life Cycle: Project Management Life Cycle Phases, Project Management Process (Project Process, Process Group, Process Interactions, Customization, Process Group and Knowledge Area Matrix)

UNIT III. Project Planning: Planning Need, Importance of Planning, Planning Process, Work Breakdown Structure and Organization Breakdown Structure, Roles, Responsibility and Team Work, Feasibility Studies.

UNIT IV. Project Evaluation: Investment Analysis of Projects (Time Value of Money, Interest Rates, Compounding/Discounting, Payback Period, Average Rate of Return, Net Present Value, Profitability Index, Internal Rate of Return), Sources of Finance.

UNIT V. Project Scheduling: Importance of Project Scheduling, Scheduling Techniques (Gantt Chart and Line of Balance, Network Analysis – CPM/PERT, Slack and Float).

UNIT VI. Project Cost Control: Direct and Indirect Cost, Normal Cost and Crash Cost, Time– Cost Trade-off Analysis - Optimum Project Duration, Resource Allocation and Leveling.

UNIT VII. Legal and Quality Aspects of Project Management: Project Contract (Types of Contract, Sub-Contracting, Tenders, Payment to Contractors), Project Audit.

UNIT VIII. IT in Projects: Overview of types of Software for Projects, Major Features of Project Management Software like MS Project, Criterion for Software Selection.

UNIT IX. Entrepreneurship: Meaning & Concept of Entrepreneurship, Conditions needed for Entrepreneurship (Social Factors, Economic Factors, Psychological Factors, Legal Factors, Education & Technical Knowhow, Financial Assistance), Qualities of a Prospective Entrepreneur.

UNIT X. Entrepreneurial Motivation: McClelland's N-Ach Theory (Need for Affiliation, Need for Power, Need for Achievement), Self–Analysis, Personal Efficacy, Culture & Values, Risktaking Behaviour, Technology Backup.

UNIT XI. Introduction to various form of business organization (sole proprietorship, partnership, corporations, Limited Liability company), mission, vision and strategy formulation.

UNIT XII. Entrepreneurial Skills: Creativity, Problem Solving, Decision Making, Communication, Leadership Quality.

Internal (CA) Evaluation: An Entrepreneurship Plan (25 marks), Minor project report (25 marks), Viva-voce (10 marks).

ESE Evaluation: Presentation of the minor project (15 marks), Presentation of entrepreneurship plan (15 marks), Viva-voce (10 marks).

References/ Suggested Readings:

1. P. Gopalkrishnan and R. M. Moorthy, Text Book of Project Management, Macmillan
2. K. Nagarajan, Project Management, New Age International Publishers; 5th Edn.
3. P. Chandra, Projects; Tata McGraw Hill; 6th Edn.
4. J. M. Nicholas, Project Management for Business and Technology – Principles and Practice; Prentice Hall India; 2nd Edn.
5. H. Maylor, Project Management; Pearson; 3rd Edn.
6. D. F. Kuratko and R. M. Hodgetts, Entrepreneurship; Thomson Learning; 7th Edn.
7. R. Roy, Entrepreneurship; Oxford University Press.

Course Name: Introduction to Cyber Security

Course Code: BCADSE501

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-1 or DSEC-2</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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<tr><td>….</td><td>15</td><td>….</td><td>35</td></tr>
</table>

Course Content:

Theory

UNIT I. Introduction to Cyber Security: Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cyber security. Confidentiality, integrity, & availability, Authentication & nonrepudiation, Types of attack.

UNIT II. Cryptography Concepts & Techniques: Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size.

UNIT III. Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

UNIT IV. Asymmetric Key Algorithm, Digital Signature and RSA: Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, NP-hard, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).

UNIT V. Firewall: Introduction, Types of firewall, Firewall Configurations, DMZ Network.

UNIT VI. Future Implications & Evolving Technologies: New & emerging IT & IS technologies, Mobile security issues, risks, & vulnerabilities, Cloud concepts around data & collaboration.

UNIT VII. Electronic Mail Security: Basics of mail security, Pretty Good Privacy, S/MIME.

References/ Suggested Readings:

1. William Stallings, Cryptography and Network Security, Pearson Education Asia
2. C. Kaufman, R. Perlman and M. Speciner, Network Security private communication in a public world, Pearson.
3. Atul Kahate, Cryptography & Network Security, TMH.
4. Wu Chwan-Hwa (John) et.al., Introduction To Computer Networks And Cybersecurity, BSP Books.
5. P. W. Singer and Allan Friedman, Cyber Security and Cyber War, Oxford University Press.

Course Name: Data Science

Course Code: BCADSE502

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-1 or DSEC-2</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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<tr><td>….</td><td>15</td><td>….</td><td>35</td></tr>
</table>

Course Content:

Theory

UNIT I. Introduction to data science, Exploratory data analysis, Linear regression and regularization, Model selection and evaluation.

UNIT II. Classification: kNN, decision trees, SVM; Ensemble methods: random forests, Naïve Bayes and logistic regression.

UNIT III. Feature engineering and selection, Clustering: k-means, hierarchical clustering, Dimensionality reduction: PCA and SVD

UNIT IV. Text mining and information retrieval, Network Analysis, Recommender systems.

References/ Suggested Readings:

1. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer.
2. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann.
3. Hastie, T., Tibshirani, R., Friedman, J. The Elements of Statistical Learning, Springer.
4. Murphy, K. Machine Learning: A Probabilistic Perspective, MIT Press.

Course Name: Intelligent Systems

Course Code: BCADSE503

Course Type: **DSE (Theoretical)**	Course Details: **DSEC-1 or DSEC-2**			L-T-P: **5-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Introduction: What is AI- Importance of AI-Objectives.Applications of AI in Natural Language Processing, Speech Understanding, Computer Vision, Planning, etc. Introduction to LISP: Study of features and its application.

UNIT II. Knowledge and AI Problem solving concepts: Its representation, Organisation – Manipulation and Acquisition.

UNIT III. Predicate Calculus in AI – First Order Predicate Logic & its use in Knowledge Representation – Resolution Principal.Use of Resolution in reasoning and Question answering.Production Systems and Search Strategies – Production System and its variants – Heuristic Search Methods.

UNIT IV. Uncertainty Management: Fuzzy Logic, Bayesian inferencing, certainty factor Structured Representation of Knowledge – Semantic networks, Frames, Conceptual Dependancy& Scripts.

UNIT V. Learning: Learning automation, learning by induction, Neural Networks, Genetic Algorithms.

UNIT VI. Expert Systems: Rule Based System Architecture – Non-production System Architecture – Knowledge Acquisition Methods – Explanation Methods – Expert System Shells.

References/ Suggested Readings:

1. D.W.Patterson, Introduction to Artificial Intelligence and Expert System, PHI
2. N.J.Nilson, Principle of Artificial Intelligence, Narosa.
3. Ritch & Knight, Artificial Intelligence, TMH.
4. Stuart Russel and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson

Course Name: Microprocessor and Assembly Language Programming

Course Code: BCADSE504

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-1 or DSEC-2</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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<tr><td>….</td><td>15</td><td>….</td><td>35</td></tr>
</table>

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. Memory interfacing; I/O interfacing; Peripheral ICs; I/O memory Interfacing Chips, Bus structure of microprocessor based systems, bus arbitration; Interrupt handling and DMA operation. Basic idea about microprogramming.

UNIT V. Case Study: Intel 8085 microprocessor.

UNIT VI. Advanced Microprocessors: Functional description of 8086 microprocessor, software model of 8068/8088; Data addressing modes of 8086; 80x86 family of microprocessor.Comparison of different microprocessors; microprocessors of other families.

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.

Course Name: Multimedia System Design

Course Code: BCADSE505

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-1 or DSEC-2</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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<tr><td>….</td><td>15</td><td>….</td><td>35</td></tr>
</table>

Course Content:

Theory

UNIT I. Multimedia: Introduction to multimedia, components, uses of multimedia, multimedia applications, virtual reality. Text: Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia & Hypertext.

UNIT II. Images: Still Images – bitmaps, vector drawing, 3D drawing & rendering, natural light & colors, computerized colors, color palettes, image file formats.

UNIT III. Sound: Digital Audio, MIDI Audio, MIDI vs Digital Audio, Audio File Formats.

UNIT IV. Video: How video works, analog video, digital video, video file formats, video shooting and editing.

UNIT V. Animation: Principle of animations, animation techniques, animation file formats. Internet and Multimedia: www and HTML, multimedia on the web – web servers, web browsers.

UNIT VI. Making Multimedia: Stages of a multimedia project, Requirements to make good multimedia.

UNIT VII. Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals - Connections, Memory and storage devices, Multimedia software and Authoring tools.

References/ Suggested Readings:

1. Tay Vaughan, .Multimedia: Making it work., TMH.
2. Ralf Steinmetz and KlaraNaharstedt, .Multimedia: Computing, Communications Applications., Pearson.
3. Keyes, .Multimedia Handbook., TMH.
4. K. Andleigh and K. Thakkar, .Multimedia System Design., PHI.

Semester- VI

Course Name: Programming in Python

Course Code: BCAC601

Course Type: **Core (Theoretical+Practical)**	Course Details: **CC-13**			L-T-P: **4-0-4**	
Credit: 6	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, catch, 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.

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 programs 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 program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
14. Write a Python class to convert an integer to a roman numeral.
15. 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 Technology Inc.

Course Name: Major Project

Course Code: BCAC602

<table>
<tr><td>Course Type: Core (Practical)</td><td colspan="2">Course Details: CC-14</td><td colspan="2">L-T-P: 0-0-12</td></tr>
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Course Content:

Practical

It is desirable that project report should be done in an Industry/Organization only using the tools learn in the BCA LOCF curriculum for the session 2021-2024. The report should be prepared as per Kazi Nazrul University project template.

Internal Evaluation: Project Report (30 marks), Demonstration (20 marks) and Viva voce (10 marks).

End Semester Evaluation: Presentation (20 marks) and Viva voce (20 marks).

Course Name: Computer Graphics

Course Code: BCADSE601

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-3 or DSEC-4</td><td colspan="2">L-T-P: 5-1-0</td></tr>
<tr><td rowspan="3">Credit: 6</td><td rowspan="3">Full Marks: 50</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>….</td><td>15</td><td>….</td><td>35</td></tr>
</table>

Course Content:

Theory

UNIT I. Computer Graphics Basics: Basic elements of Computer graphics, Cathode Ray Tube, Raster Scan, Application of Computer Graphics. Architecture of Raster and Random scan display devices, input/output devices.

UNIT II. Output Primitives: Points and Lines, Line Generation Algorithm (DDA Algorithm, Bresenham's Line Generation, Mid-Point Algorithm), Line Function, Circle-Generating Algorithms (Bresenham's Algorithm and Midpoint Circle Algorithm), Properties of Circles, Ellipse-Generating Algorithms, Midpoint Ellipse Algorithm, Properties of Ellipses. Filled-Area Primitives, Scan-Line Polygon Fill Algorithm Inside-Outside Tests, Scan-Line Fill of Curved Boundary, Areas Boundary-Fill Algorithm, Flood-Fill Algorithm, Fill-Area Functions.

UNIT III. Two-Dimensional Geometric Transformations: Basic Transformations Translation Rotation Scaling , Matrix Representations and Homogeneous Coordinates , Composite Transformations, General Pivot-Point Rotation ,General Fixed-Point Scaling, General Scaling Directions, Concatenation Properties, General Composite Transformations and Computational Efficiency ,Other Transformations – Reflection, Shear, Transformations Between Coordinate Systems.

UNIT IV. Two-Dimensional Viewing: Viewing Coordinate Reference Frame, Window-to-viewport Coordinate Transformation, Clipping Operations, Point Clipping, Line Clipping(Cohen-Sutherland Line Clippings, Cyrus-Beck Line Clipping Algorithm), Polygon Clipping (Sutherland Hodgman Algorithm),Text Clipping,Curve Clipping, Exterior Clipping.

UNIT V. Three-Dimensional Geometric and Modeling Transformations: Translation, Rotation, Coordinate-Axes Rotations , General Three-Dimensional Rotations, Scaling, Reflections, Shears, Composite Transformations, Three-Dimensional Transformation Functions, Modeling and Coordinate Transformations.

References/ Suggested Readings:

1. Computer Graphics –Hearn and Baker, PHI.
2. Computer Graphics and Multimedia, D.P. Mukherjee, PHI.

Course Name: Theory of Computation

Course Code: BCADSE602

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-3 or DSEC-4</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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</table>

Course Content:

Theory

UNIT I. Introduction: Synchronous & Asynchronous Sequential Circuit, Storage Element, Melay and Moore Machines, Design Technique of State Machine.

UNIT II. Finite State Model: Synchronous Sequential Machine; State Successor in Sequential Machine; Capabilities and Limitations of FSM; State Equivalence and Machine Minimization.

UNIT III. Theory Of Automata: Definition of Automation; Description of Finite Automation; Transition System; Properties of Transition Function; NDFA, DFA, Conversion from NDFA to DFA, Minimization Of States (Equivalence Partition);Conversion From Moore to Mealy machine and Vice Versa.

UNIT IV. Formal Languages: Basic Definition of Grammar and Languages; Examples; Chomsky Classification of Languages; Languages and their Relations; Operation on Languages; Language and Automata.

UNIT V. Regular Set And Regular Grammar: Regular Expression; Finite Automata and Regular Expression; Regular Grammars and Regular Languages; Pumping Lemma for Regular Sets, Application of Pumping Lemma, Closure Properties of Regular Languages.

UNIT VI. Context-Free Languages: Basics of CFL; Sentential Forms; Derivation Trees; Ambiguity in CFG; Simplification of CFG; CNF And GNF;

UNIT VII. Pushdown Automata: Basic Definition; Language Acceptance by PDA; Deterministic PDA.

UNIT VIII. Turing Machine: Turing Machine Model; Representation of Turing Machine; Language Acceptability by TM; Design of TM; Nondeterministic TM.

References/ Suggested Readings:

1. Mishra, Chandrasekaran - Theory of Computer Science, PHI
2. J.E. Hopcroft and J.D. Ullman: Introduction to Automata Theory, Languages and Computation.
3. H.R. Lewis and C.H. Papadimitriou: Elements of the Theory of Computation

Course Name: Cloud Computing

Course Code: BCADSE603

Course Type: **DSE (Theoretical)**	Course Details: **DSEC-3 or DSEC-4**			L-T-P: **5-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Introduction to cloud computing: Definition, characteristics, components, Cloud service provider, the role of networks in Cloud computing, Cloud deployment models- private, public & hybrid, Cloud service models, multitenancy, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS.

UNIT II. Virtualization: Virtualization concepts , Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, VMware hypervisors and their features.

UNIT III. Data in cloud computing: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using MapReduce.

UNIT IV. Cloud security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges : Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

UNIT V. Issues in cloud computing: Implementing real time application over cloud platform, Issues in Inter-cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud.

References/ Suggested Readings:

1. Gautam Shroff, Enterprise Cloud Computing,Cambridge publication
2. Ronald Krutz and Russell Dean Vines, Cloud Security, Wiley-India.
3. Dr. Kumar Saurabh, Cloud Computing, Wiley Publication.

Course Name: Digital Marketing

Course Code: BCADSE604

Course Type: **DSE (Theoretical)**	Course Details: **DSEC-3 or DSEC-4**			L-T-P: **5-1-0**	
Credit: **6**	Full Marks: **50**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**15**	**….**	**35**

Course Content:

Theory

UNIT I. Introduction to Digital Marketing: Difference between Traditional Marketing and Digital Marketing, Benefits of using Digital Media, Inbound and Outbound Marketing, Online marketing POEM: (Paid, Owned, and Earned Media), Components of Online Marketing (Email, Forum, Social network, Banner, Blog), Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing.

Email Marketing: Email newsletters, Digests, Dedicated Emails, Lead Nurturing, Sponsorship Emails and Transactional Emails, Drawbacks of Email Marketing

Social Media Marketing (SMM): Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc.

UNIT II. **Search Engine Optimisation (SEO)**: About SEO, Need of an SEO friendly website, Importance of Internet and Search Engines; Role of Keywords in SEO.

On-Page Optimization (Onsite): Basics of Website Designing/Development; HTML Basics for SEO; Onsite Optimization Basics; Website Structure and Navigation Menu Optimization; SEO Content Writing. Keywords Research and Analysis (eg. SWOT analysis of website, finding appropriate keywords).

Off Page Optimization: Introduction; Local marketing of websites depending on locations; Promoting Subsequent pages of the website. Introduction to organic SEO vs non-organic SEO; Social Media Optimization Techniques and Page Rank Technology.

UNIT III. **Content Marketing Strategy:** Goals and concepts, Strategic building blocks, Content creation & channel distribution, Tools of the trade, Advantages and challenges.

Keywords Research and Analysis: Introduction to Keyword Research; Business Analysis; Types of Keywords; Keywords Analysis Tools.

Web Presence: How to increase online presence and drive more traffic for a website, Search result visibility in search engines for chosen keyword and phrases, Using e-mail marketing to drive traffic for a website, Posting social media content for lead generation, Tools to create and manage content, Use of Blogging as content strategy.

Creating content: Writing and posting content on the web and in social networks, blog and video; Create, manage and implement a content marketing strategy; Monitoring and

recording results to improve content marketing campaigns, Successful content marketing strategies and case studies.

UNIT IV. Online Advertising, Mobile Marketing and Web analytics: Introduction to Online Advertising and its advantages, Paid versus Organic, Pay Per Click (PPC) Model. Basic concepts Cost per Click (CPC), CPM, CTR, CR ete. About Mobile Marketing, Objectives of Mobile Advertising, Creating a Mobile Marketing Strategy, Introduction to SMS Marketing. About Web Analytics Topk of Wch, Anastics (Onsite, off-site), Importance of Web Analytics.

References/ Suggested Readings:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.
4. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
5. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
6. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM". CreateSpace Independent Publishing Platform, First edition.
7. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO." O'Reilly Media, Inc.".

Course Name: Soft Computing

Course Code: BCADSE605

<table>
<tr><td>Course Type: DSE
(Theoretical)</td><td colspan="2">Course Details: DSEC-3 or DSEC-4</td><td colspan="2">L-T-P: 5-1-0</td></tr>
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</table>

Course Content:

Theory

UNIT I. Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.

UNIT II. Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System, Mamdani Fuzzy Models – Sugeno Fuzzy Models.

Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting.

UNIT III. Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron.

Neural Network models: Perceptron, single layer network; Back-propagation and multi layer networks.

Competitive learning networks: Kohonen self organizing networks, Hopfield Networks.

Applications of Neural Networks: Pattern Recognition and classification.

UNIT IV. Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA).

Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition.

UNIT V. Other Soft Computing techniques: Basic concept of Simulated Annealing and Particle Swarm Optimization (PSO).

References/ Suggested Readings:

1. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
2. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
3. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
4. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH,
5. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson.
6. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
7. Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.