(BCA)
BACHELOR OF COMPUTER APPLICATION

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Detailed Syllabus

Programme Code: BCA
Duration: 3 Years

EFFECTIVE FROM SESSION: 2022-2023

Department of Computer Sciences
Faculty of Engineering
CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY PANVEL, NAVI MUMBAI

SEMESTER I

Course Code	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
		L	T	P	IA	ESE	IA	ESE		
CSAB1010	C Programming	3	-	-	30	70	-	-	100	3
CSAB1020	Computer Fundamental & Office Automation	3	1	-	30	70	-	-	100	4
MGTG1000	Principle of Management - I	3	-	-	30	70	-	-	100	3
ENGG1000	Professional English	3	1	-	30	70	-	-	100	4
MTHG1000	Mathematics - I	3	1	-	30	70	-	-	100	4
CSAB1011	C Programming Lab	-	-	4	-	-	15	35	50	2
CSAB1021	Office Automation Lab	-	-	4	-	-	15	35	50	2
	Soft Skills	1	1	-	-	-	-	-	-	2
	TOTAL	**16**	**4**	**8**	**150**	**350**	**30**	**70**	**600**	**24**

The table title "BCA 1 Year - Semester 1" appears as the header above the table.

C Programming

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objectives:

1. The subject aims to provide exposure to problem-solving through programming.
2. It aims to train the student to the basic concepts of the C-programming language.
3. This subject involves a lab component which is designed to give the student hands-on experience with the concepts.

Detailed Syllabus:

UNIT I

Introduction to 'C' Language

History, Structures of 'C' Programming, Function as building blocks, Language Fundamentals: Character set, C Tokens, Keywords, Identifiers, Variables, Constant, Data Types, Comments, Operators, Built-in Operators and function, Console based I/O and related built-in I/O function, Concept of header files, Preprocessor directives.

UNIT II

Control structures

Decision making structures- If, If-else, Nested If -else, Switch. Loop Control structures- While, Do-while, for, nested for loop, Other statements- break, continue, goto, exit.

UNIT III

Arrays and Pointers

Arrays: Definition, declaration and initialization of one dimensional array, accessing array elements, displaying array elements, Two-Dimensional array-declaration and initialization, accessing and displaying, memory representation of array-row major, Column major, Multidimensional array.
Pointers: Definition and declaration, Initialization, indirection operator, address of operator, pointer arithmetic, dynamic memory allocation, arrays and pointers, function and pointers

UNIT IV

Structures and Functions

Structures: Definition and declaration, Variables initialization, accessing fields and structure operations, Nested structures, Union-Definition and declaration, Differentiate between Union and structure.

Functions: Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing- Call by value, Call by reference, Scope of variables, Storage classes, Recursion.

UNIT V

Strings and File Handling

Strings: Definition, declaration and initialization of strings, standard library functions: -strlen (), strcpy( ), strcat( ), strcmp( ), Implementation without using standard library functions.

File handling: Definition of Files, Opening modes of files, Standard function: -fopen( ), fclose( ), feof( ), fseek( ), rewind( ),Using text files:- fgetc( ), fputc( ), fprintf( ), fscanf(**).**

Text /Reference Books:

1. Let us C-Yashwant Kanetkar.
2. Programming in C- Balguruswamy
3. The C Programming Lang., Pearson Ecl – Dennis Ritchie
4. Structured programming approach using C-Forouzah &Ceilberg Thomson learning publication.
5. Pointers in C – Yashwant Kanetkar
6. How to solve it by Computer – R. G. Dromy
7. Introduction to algorithms – Cormen, Leiserson, Rivest, Stein

Course Outcomes:

After completion of this subject students will be able to

1. Students acquire very basic knowledge about c programming.
2. Students get some information about control structures which is to be used further in practical's.
3. Students become familiar with functions used in C programming.
4. Student gets detail information about Arrays & its application in C programming.
5. Students become familiar with pointers.
6. Information of String & other library functions is handled.
7. Details of structure implementation are handled.
8. Students get detailed information about file handling in C programming.

Computer Fundamental & Office Automation

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are
1. To provide the foundational concepts of computer hardware, software, operating systems, peripherals, etc. along with how to get the most value and impact from computer technology.

2. To make knowledge for beginners as well as advanced learners who want to deal with computers.

3. To make students at a moderate level of expertise in the knowledge of computer basics from where a student can take himself to the next level.

Detailed Syllabus:

UNIT I

Introduction

Introduction of computer, Characteristics of Computers, Block diagram of computer, Block diagram of computer, Types of computer and features, Types of programming languages, Data Organization, Drives, Files, Directories, Types of Memory, Secondary storage devices, I/O devices, Number Systems.

UNIT II

Algorithm and Flowcharts

Algorithm - Definition of Algorithm, Characteristics of Algorithm, Advantages and disadvantages, Examples. Flowchart- Definition, Define symbols of flowchart, Advantages and disadvantages, Examples.

UNIT III

Windows Operating Environment

Features of MS –Windows, Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush. Editors and Word Processors: Basic Concepts, MS-Word, Introduction to desktop publishing.

UNIT IV

Spread sheets and Database packages

Purpose, usage, commands, MS-Excel, Creation of files in MS-Access, Switching between application, MS -PowerPoint.

UNIT V

DOS and Linux

DOS: Introduction to Operating System, DOS - History Files and Directories, Internal and External Commands, Batch Files, Types of O.S.

Linux: File system, Linux Commands, Permission, I/O redirection, VI Editor.

Text /Reference Books:

1. Fundamentals of computers - V. Rajaraman - Prentice- Hall of India
2. Microsoft Office 2007 Bible - John Walkenbach,Herb Tyson,Faithe Wempen,cary N.Prague, Michael R.groh, Peter G.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.
3. The complete reference Linux - Richard Retersen - Tata McGraw - Hill Edition
4. A Conceptual Guide to OpenOffice.org 3 - R. Gabriel Gurley- CreateSpace Independent Publishing Platform, 2008
5. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.
6. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications

Course Outcomes:
After completion of this subject students will be able to

1. Students acquire basic knowledge about computers.
2. Students get some information about basic DOS commands & knowledge of flowcharts with algorithm concepts.
3. Students become familiar with the Windows operating environment with additional knowledge of word processors.
4. Students get detailed information about Basic database applications & know about spreadsheets which will be used in daily work life.
5. Students become familiar with the operating system Linux.

Principle of Management– I

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs / Week	Internal Assessment Test	30 Marks
Total Credits	3	End-Semester Examination	70 Marks

Course Objectives:
1. This subject is primarily meant for all those students of Management who aspire to enter the corporate world.
2. To make a handy reference guide for professionals who have started their career and want to become successful managers in future.

Detailed Syllabus:

UNIT I

Overview of Management
Definition, Management, Role of managers, Evolution of Management thought, Organization and the environmental factors, Trends and Challenges of Management in Global Scenario.

UNIT II

Planning
Nature and purpose of planning, Planning process, Types of plans, Objectives, managing by objective (MBO) Strategies, Types of strategies, Policies, Decision Making, Types of decision, Decision Making Process, Rational Decision Making

UNIT III

Organizing
Nature and purpose of organizing, Organization structure, Formal and informal groups in organization, Line and Staff authority, departmentation, Span of control, Centralization and Decentralization, Delegation of authority, Staffing, Selection and Recruitment, Orientation, Career Development, Career stages, Training, Performance Appraisal

UNIT IV

Directing
Creativity and Innovation, Motivation and Satisfaction, Motivation Theories, Leadership Styles, Leadership theories, Communication, Barriers to effective communication, Organization Culture, Elements and types of culture, Managing cultural diversity.

UNIT V

Controlling

Process of controlling, Types of control, Budgetary and non-budgetary control Q techniques , Managing Productivity , Cost Control , Purchase Control , Maintenance Control , Quality Control , Planning operations.

Text and Reference Books:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition. 2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.
2. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
3. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global
4. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
5. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
6. Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
7. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

Course Outcomes:

After completion of this subject students will be able to
1. Acquire knowledge about Management.
2. Gets detail information about planning
3. Become familiar with organizing.
4. Get detailed information directed at the organization.
5. Details of controlling in organization.

Professional English

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course Objectives:

1. To acquaint the students with appropriate language skills with the purpose of improving the existing ones-LSRW.

2. To make the learners understand the importance and effective use of non-verbal communication.

3. To make the learner proficient in public speaking and presentation skills.

4. To guide and teach the students to utilize the principles of professional business and technical writing for effective communication in the global world.

Detailed Syllabus:

UNIT I

Communication and Communication Process

Introduction to Communication, Forms and functions of Communication, Barriers to Communication ((linguistic and semantic, psychological, physical, mechanical, cultural), and overcoming them, Types of communication: verbal and non-verbal communication. Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Fast Reading, Strategies for Reading, Comprehension. Listening: Importance of Listening, Types of Listening, and Barriers to Listening.

UNIT II

Writing Skills, Reading Skills & Listening Skills

Features of Good Language, Technical Style of writing, Writing Emails and it's etiquettes, Technical Reports: Report Writing: Types, Format and Structure of reports.

UNIT III

Letter Writing

Types of letters: Job application letter, complaint letter, enquiry letter, reply to enquiry, sales letter, Essential and non-essential parts of letters, formats of letters.

UNIT IV

Grammar

Types of sentences, Antonyms and Synonyms, Use of Auxiliaries and Modal Auxiliaries, Synonyms and Antonyms, Pairs of confused words, Common Errors in sentences

UNIT V

Soft Skills

Body language, Teamwork and skills, Decision making ability, Negotiation skills and Interview skills.

UNIT VI

Dialogues Writing and Speaking

Greeting someone and responding to greet, Thanking someone and responding to thanks, Making inquiry and responding to enquiry on telephone, Making request and responding to request.

Text Books and References:

1. Communication in Organizations by Dalmar Fisher, Jaico Publishing House
2. Communication Skills by Meenakshi Raman & Sangeeta Sharma,
3. Oxford University Press
4. Business Correspondence & Report-writing by R.C. Sharma& Krishna Mohan, Tata McGraw-Hill Education
5. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill.
6. Technical Writing & Professional Communication for non-native speakers of English by Thomas N. Huckin & Leslie A. Olsen, McGraw –Hill.
7. Mastering Communication by Nicky Stanton, Palgrave Master Series

Course Outcomes:

After completion of this subject students will be able to

1. Understand and evaluate information they listen to and express their ideas with greater clarity.
2. Speak and respond effectively along the various channels of communication in a business organization.
3. Speak convincingly before an audience with the help of an expanded vocabulary and enhanced digital content.
4. Communicate through result oriented writing both within and outside the organization.
5. Write a set of effective and easy to understand technical description, instructions.

Mathematics - I

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:
1. To make the students familiarize with concepts and techniques in Calculus, Complex number and Matrices.
2. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines

Detailed Syllabus:

UNIT 1

Matrices

Review on matrices: Definition of matrix, types of matrix, Algebra of matrices, Adjoint of matrix, inverse of matrix, Unitary & Orthogonal matrices, Echelon form, Rank of a matrix, Normal form, PAQ normal form. System of homogeneous & Non homogeneous equations, Conditions of their consistency & Inconsistency & solutions. Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Guass Jordan Method (3) Jacobi iteration (4) Gauss Seidal Method

UNIT II

Complex Numbers

Definition of Complex number ,Algebra of complex number ,Representation of complex number on complex plane ,D'Moivre's Theorem., Powers and roots of Exponential & Trigonometric functions., Expansion of $sin^n\theta, cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ . Circular functions of complex numbers and Hyperbolic functions, Inverse Circular and Inverse Hyperbolic functions, Logarithmic functions. Separation of real and Imaginary parts of all types of Functions

UNIT III

Numerical Integration

Numerical Integration-Different types of operators such as shift, forward, backward difference and their relation. Interpolation, Newton Interpolation, Integration by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule.

UNIT IV
Partial Differential Equation
Partial derivatives of first and higher order, total differentials, differentiation of composite and implicit functions, Euler's Theorem on Homogeneous functions with two and three independent variables (with proof). Deductions from Euler's Theorem

UNIT V
Application of Partial Differentiation, Indeterminate forms and curve fitting
Maxima and Minima of a function of two independent variables, Indeterminate forms, L-Hospital rule, Fitting of curves by least square method for line, parabola and exponential.

Recommended Books:

1. A text book of Applied Mathematics, P.N.Wartikar and J.N.Wartikar,Vol – I and –II by Pune Vidyarthi Graha.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited,9thEd.
4. Matrices by Shanti Narayan.
5. Numerical by S.S.Sastry, Prentice Hall

Course Outcomes:
After completion of this subject students will be able to
1. Apply the concepts of complex numbers to engineering problems.
2. Apply the knowledge of nth order derivatives of standard function.
3. Apply the principles of basic operations of matrices.
4. Apply the basic principles of partial differentiation.
5. Apply concepts of partial differentiation (maxima and minima), expansion of functions as an application of successive differentiation.

C Programming Lab

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Suggested list of experiments:

1. Write a C program to display "This is my first C Program.
2. Write a C program to add two numbers and display its sum.
3. Write a C program to multiply two numbers (4 and 5) and display its product.
4. Write a C program to calculate area and circumference of a circle.
5. Write a C program to perform addition, subtraction, division and multiplication of two numbers. Write a Program to Check Whether a Number is Prime or not.
6. Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.
7. Write a program to check whether the entered year is a leap year or not (a year is leap if it is divisible by 4 and divisible by 100 or 400.)
8. Write a program to find the factorial of a number.
9. Write a program to check if the number is Armstrong or not. (Hint: A number is Armstrong if the sum of cubes of individual digits of a number is equal to the number itself).
10. Write a program to print day names using switch cases.
11. Write a program to determine whether the input character is capital or small letter, digits or special symbol.
12. Write a program to reverse a given integer.
13. Write a program to print numbers in reverse order with a difference of 2.
14. Write a program to print the sum of digits of a number using a for loop.
15. Write a program to check whether a number is Palindrome or not.
16. Write a program to generate Fibonacci series.
17. Write a Program to Search an element in an array.
18. Write a Program to find the largest and smallest element in Array.
19. Write a program to add, subtract, multiply and divide two integers using user defined type function with return type.
20. Write a program to calculate the sum of the first 20 natural numbers using a recursive function.
21. Write a program to swap values of two variables using a pointer.
22. Write a program to add two numbers using pointers.
23. C Program to list all files and sub-directories in a directory.
24. C Program to count the number of lines in a file.
25. C Program to print contents of file.
26. C Program to copy contents of one file to another file.

Office Automation Lab

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Suggested list of experiments:

MS-WORD

1. Text Manipulation: Write a paragraph about your institution and Change the font size and type, Spell check, Aligning and justification of Text
2. Bio data: Prepare a Bio-data.
3. Find and Replace: Write a paragraph about yourself and do the following. Find and Replace - Use Numbering Bullets, Footer and Headers.
4. Tables and manipulation: Creation, Insertion, Deletion (Columns and Rows). Create a mark sheet.
5. Mail Merge: Prepare an invitation to invite your friends to your birthday party. Prepare at least five letters.

MS-EXCEL

1. Data Sorting-Ascending and Descending (both numbers and alphabets)
2. Mark list preparation for a student
3. Individual Pay Bill preparation.
4. Invoice Report preparation.
5. Drawing Graphs. Take your own table.

MS-POWERPOINT

1. Create a slideshow presentation for a seminar.
2. Preparation of Organization Charts
3. Create a slideshow presentation to display percentage of marks in each semester for all students
A. Use a bar chart (X-axis: Semester, Y-axis: % marks).
B. Use different presentation templates and different transition effects for each slide.

MS-ACCESS

1. Create a new database, save it on the desktop and name it "School Database"
2. Create a Table in the School Database with the following:

Field Name	Data Type	Field Size
ID	Number	10
Name	Text	15
Surname	Text	15
Telephone	Number	Number Long Integer
Date of Birth	Date/Time	Medium Date
Stipend	Currency	Currency
Foreigner	Yes/No	Yes/No

   Make the "ID Number" Field as the Primary Key& Save the table as "Student's Table".
3. Open the "Students Table" and enter 5 complete records, Sort the table in ascending order by surname. Delete the last Record you have entered.

4. Create a Report: Use the Report Wizard to create a report having the following requirements:

   a. Select the LastName field from the Author table.
      - Select the Title and Price fields from the Book table.
      - Select the PubName field from the Publisher table.
      - View the data by Publisher.
      - Add a grouping level using Last Name.
      - Sort the report by the Title field in ascending order.
      - Choose Stepped layout and Portrait orientation.
      - Type Book List as the report's title.

   b. Switch to Layout view and adjust each column's width as necessary.

Soft Skills

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	—--
Total Credits	2	End-Semester Examination	—--

Course Objectives:

1. To help the students in building interpersonal skills.
2. To develop the skill to communicate clearly.
3. To enhance team building and time management skills.
4. To learn active listening and responding skills.

Detailed Syllabus:

UNIT I

Self Awareness & self-Development

Self-Awareness: Self-Assessment, Self-Appraisal, SWOT, Goal setting: Personal & career: Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting. b) Self Development: Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

UNIT II

Communication Skill

Communication: Importance, types, barriers of communication, effective communication. b) Speaking Skills: Public Speaking, Presentation skills, Group discussion: Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques. c) Listening Skills: Law of nature: you have 2 ears and 1 tongue so listening twice and speaking once is the best policy, Empathic listening, and Avoid selective listening. d) Group Discussion: characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency. e) Presentation skills: planning, preparation, organization, delivery.

UNIT III

Corporate / Business Etiquettes

Corporate / Business Etiquettes: Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting: Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. b) Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

UNIT IV

Interpersonal relationship

Team work: Team effectiveness, Group discussion, Decision making: Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity. b) Group Discussion (GD): Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD, Conflict management, Do's and Don'ts in GD.

Text and Reference Books:

1. Ethics in Engineering Practice and Research by Caroline & Whitbeck, Cambridge University Press.
2. NASSCOM-Global Business Foundation Skills: Accenture, Convergys, Dell et.al. Foundation Books: Cambridge University Press.
3. Basic Managerial Skills by E. H. McGrath, Eastern Economy Edition, Prentice hall India.
4. Personality Development and Group Discussions by Barun K. Mitra, Oxford University Press. 5. Group Discussions and Interview Skills by Priyadarshi Patnaik , Foundation Books , Cambridge University Press.
5. Thinks and Grow Rich by Napoleon Hill, Ebury Publishing, ISBN 9781407029252.
6. Awaken the Giant Within by Tony Robbins HarperCollins Publishers, ISBN139780743409384.
7. Change Your Thoughts; Change Your Life by Wayne Dyer, Hay House India, ISBN139788189988050.

Course Outcomes:

On completion of the course, learner will be able to

1. Make use of techniques for self-awareness and self-development.
2. Apply the conceptual understanding of communication into everyday practice.
3. Understand the importance of teamwork and group discussion skills.
4. Develop time management and stress management.
5. Apply business etiquette skills effectively that an engineer requires.

SEMESTER II

Course Code	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
		L	T	P	IA	ESE	IA	ESE		
CSAB2010	Data Structure using C	3	1		30	70			100	4
CSAB2020	Database Management System (DBMS)	3			30	70			100	3
EVSG2000	Environmental Science	3			30	70			100	3
CSAB2030	Software Engineering	3			30	70			100	3
MTHG2010	Element of Statistics	3	1		30	70			100	4
CSAB2011	Data Structure using C Lab			4			15	35	50	2
CSAB2021	Database Management System (DBMS) Lab			4			15	35	50	2
	Aptitude Building	2								2
	TOTAL	**17**	**3**	**8**	**150**	**350**	**30**	**70**	**600**	**23**

Table title: **BCA 1 Year - Semester 2**

Ability Enhancement Compulsory Courses (AECC)

Semester	Offering Department	Course Code	Course Name	(L-T-P)	Credits
II	Basic Sciences	EVSG2000	Environmental Studies	3-0-0	3

DATA STRUCTURE USING C

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course Objectives:
The objectives of this course are
1. To make the students familiarize with algorithms and its analysis procedure.
2. To make the learners introduce the concept of data structures through ADT including List, Stack, Queues to the learners..
3. To make the students design and implement various data structure algorithms.
4. To make the students familiarize with various techniques for representation of the data in the real world.
5. To illustrate students how to develop applications using data structure algorithms.
6. To help students compute the complexity of various algorithms.

Detailed Syllabus:

UNIT-I: Introduction
Introduction to Data Structures, Concept of Abstract Data Types(ADT), An Introduction to C++ Class-Declaring Class Objects and Invoking Member Functions, The Array as an Abstract Data Type, Sparse Matrices Introduction- Sparse Matrix Representation- Transposing a Matrix- Matrix Multiplication.
SORTING AND SEARCHING TECHNIQUES
Insertion Sort, Quick Sort, Merge Sort, Heap Sort.
Hashing-Concept, Hash Functions, Collision resolution Techniques
UNIT-II: STACKS AND QUEUES
Introduction, ADT of Stack, application of stack. Introduction of Double Ended Queue, Applications of Queue. Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.
UNIT-III: LINKED LISTS
Introduction of Linked List v/s Array, Types of Linked List, Circular Linked List, Doubly Linked List, Operations on Doubly Linked List, Stack and Queue using Singly Linked List, Singly Linked List Application-Polynomial Representation and Addition.
UNIT-IV: TREES
Introduction, Tree Operations on Binary Search Tree, Applications of Binary Tree, Huffman Encoding, Search Trees-AVL, rotations in AVL Tree, operations on AVL Tree, Introduction of B Tree, B+ Tree.
UNIT-V: GRAPHS
Introduction of Graph Terminologies, Graph Traversals-Depth First Search (DFS) and Breadth First Search (BFS), Graph Application-Topological Sorting.

Text /Reference Books:
1. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
3. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.

4. Thareja, "Data Structure Using C" Oxford Higher Education.
5. AK Sharma, "Data Structure Using C", Pearson Education India.
6. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.

Course Outcomes:

At the end of this course students will able to:

1. Select appropriate data structures as applied to specified problem definitions.
2. Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.
3. Implement Linear and Non-Linear data structures.
4. Implement appropriate sorting/searching techniques for given problems.
5. Design advanced data structure using Non Linear data structure.
6. Determine and analyse the complexity of given Algorithms.

Database Management System

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To make the students learn and practice data modelling using the entity-relationship and developing database designs.
2. To make students understand the use of Structured Query Language (SQL) and learn SQL syntax.
3. To illustrate students how to apply normalization techniques to normalize the database
4. To make students understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Detailed Syllabus:

UNIT 1

Introduction to Database Concepts:

Introduction, Characteristics of databases, File system v/s Database system, Users of Database system

Data Independence, DBMS system architecture, Database Administrator

UNIT 2

Entity–Relationship Data Model

The Entity-Relationship (ER) Model: Entity types : Weak and strong entity sets, Entity sets, Types of

Attributes, Keys, Relationship constraints : Cardinality and Participation, Extended Entity-Relationship

 (EER) Model : Generalization, Specialization and Aggregation

UNIT 3

Relational Model and Relational Algebra

Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER

Model to the Relational Model

Relational Algebra – unary and set operations, Relational Algebra Queries.

UNIT 4

Structured Query Language (SQL)

Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Transaction Control Commands.

Set and string operations, aggregate function - group by, having,.

Views in SQL, joins , Nested and complex queries, Integrity constraints :- key constraints, Domain Constraints, Referential integrity , check constraints

Triggers

UNIT 5

Relational–Database Design and Transaction Management

Pitfalls in Relational-Database designs , Concept of normalization, Function Dependencies , First Normal Form, 2nd , 3rd , BCNF, multi valued dependencies , 4NF.

Transaction concept, Transaction states, ACID properties, Concurrent Executions, Serializability – Conflict and View.

Text /Reference Books:
1. G. K. Gupta ―Database Management Systems‖, McGraw – Hill.
2. Korth, Slberchatz, Sudarshan, ―Database System Concepts‖, 6th Edition, McGraw – Hill
3. Elmasri and Navathe, ―Fundamentals of Database Systems‖, 5th Edition, Pearson education.
4. Peter Rob and Carlos Coronel, ―Database Systems Design, Implementation and Management‖, Thomson Learning, 5th Edition.

Course Outcomes:
At the end of this course students will able to:
1. Understand the fundamentals of a database systems
2. Design and draw ER and EER diagrams for real life problems.
3. Convert conceptual model to relational model and formulate relational algebra queries.
4. Design and querying databases using SQL.
5. Analyze and apply concepts of normalization to relational database design.
6. Understand the concept of transaction, concurrency and recovery.

Environmental Science

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:
1. Recognize the interconnectedness of multiple factors in environmental challenges
2. Engage constructively with diverse forms of knowledge and experience
3. Identify the multiple scales, actors, and stakes of an issue
4. Recognize and apply methodological approaches of the social sciences, natural sciences, and humanities
5. Identify assumptions inherent in arguments and perspectives
6. Evaluate and interpret various forms of evidence, including text, data, and other media about the environment
7. Work productively with those within and beyond the academy on interdisciplinary collaborative projects
8. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate form.

Detailed Syllabus:

UNIT I

Multidisciplinary nature of environmental studies

Multidisciplinary nature of environmental studies Definition, scope and importance Need for public awareness.

UNIT II

Natural Resources

Renewable and non-renewable resources: Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT III

Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flows in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: - a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT IV

Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values • Biodiversity at global, National and local levels. • India as a mega-diversity nation V • Hot-sports of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. • Endangered and endemic species of India • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNITV

Environmental Pollution Definition

Cause, effects and control measures of: - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. • Pollution case studies. • Disaster management: floods, earthquake, cyclone and landslides.

UNIT VI

Social Issues and the Environment

From Unsustainable to Sustainable development • Urban problems related to energy • Water conservation, rain water harvesting, watershed management • Resettlement and rehabilitation of people; its problems and concerns. Case Studies • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Public awareness.

UNITVII

Human Population and the Environment

Population growth, variation among nations. • Population explosion – Family Welfare Programme. • Environment and human health. • Human Rights. • Value Education. • HIV/AIDS. • Women and Child Welfare. • Role of Information Technology in Environment and human health. • Case Studies.

Field work

 Visit to a local area to document environmental assets river /forest/grassland/hill/mountain • Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural • Study of common plants, insects, birds. • Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE BOOKS:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)

Course Outcomes:
After completion of this subject -
1. Students will understand key concepts in the life and physical sciences, and will apply them to environmental issues.
2. Students will understand and apply the scientific process, as well as appreciate both the potential and limitations of the process.
3. Students will be able to locate, evaluate and synthesize information from the scientific literature.
4. Students will analyze data using appropriate statistical methods, and will be able to evaluate the use of statistics by others in a variety of contexts.
5. Students will apply knowledge of the sciences within an interdisciplinary context in solving environmental issues such as environmental health, food and agriculture, energy, waste and pollution, climate change, population, resource management, and loss of biodiversity.

Software Engineering

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	**Internal Assessment Test**	**30 Marks**
Total Credits	3	**End-Semester Examination**	**70 Marks**

Course Objective:

The objectives of this course are
1. To make the students familiarize with system analysis and design is the backbone of Application software development.
2. To illustrate students the steps in analysis and design of the system.
3. It includes the knowledge of preparing projects systematically.
4. It is important to know about various aspects of the system analysis and design so that the students will be able to understand the responsibilities while designing and implementing the project.

Detailed Syllabus:

UNIT I

Introduction to Software Engineering, System Concepts: Types of systems : (open, closed, static and dynamic systems). Introduction, Programmes v/s Software Products Emergence of Software Engineering- Early Computer Programming, High-level Language Programming, Control flow based Design, Data Structure Oriented Design, Object Oriented Design

UNIT II

Software Life Cycle Models, Requirement of Life Cycle Model, Classic Waterfall Model, Prototyping Model, Evolutionary Model, Spiral Model, introduction to agile methodology. Comparison of different Life Cycle Models

UNIT III

Software Planning, Responsibilities of Software Project Manager - Metrics for Project Size Estimation- LOC(Lines of Code), Function Point Metric - Project estimation Techniques- Using COCOMO Model.

UNIT IV

Requirement Analysis and Specification, Requirement gathering and Analysis, Software Requirement Specifications(SRS), Characteristics of good SRS

UNIT V

Software Design and Implementation, Characteristics and features of good Software Design Cohesion and Coupling, Software design Approaches- Function Oriented Design (Data flow diagrams, Data dictionary,

Decision Trees and tables), Object Oriented Design, Structured Coding Techniques, Coding Styles, and documentation.

UNIT VI

Software Testing, Concept of Testing, Testing type cycle (V-Model), Verification v/s Validations, Unit Testing, Black Box Testing, White Box Testing, Integration testing, System testing, Configuration management, Overview of test cases.

Text Books:
1. Software Engineering by Rajib Mall, PHI Publishers, New Delhi
2. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House Pvt Ltd, Darya Ganj, New Delhi 110002
3. Software Engineering, Sangeeta Sabharwal, New Age International, Delhi
4. Software Engineering by KK Aggarwal and Yogesh Singh
5. Software Engineering – A Practitioner's Approach by RS Pressman, Tata McGraw Hill Publishers, New Delhi

Course Outcomes:

At the end of this course students will able to:

1. Understand the problem and corresponding requirement for development of software.
2. Describe the various phases of the system development life cycle.
3. Identify the expected benefits and scope of the projects.
4. Prepare and develop data flow diagrams and decision tables.
5. Perform a feasibility study of the system.
6. Select methods for evaluating the effectiveness and efficiency of a system.
7. Apply different testing techniques on simple programs.

Element of Statistics

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course Objectives:

1. To demonstrate knowledge of probability and the standard statistical distributions.
2. To demonstrate knowledge of fixed-sample and large-sample statistical properties of point and interval estimators.
3. To demonstrate knowledge of the properties of parametric, semi-parametric and nonparametric testing procedures.
4. To demonstrate the ability to perform complex data management and analysis.

Detailed Syllabus:

UNIT I

Introduction to Statistics:
Introduction, Definitions of Statistics, Importance of Statistics, Scope of Statistics

UNIT II

Statistical Data:
Introduction: Nature of Subject, Language of Statistics: Population, Variables, Size of Population, Discrete and Continuous Variables, Classification of data: Classification by attributes, Classification of variables, Graphical representation of data: Histogram, Frequency polygon, Ogive curves, Diagrammatic representation of data: Simple bar diagram, Subdivided bar diagram, Pie diagram.

UNIT III

Measures of Central Tendency:
Introduction, Arithmetic mean: Properties of arithmetic mean, Merits and Demerits of mean, Median: Merits and Demerits of median, Mode: Merits and Demerits of mode.

UNIT IV

Measures of Dispersion:
Introduction, Range, Mean Deviation, Variance, Standard Deviation, Absolute and Relative Measure of Dispersion, Coefficient of Variation

UNIT V

Correlation and Linear Regression:

Correlation: Introduction, Positive & Negative Correlation Covariance, Coefficient of Correlation: Properties of Correlation Coefficient, Interpretation of the value of Correlation Coefficient, Computing Correlation Coefficient for Ungrouped Data.

Linear Regression: Introduction, Line of Regression, Equation of Line of Regression by the Method of Least Squares, Interpretation of Coefficient of Regression, Properties of Coefficient of Regression.

Recommended Books:
1. "Probability and Statistics" by M H DeGroot.
2. "Introduction to the Practice of Statistics" by David S Moore and George P McCabe
3. Mathematical Statistics by Ray, Sharma and Choudhary
4. Business Statistics By V. K. Kapoor, pub: S. Chand
5. *Schaum's outline* of theory and *problems* of *statistics* Murray R. Spiegel, Larry J. Stephens

Course Outcomes:

After completion of this subject students will be able to -
1. Describe and discuss the key terminology, concepts tools and techniques used in statistical analysis
2. Critically evaluate the underlying assumptions of analysis tools
3. Understand and critically discuss the issues surrounding sampling and significance
4. Discuss critically the uses and limitations of statistical analysis
5. Solve a range of problems using the techniques covered.
6. Conduct basic statistical analysis of data.

Data Structure using C Lab

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Suggested list of experiments:

1. Implementation of Insertion Sorting Algorithm.

2. Implementation of Merge Sorting Algorithm.

3. Implementation of Selection sorting algorithm.

4. Implementation of Sequential Searching Algorithm.

5. Implementation of Binary search.

6. Implementation of Stack using Array.

7. Implementation of Queue using Array.

8. Implementation of Circular Queue using Array.

9. Implementation of Linked List: create, insert, delete, update.

10. Implementation of Queue using Linked List.

11. Implementation of Circular Queue using Linked List.

12. Implementation of graph representation using linked list and matrix.

Database Management System Lab

Teaching Scheme		Evaluation Scheme	
Lectures	**4 Hrs/Week**	**Internal Assessment Test**	**15 Marks**
Total Credits	**2**	**End-Semester Examination**	**35 Marks**

Suggested list of experiments:

1. Creating a Table with constraints.
2. Writing SQL statements Using ORACLE
     1. Writing basic SQL SELECT statements.
     2. Restricting and sorting data.
     3. Displaying data from multiple tables.
     4. Aggregating data using group functions.
     5. Creating and managing tables.
3. Normalization in ORACLE.
4. Creating a cursor in oracle.
5. Creating procedure and functions in oracle.
6. Creating packages and triggers in oracle.
7. Design a Database and create required tables. For e.g. Bank, College Database
8. Apply the constraints like Primary Key , Foreign key, NOT NULL to the tables.
9. Write a sql statement for implementing ALTER,UPDATE and DELETE
10. Write the queries to implement the joins
11. Write the query for implementing the following functions: MAX(),MIN(),AVG(),COUNT()
12. Write the query to implement the concept of Integrity constrains
13. Write the query to create the views
14. Perform the queries for triggers
15. Perform the following operation for demonstrating the insertion , updation and deletion using the referential integrity constraints
16. Write the query for creating the users and their role.

Aptitude Building

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Course Objectives:
The objectives of this course are

Everyone has a desire to improve their aptitude and reasoning skills because nowadays wherever you want to succeed, Aptitude and Reasoning are weapons to seal it, because aptitude is a basic topic which is used to determine any person's problem solving skills and numerical ability. Anything in life can be achieved by continuous practice because practice makes man intelligent. Key for developing any sort of skill is passionate handwork following a well-planned strategy.

Detailed Syllabus

UNIT I
Basics of Quantitative Abilities Problems
Basics of Quantitative Abilities Problems on Number System Problems on HCF and LCM Problems on Average Problems on Ratio and Proportion Problems on Percentage

UNIT II
Arithmetic Quantitative Abilities Problems
Arithmetic Quantitative Abilities Problems on Ages Problems on Profit and Loss Problems on Simple and Compound Interest Problems on Time and Distance

UNIT III
Logical Reasoning Number Series
Logical Reasoning Number Series Alphanumeric, Letter & Symbol Series Numerical and Alphabet Puzzles Seating Arrangement

UNIT IV
Verbal Reasoning Para
Verbal Reasoning Para – Jumble, Text Completion

Reference Books:
1. Quantitative abilities by Arun Sharma
2. Quantitative Aptitude for Competitive Examinations by R S Agrawal
3. Verbal and Non-Verbal reasoning by R S Agrawal

Course Outcomes:

On successful completion of the course the students will be able to:

1. Understand the basic concepts of quantitative ability.
2. Understand the basic concepts of logical reasoning Skills.
3. Acquire satisfactory competency in use of verbal reasoning.
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

SEMESTER III

Course Code	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
		L	**T**	**P**	**IA**	**ESE**	**IA**	**ESE**		
		BCA 2 Year - Semester III								
CSAB3010	Computer Organization & Architecture	3	1	-	30	70	-	-	100	4
CSAB3020	Object Oriented Programming with C++	3	1	-	30	70	-	-	100	4
CSAB3030	Operating System	3	1	-	30	70	-	-	100	4
CSAB3040	Software Testing and Quality Assurance	3	1	-	30	70	-	-	100	4
MGTG3100	Financial Accounting & management	3		-	30	70	-	-	100	3
CSAB3021	Object Oriented Programming with C++ Lab	-	-	4	-	-	15	35	50	2
CSAB3031	Operating System Lab	-	-	4	-	-	15	35	50	2
	Quantitative Aptitude and Logical Reasoning – I (Internal Evaluation Only)	1	-	-	-	-	-	-	-	1
	TOTAL	**16**	**4**	**8**	**150**	**350**	**30**	**70**	**600**	**24**

Computer Organization & Architecture

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To make students conceptualize the basics of organizational and architectural issues of a digital computer.
2. To analyze performance issues in processor and memory design of a digital computer.
3. To understand various data transfer techniques in digital computers to learners.
4. To make the students analyze processor performance improvement using instruction level parallelism.

Detailed syllabus:

UNIT I

Digital Logic Circuits: Basic Logic Functions, Synthesis of Logic Functions Using AND, OR, and NOT Gates, Minimization of Logic Expression, Synthesis with NAND and NOR Gates, Flip-Flops, Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices (PLDs), Basic Structure of Computers: Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers

UNIT II

Data Representation: Data types, Complements, Other binary codes, Error Detection codes, Register and Micro operations: Register Transfer language, Register Transfer Bus and memory transfers, Arithmetic Micro operations, logic micro operations, Shift micro operations, Arithmetic logic shift unit

UNIT III

Processing Unit: Instruction Codes, Computer Registers, Computer Instructions, Instruction Cycle, Memory Reference Instructions, Hardwired Control, Micro Programmed Control, Register organization, Stack organization, Instruction formats Addressing modes, Data Transfer and manipulations, RISC, CISC, Computer Arithmetic: Addition, subtraction, multiplication and division operations, Floating point Arithmetic operations

UNIT IV

Input-Output Organization: Peripheral Devices, Input Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor, Serial communication, Parallel and Vector Processing: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline, RISC Pipeline, Vector Processing, Array Processors

UNIT V

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associative memory Virtual memory, Cache memory, Memory management hardware

Reference Book:
1. John L. Hennessy and David A. Patterson, "Computer Architecture a quantitative approach", 4th Edition Elsevier, ISBN:10:0123704901
2. William Stallings, "Computer Organization and Architecture", 6th Edition, Pearson/PHI, ISBN:10:0-13-609704-9
3. Donald e Givone, "Digital Principles and Design", TMH.
4. A.Anandkumar, "Fundamentals of digital circuits", 4th edition, PHI.

Course Outcomes:

At the end of this course students will able to

1. Make the students familiarize with the basic structure of computers.

2. Help students perform computer arithmetic operations.

3. Understand control unit operations.

4. Make the students design a memory organization that uses banks for different word size operations.

5. Understand the concept of cache mapping techniques.

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

OBJECT ORIENTED PROGRAMMING WITH C++

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	**Internal Assessment Test**	**30 Marks**
Total Credits	4	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are
1. To make students understand Object Oriented Programming concepts using the C++ language.
2. To introduce the principles of data abstraction, inheritance to the learner.
3. To introduce the principles of virtual functions and polymorphism.
4. To illustrate students how to handle formatted I/O and unformatted I/O.
5. To make the students familiarize with the concept of exception handling.

Detailed syllabus:

UNIT I

Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts- Abstraction, Encapsulation, Inheritance and Polymorphism.

UNIT II

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions. Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives.

UNIT III

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

UNIT IV

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

UNIT V

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

References:
1. Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications
2. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH
3. Y. Kanetkar, 'Let's C++', BPB publications
4. E Balagurusamy, 'Object oriented programming with C++', 4th edition, TMH
5. Sourav Sahay , 'Object-Oriented Programming with C++' , Oxford University Press, 2006.

Course Outcomes:

At the end of this course students will able to

1. Develop programs with reusability.
2. Develop programs for file handling.
3. Handle exceptions in programming.
4. Develop applications for a range of problems using object-oriented programming techniques.

Operating System

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course Objectives:

The objectives of this course are
1. To make students learn the evolution of OS.
2. To make the learners introduce basic concepts of Operating System, its functions and services.
3. To familiarize the students with various views and management policies adopted by O.S.
   as pertaining with processes, Deadlock, memory, File and I/O operations.
4. To make students understand functionality of various OS like Unix, Linux and Windows XP as
   Pertaining to resource management.
5. To provide the knowledge of basic concepts towards process synchronization and related
   Issues to the students.

Detailed syllabus:

UNIT I

Introduction :
Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multiprocessing Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Monolithic and Microkernel Systems.

UNIT II

Concurrent Processes:
Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Inter Process Communication models.

UNIT III

CPU Scheduling:
Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling.
Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock

UNIT IV

Memory Management:
Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.

UNIT V

I/O Management and Disk Scheduling:
I/O devices and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, file system implementation issues, File system protection and security

References:
1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education
3. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
4. D M Dhamdhere, "Operating Systems : A Concept based Approach", 2nd Edition, TMH
5. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education
6. A.S Tanenbaum "Modern Operating Systems" Pearson Education

Course Outcomes:

At the end of this course students will able to

1. Appreciate the role of operating systems as System software.
2. Compare the various algorithms and comment about performance of various algorithms used for management of memory and apply various concepts related with Deadlock to solve problems related with resources allocation, after checking whether the system is in Safe state or not.
3. Compare various algorithms of CPU scheduling and appreciate role of Process synchronization towards increasing throughput of the system.
4. Understand the concepts of File handling and I/O operations
5. Control the behaviour of the OS by writing Shell scripts.
6. Describe the various Data Structures and algorithms used by Different OS like Windows XP , Linux and Unix pertaining with Process , File , I/O management.

Software Testing and Quality Assurance

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objective:

The objectives of this course are
1. To provide learners knowledge in Software Testing techniques.
2. To make students understand how testing methods can be used as effective tools in providing quality assurance concerning software.
3. To provide skills to design test case plans for testing software to the students.

Detailed syllabus:

UNIT I

Software Testing and Introduction to quality :
Introduction, Nature of errors, an example for Testing, Definition of Quality , QA, QC, QM and SQA , Software Development Life Cycle, Software Quality Factors
Verification and Validation : Definition of V&V , Different types of V & V Mechanisms, Concepts of Software Reviews, Inspection and Walkthrough.

UNIT II

Software Testing Techniques :
Testing Fundamentals, Test Case Design, White Box Testing and its types, Black Box Testing and its types.

UNIT III

Software Testing Strategies:
Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing

UNIT IV

Software Metrics :
Concept and Developing Metrics, Different types of Metrics, Complexity metrics
Defect Management: Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.

UNIT V

Software Quality Assurance :
Quality Concepts, Quality Movement, Background Issues, SQA activities, Software Reviews, Formal Technical Reviews, Formal approaches to SQA, Statistical Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, SQA Plan , Six sigma, Informal Reviews 15L

Textbooks:
1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4 th Edition,, Pearson Education, 2005
2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 5 th Edition, Tata McGraw Hill, 2001
3. Quality Management, Donna C. S. Summers, 5 th Edition, Prentice-Hall, 2010. 4. Total Quality Management, Dale H. Besterfield, 3 rd Edition, Prentice Hall, 2003

Additional References:
1. Software engineering: An Engineering approach, J.F. Peters, W. Pedrycz , John Wiley,2004
2. Software Testing and Quality Assurance Theory and Practice, Kshirsagar Naik, Priyadarshi Tripathy , John Wiley & Sons, Inc. , Publication, 2008 3. Software Engineering and Testing, B. B. Agarwal, S. P. Tayal, M. Gupta, Jones and Bartlett Publishers, 2010

Course Outcomes :

At the end of this course students will able to

1. Understand various software testing methods and strategies.
2. Understand a variety of software metrics, and identify defects and managing those defects for improvement in quality for given software.
3. Design SQA activities, SQA strategy, formal technical review report for software quality control and assurance.

Financial Accounting & Management

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

To equip the students with the skill of preparing accounts and financial statements of various types of business units other than corporate undertakings.

UNIT I

Financial Accounting

An Introduction: Introduction, Meaning of Accountancy, book-keeping and Accounting, Accounting Process, Objectives for accounting, Differences between book-keeping and accounting Users of accounting information, Limitations of Accounting, Basic terminologies.

UNIT II

Accounting Concepts

Principles, Bases and Policies: Introduction , Accounting Concepts, Principles, Policies and Standards, Types of accounting concepts - Business Separate entity concept - Going concern concept - Money measurement concept - Periodicity concept - Accrual concept, Accounting Principles - Principle of Income recognition - Principle of expense - Principle of matching cost and revenue - Principle of Historical costs - Principle of full disclosure - Double aspect principle - Modifying Principle - Principle of materiality - Principle of consistency - Principle of conservatism or prudence, Accounting Policies - Changes in Accounting Policies - Disclosure in case of changes in Accounting Policies, Accounting Standards - Scope and functions of Accounting Standards Board - International Financial Reporting System.

UNIT III

Double Entry Accounting

Introduction, meaning of double entry accounting, Classification of accounts under Traditional approach, Classification of accounts under Accounting Equation approach, Comparison of traditional approach with Modern approach equal approach, Accounting Trail, Transactions and events, Meaning and roles of debit and credit, Accounting equation.

UNIT IV

Secondary Books

Introduction, Secondary books, Purchases Book/Purchases Day book - Cash discount, Trade discount - Difference between cash discount and trade discount, Sales Book or Sales Day book - Purchase Returns Book - Sales Returns Book, bills receivable book - Bills payable book - Cash book, posting to Ledger Accounts Posting to Ledger.

UNIT V

Trial Balance

Introduction, Meaning, Objectives of preparing a trial balance, Methods of preparing a trial balance, Preparation of Trial balance, Adjusting Entries, Errors and their rectification, Errors disclosed by Trial Balance, Errors not disclosed by Trial Balance, steps to locate the errors.

UNIT VI

Final Accounts

Introduction, Adjustments before preparing final accounts, Depreciation, Bad Debts and accounting treatment of bad debts, Provision for doubtful debts, Reserves for Discount on Debtors, Reserve for Discount on Creditors, Closing Stock, Trading Account, Profit and Loss Account, Balance Sheet.

Text and Reference Books:

1. Principles of Accounting : J.R. Batlibuoy
2. Advance Accounting and Auditing : Shukla and Grewal
3. "Financial Accounting" by T S Reddy and A Murthy
4. "Financial Accounting" by Goyal V K

Course Outcomes :

At the end of this course students will able to

1. Define bookkeeping and accounting.
2. Explain the general purposes and functions of accounting.
3. Explain the differences between management and financial accounting.
4. Describe the main elements of financial accounting information – assets, liabilities, revenue and expenses.
5. Identify the main financial statements and their purposes.

Object Oriented Programming with C++ Lab

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Suggested list of experiments:

1. WAP to swap two numbers.
2. WAP to display the grade of students using switch cases.
3. WAP to check whether the given string is palindrome or not.
4. WAP to find LCM and HCF of two numbers using a while loop.
5. WAP to print following alphabet pattern

   A
   A B
   A B C
   A B C D

6. WAP to calculate the sum of 10 elements of an array.
7. WAP to implement linear search.
8. WAP to implement bubble sort.
9. WAP to perform addition of two matrices.
10. WAP to implement an array of structures. Declare structure as Student with variables as rollno, name, and branch. Create an array of structure of size 10 and display information of all students.
11. WAP to declare a class Student having data members roll_no and name. Accept and display this data for 3 objects.
12. WAP to declare a class Time having data members as hrs, min and sec. Write a constructor and destructor for class Time and display for 3 objects. (Default constructor, parameterized constructor,   copy constructor).

13. Create two classes as AB and XY. Declare one variable of each class. Swap the contents of variables of two classes using the friend function.
14. WAP to implement single inheritance.
    Parent class- Employee, data members- emp_id, name. Member Functions- void get1(), void put1().
    Child class-Fitness, data members- height, weight. Member Functions- void get2(), void put2().

15. WAP to implement multilevel inheritance.
16. WAP to implement Multiple inheritance.
17. WAP to implement hierarchical inheritance.
18. WAP to implement hybrid inheritance using virtual base class.

Operating System Lab

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Suggested list of experiments:

1. Installation Process of various Operating System.
2. Commands for files & directories: cd, ls, cp, md, rm, mkdir, rmdir.
3. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions).
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions).
6. Study of Inter Process communication (using shared memory, pipes or message queues).
7. Implement some memory management schemes – I
8. Implement some memory management schemes – II
9. Implement any file allocation technique (Linked, Indexed or Contiguous).
10. To write simple shell programs by using conditional, branching and looping statements

Quantitative Aptitude and Logical Reasoning – I
(Internal Evaluation Only)

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Course Objective:

The objectives of this course are

Logical Reasoning is a part of almost all major Government exams conducted in the country and is one of the most scoring sections as well. Candidates who are preparing for the upcoming competitive exams can find all topics, tips and some sample questions related to Logical reasoning.

Detailed Syllabus
The topics included in the logical reasoning section comprise of the following type of questions:

UNIT I

Verbal Questions – These type of questions can be solved verbally and no pen-paper solution is required.

UNIT II

Image-Based Questions – Mirror images or paper construction based images may be given in the question and candidates may be asked to find similar or dissimilar figures.

UNIT III

Puzzle Questions – This includes seating arrangement or arranging people/days/months/places, etc. in different formats.

UNIT IV

Sequence Questions – In such questions a series or sequence of people/numbers/alphabets, etc. may be given and questions based on the same may be asked.

Course Outcomes: At the end of this course students will able to
1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning skills
3. Acquire satisfactory competency in use of verbal reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

SEMESTER IV

BCA 2 Year - Semester IV

	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
		L	T	P	IA	ESE	IA	ESE		
CSAB4010	Python Programming	3	1	-	30	70	-	-	100	4
CSAB4020	JAVA Programming	3	-	-	30	70	-	-	100	3
CSAB4030	Design Analysis & Algorithm	3	1	-	30	70	-	-	100	4
CSAB4040	Computer Networks	3	1	-	30	70	-	-	100	4
**	Elective 1	3	-	-	30	70	-	-	100	3
CSAB4011	Python Programming Lab	-	-	4	-	-	15	35	50	2
CSAB4021	JAVA Programming Lab	-	-	4	-	-	15	35	50	2
	Verbal Ability and Reasoning (Internal Evaluation Only)	2	-	-	-	-	-	-	-	2
	TOTAL	**17**	**3**	**8**	**150**	**350**	**30**	**70**	**600**	**24**

Elective –I

Elective-1 CSAB4620/ CSAB4930
1. **Data Warehousing and Data Mining**
2. **E-Commerce**

Python Programming

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course objectives:

1. To make the students understand the concepts of programming before actually starting to write programs.
2. To train the students to develop logic for Problem Solving.
3. To make the students familiar with the basic constructs of programming such as data, operations, conditions, loops, functions etc.
4. To develop among students problem solving skills using syntactically simple language i.e. Python (version: 3.X or higher).

Detailed syllabus:

UNIT I

Introduction to Python: The basic elements of python, basic syntax, Writing and executing simple programs, Basic Data Types such as numbers, strings, Declaring variables, Performing assignments, arithmetic operations, Simple input-output, Features.

UNIT II

Python Program Flow Control: Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges list and dictionaries Use of while loops in python Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops block.

UNIT III

Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters.

UNIT IV

Structured Types, Mutability and Higher-Order Functions: Strings, Tuples, Lists and Dictionaries Lists and Mutability, Functions as Objects.

UNIT V

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

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function, Plotting using PyLab.

References:

1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India.
2. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2/E 2014.
3. James Payne , Beginning Python: Using Python 2.6 and Python 3, Wiley India, 2010 2. A. Lukaszewski, MySQL for Python: Database Access Made Easy, Pact Publisher, 2010
4. R. Nageswara Rao, "Core Python Programming", dreamtech.
5. Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall.
6. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Pyhon", Wiley.
7. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
8. Luke Sneeringer, "Professional Python", Wrox.

Course Outcomes :

At the end of this course students will able to

1. Understand the concepts of programming before actually starting to write programs.
2. Develop logic for Problem Solving.
3. Familiar with the basic constructs of programming such as data, operations, conditions, loops, functions etc.
4. Apply the problem solving skills using syntactically simple language i.e. Python (version: 3.X or higher).

JAVA Programming

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	3	End-Semester Examination	70 Marks

Course Objectives:

The objectives of this course are
1. To make students understand the concept of Object Oriented Programming.
2. To help students to understand the use of programming languages such as JAVA to resolve problems.
3. To guide and teach the students problems understanding, analysing skills in order to formulate Algorithms.
4. To provide knowledge about JAVA fundamentals: data types, variables, keywords and Control structures to the students.
5. To understand methods, arrays, inheritance, Interface, package and multithreading and Concept of Applet

Detailed syllabus:

UNIT I
Fundamental Concepts of object oriented programming:
Overview of object oriented programming, classes, objects, messages, abstraction, encapsulation, inheritance, polymorphism, exception handling, and object-oriented containers, Differences and similarity between C++ and JAVA.

UNIT II
Fundamental of Java programming:
Features of Java, JDK Environment & tools, structure of Java program, Keywords , data types, variables, operators, expressions, decision making, looping, type casting, Input output using scanner class.

UNIT III
Classes and objects:
Creating classes and objects, Memory allocation for objects, Passing parameters to Methods, Returning parameters, Method overloading, Constructor , types of constructor and finalize ( ), Arrays: Creating an array, one dimensional Array, Two Dimensional array.

UNIT IV

Inheritance, interface and package:
Types of inheritance: Single Inheritance, Multilevel Inheritance, Method overriding, super keyword, final keyword, abstract class, Virtual Functions, Interface, Packages

UNIT V

Multithreading and Applet:
 Life cycle of thread, Methods, Multithreading, Priority in multithreading, Applet life cycle, creating applet.

References:

1.   The Complete Reference -Java by Herbert Schild, TMH Publication.
2.   Programming with Java- A Primer by E. Balagurusamy, 3rd Edition, TMH Publication.
3.   The Complete Reference- JAVA.
4.   3rd Edition By Patrick Naughton, TMH Publ.
5.   Java 6, Programming Black Book by Kogent Solution Inc., Dreamtech Press Publ.
6.   Java 2, Black Book by Steve Holzner, Paraglyph Press, 2nd Ed.

Course Outcomes :

At the end of this course students will able to

1. Use the syntax and semantics of java programming language and basic concepts of OOP.
2. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
4. Design event driven GUI and web related applications which mimic the real world scenarios.

Design Analysis & Algorithm

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course Objectives:

The objectives of this course are

1. To teach various problem solving strategies to the students.
2. To make the students study background for algorithm analysis and implementation of various strategies like divide and conquer, Greedy method, Dynamic programming , Backtracking , branch and bound.
3. To make the learners study different string matching algorithms.

Detailed Syllabus:

UNIT I

Algorithm Design Techniques
Divide and Conquer: Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity. Heap Sort and its complexity, Dynamic Programming: Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path. Backtracking: Basic method, use, Examples – 8 queens problem, Graph coloring problem. Greedy Method: Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines.

UNIT II

Lower Bound Theory
O(nlogn) bound for comparison sort ,Disjoint set manipulation: Set manipulation algorithm like UNION-FIND, union by rank.

UNIT III

Graph traversal algorithm
Recapitulation, Breadth First Search(BFS) and Depth First Search(DFS) – Classification of edges - tree, forward, back and cross edges – complexity and comparison.

UNIT IV

String matching problem
Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

UNIT V

Network Flow
Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

References :
1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms".
2. A. Aho, J.Hopcroft and J.Ullman "The Design and Analysis of Algorithms".

Course Outcomes :

At the end of this course students will able to

1. Select appropriate problem solving strategies.
2. Calculate time complexity and space complexity of an algorithm.
3. Analyze different divides and conquer problems.
4. Analyze different greedy method problems.
5. Analyze different dynamic programming problems.
6. Analyze different backtracking problems.
7. Analyze different string matching algorithms.

Computer Networks

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To make students understand computer networking basics.
2. To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications to the students.

Detailed Syllabus:

Unit- I

Introduction to Networking

Introduction to computer network, network application, network software and hardware components (Interconnection networking devices), Network topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services, Reference models: Layer details of OSI, TCP/IP models. Communication between layer.

Unit- II

Physical Layer

Electromagnetic Spectrum, Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided, media (Wireless Transmission): Radio Waves, Microwave.

Unit- III

Data Link Layer

DLL Design Issues (Services, Framing, Error Control, Flow Control), Error Detection and Correction(Hamming Code, CRC, Checksum) , Elementary Data Link protocols , Stop and Wait, Sliding Window(Go Back N, Selective Repeat). Access Control sublayer, Channel Allocation problem, Multiple ,access Protocol(Aloha, Carrier SenseMultiple Access (CSMA/CD),(CSMA/CA).

Unit- IV

Network Layer

Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (classfull and classless), Subnetting, Supernetting design problems, IPv4 Protocol, Network Address Translation (NAT),Routing algorithms : Shortest Path(Dijkastra's), Distance Vector Routing, Protocols - ARP,RARP,Token & Leaky bucket algorithms.

Unit- V

Transport & Application Layer

Connection management (Handshake), UDP, TCP,DNS, HTTP,SMTP, Telnet, FTP

References:
1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education
3. W. Stallings, Data and Computer Communication, Macmillan Press
4. Bhavneet Sidhu, An Integrated approach to Computer Networks, Khanna Publishing House
5. Gary R.Wright,W.Richard Stevens "TCP/IP Illustrated,Volume2 The Implementation" Addison-Wesley
6. Michael A. Gallo and William M. Hancock "Computer Communication and Networking Technology" Cengage Learning
7. Anuranjan Misra, "Computer Networks", Acme Learning
8. G. Shanmugarathinam, "Essential of TCP/ IP", Firewall Media.

Course Outcomes :

At the end of this course students will able to

1. Recognize the technological trends of Computer Networking.
2. Discuss the key technological components of the Network.
3. Evaluate the challenges in building networks and solutions to those.

Elective - I
Data Warehousing & Data Mining

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objective:

The objectives of this course are

1. To make students extract knowledge from a data repository for data analysis, frequent pattern, classification and prediction**.**
2. To guide and teach the students solve business problems by data analysis.
3. To help students to perform predictions based on the given data that can help in long term decision making.

Detailed syllabus:

UNIT I
Data warehousing:
Introduction, Data lakes, Data marts, Data warehousing Components, Building a Data warehouse, Data warehouse architecture, ETL process, Data Extraction, Cleanup, and Transformation Tools, Metadata Repository.
Introduction to Online Analytical Processing (OLAP), Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations Schemas for multidimensional data models, Multidimensional versus Multi Relational OLAP, OLAP tools operations. Difference between OLTP and OLAP.

UNIT II
Data mining:
Introduction, What Kinds of Data can be mined, Data mining functionalities, Technologies used, Interestingness of Patterns, Integration of a Data Mining System with a Data Warehouse, Issues, Data preprocessing – Data cleaning – Data Integration and Transformation – Data Reduction – Discretization,Data Mining Task Primitives.

UNIT III
Association Rule Mining:
Market basket analysis, Mining Frequent Patterns, Associations and Correlations, Apriori algorithm, Association Rule generation. Introduction to Mining Multilevel Association Rules and Mining Multidimensional Association rules.

UNIT IV
Cluster Analysis – **Introduction**
A categorization of Major clustering methods - Partitioning methods, Hierarchical methods , Grid-based methods, Density-based methods.

UNIT V

Classification and Prediction:

Basic Concepts, Decision Tree, Rule Based Classification , Classification by Back propagation , Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

References:

1.Ralph Kimball, "The Data Warehouse Lifecycle toolkit', 2nd edition, Wiley India.

2. Han, Kamber, "Data Mining Concepts and Techniques", 2nd edition ,Elsevier

3. Reema Theraja "Data warehousing", Oxford University Press.

4. "Introduction to Data Mining", 1/e Pang-Ning Tan, Vipin Kumar, Michael Steinbach Pearson Education

5. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education.

6.Paulraj Ponniah, "Data Warehousing Fundamentals", Wiley Student edition.

7. "Data Mining For Business Intelligence" Galit Shmueli, Nitin Patel, Peter Bruce; Wiley Student Edition.

8. "Data Warehousing, Data Mining & OLAP " Alex Berson & Stephen J Smith, Tat McGraw Hill.

9. "Data Mining with SQL Server 2008" Jamie McLennan & others, Wiley Indian Edition.

10. "Mastering Data Mining", M Berry and G. Linoff, Wiley Student Edition. 6) R. KimbalI, "The Data Warehouse Toolkit', John Wiley.

Course Outcomes :

At the end of this course students will able to

1. Understand the basic concepts of extracting, transforming and loading data in data warehouse
2. Understand the basic concepts of Association rule mining.
3. Acquire satisfactory competency in applying clustering techniques, classification and prediction.

Elective - I

E-Commerce

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are:

1. Discuss fundamentals of e-commerce, types and applications with learners.
2. To make students evaluate the role of the major types of information systems in a business environment and their relationship with each other
3. Assess the impact of the Internet and Internet technology on business electronic commerce and electronic business
4. To help students identify the major management challenges for building and using information systems and learn how to find appropriate solutions to those challenges.
5. To make students learn strategies for e-commerce, Mobile Commerce, Wireless Application Protocol, WAP technology and Mobile Information devices.

Detailed syllabus:

UNIT I

Introduction
Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models.

UNIT II

Network Infrastructure for E-commerce
Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device.

UNIT III

Web Security
Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

UNIT IV

Encryption

Encryption techniques, Symmetric Encryption: Keys and data encryption standard, Triple encryption, Secret key encryption; Asymmetric encryption: public and private pair key encryption, Digital Signatures, Virtual Private Network.

UNIT V

Electronic Payments

Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking, EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. poli-cies and Agenda.

TEXT BOOKS:

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.

REFERENCE BOOKS:

1. Pete Lohsin , John Vacca "Electronic Commerce", New Age International
2. Goel, Ritendra "E-commerce", New Age International
3. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education
4. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
5. Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education

COURSE OUTCOMES:

At the end of the course student will be able to:

1. Understand the basic concepts and technologies used in the field of management information systems.
2. Understand the processes of developing and implementing information systems.
3. Be aware of the ethical, social, and security issues of information systems and.
4. Develop an understanding of how various information systems work together to accomplish the information objectives of an organization.
5. Understand the role of information systems in organizations, the strategic management processes, and the implications for the management and learn about the importance of managing organizational change associated with information systems implementation.

Python Programming Lab

Teaching Scheme		Evaluation Scheme	
Lectures	**4 Hrs/Week**	**Internal Assessment Test**	**15 Marks**
Total Credits	**2**	**End-Semester Examination**	**35 Marks**

Suggested list of Practicals:

1. Python program to print "Hello Python".
2. Python program to do arithmetical operations.
3. Python program to find the area of a triangle.
4. Python program to solve quadratic equation.
5. Python program to swap two variables.
6. Python program to generate a random number.
7. Python program to convert kilometers to miles.
8. Python program to convert Celsius to Fahrenheit.
9. Python program to display calendar.
10. Python Program to Check if a Number is Positive, Negative or Zero.
11. Python Program to Check if a Number is Odd or Even.
12. Python Program to Check Leap Year.
13. Python Program to Check Prime Number.
14. Python Program to Print all Prime Numbers in an Interval.
15. Python Program to Find the Factorial of a Number.
16. Python Program to Display the multiplication Table.
17. Python Program to Print the Fibonacci sequence.
18. Python Program to Check Armstrong Number.
19. Python Program to Find Armstrong Number in an Interval.
20. Python Program to Find the Sum of Natural Numbers.
21. Python program to check if the given number is a disarium Number.
22. Python program to print all disarium numbers between 1 to 100.
23. Python program to check if the given number is Happy Number.
24. Python program to print all happy numbers between 1 and 100.
25. Python program to find the frequency of each element in the array.
26. Python program to left rotate the elements of an array.
27. Python program to print the duplicate elements of an array.
28. Python program to print the elements of an array.
29. Python program to print the elements of an array in reverse order.
30. Python program to print the elements of an array present on even position.
31. Python program to print the elements of an array present on odd position.

JAVA Programming Lab

Teaching Scheme		Evaluation Scheme	
Lectures	**4 Hrs/Week**	**Internal Assessment Test**	**15 Marks**
Total Credits	**2**	**End-Semester Examination**	**35 Marks**

Suggested list of experiments:

1. Swapping of two numbers without accepting numbers from the user.

2. Find out the largest of two numbers using command line arguments.

3. Print class of students according to given range using switch case.

4. Find GCD and LCM of two positive numbers using a while loop.

5. Display table of given number using for loop.

6. Java Program to check whether input character is vowel or consonant
7. Print the upper triangle using a nested for loop.
   ```
   *
   * *
   * * *
   * * * *
   ```
8. Java Program to calculate simple interest and compound interest.
9. Java program to find occurrence of a character in a String.
10. Write a class Circle with methods getdata() and area(). Create an object of that class, find the area and display the result.
11. Calculate absolute value of given number using method overloading.

12. Calculate addition of two numbers using constructor overloading.

13. Write a program to accept n integers from user into an array and display the average of these numbers.
14. Write a program to sort elements of an array in ascending order using bubble sort.

15. Write a program to find and display the sum of diagonal elements of a square matrix.

16. Write a program to implement single inheritance using super keywords.

17. Write a program to add two numbers using single inheritance such that the base class method must accept 2 numbers from the user and the derived class method must add these numbers and display the sum.
18. Write a program to find the area of a circle using single inheritance such that the base class method must accept the radius from the user and the derived class method must calculate and display the area.
19. Write a program to implement multiple inheritance.

20. Write a program to print 1A2B3C4D5E6F7G8H9I10J using thread.

Verbal Ability and Reasoning (Internal Evaluation Only)

Teaching Scheme		Evaluation Scheme	
Lectures	2 Hrs/Week	Internal Assessment Test	—
Total Credits	2	End-Semester Examination	—

Course Objectives:

The objectives of this course are:
1. To acquaint the students with appropriate language skills with the purpose of improving the existing ones.
2. To make the learners understand the importance and effective use of verbal communication.
3. To make the learner proficient in Writing.
4. To guide and teach the students to utilize the principles of professional business and technical writing for effective communication in the global world.
5. To deploy technology to communicate effectively in various situations.

Detailed Syllabus:

UNIT I

Verbal Ability- Definition, Demonstrated Skills, Comprehension skills, Spotting Errors, Spellings , Selecting Words, Sentence Formation, Ordering of Words

UNIT II

Paragraph formation, One Word Substitutes, Idioms and Phrases, Change of Voice, Change Of Speech, Verbal Analogues.

UNIT III

Reasoning Ability- Definition, Types Of Reasoning: Deductive Reasoning, Inductive Reasoning, Critical Thinking, Intuition.

UNIT IV

The Organs of Speech, The description and Classification of Speech Sounds, Accent and Rhythm in Connected Speech, Varieties of English Pronunciation

UNIT V

Critical thinking, cause and effect, Artificial Language, verbal reasoning and non-verbal reasoning

Course Outcomes:

At the end of the course student will be able to:

1. Understand and evaluate information they listen to and express their ideas with greater clarity.
2. Communicate through result oriented writing both within and outside the organization.
3. Write a set of effective and easy to understand technical description, instructions.

SEMESTER V

B.C.A-CS 3 Year - Semester V									
Course Code	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
		L	T	P	IA	ESE	IA	ESE		
CSAB5050	Open Source Technologies	3	1	-	30	70	-	-	100	4
CSAB5060	Internet Of Things	3	-	-	30	70	-	-	100	3
CSAB5030	Cloud Computing	3	-	-	30	70	-	-	100	3
CSAB5070	Network Security	3	-	-	30	70	-	-	100	3
**	Elective - II	3	-	-	30	70	-	-	100	3
CSAB5051	Open Source Technologies Lab	-	-	4	-	-	15	35	50	2
CSAB5031	Cloud Computing Lab	-	-	4	-	-	15	35	50	2
CSSB5083	Project Work - 1	-	-	8	-	-	15	35	50	4
	TOTAL	15	1	16	150	350	45	105	650	24

Elective -II

Elective-2 CSAB 5410/CSAB5420
1. Software Project Management
2. ERP

Open Source Technologies

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks

Course learning objectives:
The objectives of this course are
1. To make students understand the difference between open source software and commercial software.
2. Familiarity with Linux operating system.
3. To guide students in development of web applications using open source web technologies like Apache, MySql and PHP (LAMP/XAMP).

Detailed Syllabus:

UNIT I

BASIC PHP

Web Server, Apache, PHP, Data Types, User defined Variables, Constants, Operators, Control Structures, User defined Functions, Directory Functions, File system Functions, Arrays, String Functions, Date and Time Functions, Mathematical Functions, Miscellaneous Functions.

UNIT II

Advanced PHP with MySQL

Exceptions handling, Error Handling Functions, Predefined Variables, Cookies, Sessions, COM, DOM, CURL, SOAP, Classes and Objects-Mail Function, URL Functions. PHP with MySQL: PHP MySQL Functions, Database driven application.

UNIT III

Advanced PHP with AJAX, SEO and CMS

PHP with AJAX: Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Word press Creating an SE-Friendly Blog.

UNIT IV

Basic PERL

Introduction-Scalar Data- Lists and Arrays -Subroutines-Input and Output- Hashes-Regular Expressions-Control Structures-Perl Modules-File Tests.

UNIT V

Advanced PERL

Directory Operations-Strings and Sorting-Smart Matching-Process Management- Advanced Perl Techniques.

Reference Books:

1. James Lee and Brent Ware ,"Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", , Dorling Kindersley(India) Pvt. Ltd, 2008.
2. Eric Rosebrock, Eric Filson ,"Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

Course Outcomes:

At the end of this course students will demonstrate the ability to:
1. Understand the difference between open source software and commercial software.
2. Identify, install and run Linux operating systems.
3. Install and manage applications.
4. Identify, install open source web technologies Apache, MySql, PHP.
5. Develop web applications using LAMP.
6. Write session control PHP code for a website

Internet of Things

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	**Internal Assessment Test**	**30 Marks**
Total Credits	3	**End-Semester Examination**	**70 Marks**

Course learning objectives:
The objectives of this course are:

In this course, students will explore various components of the Internet of things such as Sensors, internetworking and cyber space. In the end they will also be able to design and implement IoT circuits and solutions.

Detailed Syllabus:

UNIT I

IOT

What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.

UNIT II

IOT Protocols

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT III

IOT Architecture

IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

UNIT IV

Web of things
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

UNIT V

IOT Applications

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

Text /Reference Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. Syllabus for Bachelor of Technology Computer Engineering.

2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.

3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

4. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1.

Course Outcomes:

At the end of this course students will demonstrate the ability to:
1. Understand general concepts of Internet of Things (IoT).
2. Recognize various devices, sensors and applications.
3. Apply design concept to IoT solutions.
4. Analyze various M2M and IoT architectures.
5. Evaluate design issues in IoT applications.
6. Create IoT solutions using sensors, actuators and Devices.

Cloud Computing

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objective:

The objectives of this course are

This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domains from a while now. It will provide the students basic understanding about cloud and virtualization along with how one can migrate over it.

Detailed syllabus:

UNIT I
Introduction to Cloud Computing:
Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy.

UNIT II
Cloud Computing Architectural Framework:
Cloud architectural principles, Role of Networks in Cloud computing, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors, Cloud Services Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment.

UNIT III
Exploiting Cloud Services:
Software as a Service(SaaS): Introduction to SaaS, Inspecting SaaS technologies, Implementing web services, Deploying Infrastructure as a Service(IaaS): Introduction to IaaS, Scalable server clusters, Machine Image, Virtual Machine (VM). Elastic storage devices, Data storage in cloud computing, Delivering Platform as a Service(PaaS): Introduction to PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Hardware-as-a-service: HaaS.

UNIT IV
Cloud Application Development:
Role of business analyst, Technical architecture considerations, Service creation environments to develop cloud based applications, Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages, Cloud Economics.

UNIT V
Cloud Security and Risk Management:
Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.

Analysis on Case study:
Business Case: Business case evaluation criteria, Business outcomes examples, Case Studies: Case Study on Open Source & Commercial Cloud: Eucalyptus, Microsoft Windows Azure, Amazon EC2, Amazon Elastic Block Storage – EBS. Google Cloud Infrastructure, MapReduce. AWS, Simple Storage Service – S3

References:
1. Distributed and Cloud Computing: Clusters, Grids, Clouds, and the Future Internet by Kai Hwang, Jack Dongarra & Geoffrey C. Fox., Morgan Kaufmann Publishers, 2012.
2. Cloud Computing Bible, Barrie Sosinsky, WileyIndia, 2010.
3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
4. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012.
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.
6. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978-0521137355].

Course Outcomes:
After completion of the course students are expected to be able to:
1. Explain the components of the cloud infrastructure and their functions.
2. Describe the software-defined data centre.
3. Know service models such as Software-as-a-Service, Platform-as-a-Service, Infrastructure-as-a-Service.
4. Describe deployment models of the cloud.

Network Security

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objective:

The objectives of this course are

1. Provide knowledge of Cryptography to the learners.

2. To provide students' knowledge of Symmetric and Asymmetric Algorithms.

3. Give insight on Message Authentication and Hash Functions.

4. To help the students understand the concepts of Security Policies and Security HandshakePitfalls.

Detailed Syllabus:

UNIT I

Introduction:
Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, hash algorithms.

UNIT II

Secret Key Cryptography:
Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

UNIT III

Hash Functions and Message Digests:
Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages.
Public key Cryptography:
Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

UNIT IV

Authentication:
Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Interdomain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

UNIT V

Security Policies and Security Handshake Pitfalls:
What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

References:
1. Atul Kahate, Cryptography and Network Security, McGraw Hill.
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.
3. Stallings, Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR., 2003.
4. Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000.
5. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan.
6. Information Security Intelligence Cryptographic Principles and App. Calabrese Thomson.
7. Securing A Wireless Network Chris Hurley SPD.

Course Outcome:
The students will be able to learn
1. Concepts of Cryptography.
2. Implement Symmetric and Asymmetric Algorithms.
3. Develop Message Authentication and Hash Functions.
4. Identify the concepts of Digital Signatures and Public Key Infrastructure.

Elective II

Software Project Management

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To make students understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To make the students manage software projects and control software deliverables.
5. To help students develop skills to manage the various phases involved in project management and people management.
6. To deliver successful software projects that support organization's strategic goals.

Detailed Syllabus:

UNIT I

Project Evaluation and Project Planning
Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II

Project Life Cycle and Effort Estimation
Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

UNIT III

Activity Planning and Risk Management
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV

Project Management and Control
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT V

Staffing in Software Projects
Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TEXT BOOK:
1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

Course Outcomes:
After completion of the course students are expected to be able to:

1. Understand Project Management principles while developing software.
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
6. Learn staff selection process and the issues related to people management.

Elective II

Enterprise Resource Planning (ERP)

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**3**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To make students understand the technical aspects and life cycle of ERP systems.
2. To understand the steps and activities in ERP.
3. To illustrate students how to identify and describe different types of ERP system.
4. To make the learners understand tools and methodology used for designing ERP for an Enterprise.

Detailed Syllabus:

UNIT I

Introduction to Enterprise Resource Planning (ERP)
Information System and Its Components, Value Chain Framework, Organizational Functional Units, Evolution of ERP Systems, Role of ERP in Organization, Three-Tier Architecture of ERP system.

UNIT II

ERP and Implementation
ERP implementation and strategy, Implementation Life cycle, Pre- implementation task, requirement definition, implementation Methodology.

UNIT III

ERP Business Modules

Finance, manufacturing, human resources, quality management, material management, marketing, Sales distribution and service

Case study on Supply Chain management (SCM), Customer relationship Management (CRM)

UNIT IV

Introduction to ERP related Technologies

Business Process Re-engineering (BPR), Data warehousing, Data **Mining**, On-line Analytical Processing (OLAP), Product Life Cycle Management (PLM), Geographical Information Management ,RFID, QR Code , Bar Coding, E-commerce and their application in Enterprise planning.

UNIT V

Extended ERP and security issues

Enterprise application Integration (EAI), open source ERP, cloud ERP, Managing ERP Securities: Types of ERP security Issues, System Access security, Data Security and related technology for managing data security.

Text Books:

1. Alexis Leon, ERP Demystified: II Edition, Tata McGraw Hill.
2. Rajesh Ray, Enterprise Resource Planning, Text and cases, Tata McGraw Hill.
3. Sandeep Desai, Abhishek Srivastava, ERP to E^2 ERP: A Case study approach, PHI.
4. Jyotindra Zaveri, Enterprise Resource Planning, Himalaya Publishing House, 2012.

Reference Books:

1. V.K. Garg & N.K. Venkatakrishnan, Enterprise Resource Planning: concepts & practices, by ; PHI.
2. Supply Chain Management Theories & Practices: R. P. Mohanty, S. G. Deshmukh, - Dreamtech Press.
3. Enterprise wide resource planning: Theory & practice: by Rahul Altekar, PHI
4. Customer Relationship Management, Concepts and cases, Second Edition.

Course Outcomes:
After completion of this course, students will be able
1. To understand the basic structure of ERP.
2. To identify the implementation strategy used for ERP.
3. To apply design principles for various business modules in ERP.
4. To apply different emerging technologies for implementation of ERP.
5. To analyze security issues in ERP.
6. To acquire ERP concepts for real world applications.

Open Source Technologies Lab

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	2	End-Semester Examination	35 Marks

Suggested List of Experiments:

1. Linux command line: File System, Process Management User Administration
2. Setting Up Web server, DNS server, FTP Servers
3. Working with IPTABLES, OpenVAS
4. Version Control
5. Working with Drupal
6. Shell Script
7. Android Setup
8. Programming in Android
9. Programming in Android

Cloud Computing Lab

Teaching Scheme		Evaluation Scheme	
Lectures	**4 Hrs/Week**	**Internal Assessment Test**	**15 Marks**
Total Credits	**2**	**End-Semester Examination**	**35 Marks**

Suggested List of Experiments

1.   Install Oracle Virtual box and create two VMs on your laptop.
2.   Install Turbo C in guest OS and execute C program.
3.   Test ping command to test the communication between the guest OS and Host OS
4.   Install Hadoop single node setup.
5.   Hopkinson's test on DC shunt machines
6.   Develop hadoop application to count no of characters, no of words and each character frequency.
7.   Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.
8.   Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
9.   Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase
10.   Use the Zookeeper to implement the coordination model in Problem 9.
11.   Develop a Hello World application using Google App Engine
12.   Develop a Guestbook Application using Google App Engine
13.   Develop a Windows Azure Hello World application using.
14.   Create a Mashup using Yahoo! Pipes.

Project Work- I

Teaching Scheme		Evaluation Scheme	
Lectures	8 Hrs/Week	Internal Assessment Test	15 Marks
Total Credits	4	End-Semester Examination	35 Marks

Course Objectives:

1. To expose students to product development cycle using industrial experience, use of state of art technologies.
2. To encourage and expose students to participation in National/International paper presentation activities and funding agencies for sponsored projects.
3. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.

Reviews1: Based on Implementation (30% implementation expected)

Reviews 2: Complete Project and Testing

Project Exhibition: All final students must see all the projects in the exhibition The group will submit at the end of semester VI.

a)   The Workable project.

b)   Project report (in Latex/Lyx/latest Word) in the form of a bound journal complete in all respects – 1 copy for the Institute, 1 copy for guide and 1 copy for each student in the group for certification. The project report contains the details.

1.   Problem definition

2.   Requirement specification

3.   System design details (UML diagrams)

4.   System implementation – code documentation – data flow diagrams/ algorithm, protocols used.

5.   Test result and procedure – test report as per ATP.

6.   Conclusions.

7.   Appendix a. Tools used b. References c. Papers published/certificates Plagiarism Report of paper and project report from any open source tool One paper should be published in a reputed International conference/International journal.

SEMESTER VI

	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
BCA 3 Year - Semester VI										
		L	T	P	IA	ESE	IA	ESE		
CSAB6010	IT Infrastructure Management	3	1	0	30	70			100	4
**	Elective 3	3	-	0	30	70			100	3
CSAB6023	Project Work	0	0	20			50	50	100	10
	TOTAL	**6**	**1**	**20**	**60**	**140**	**50**	**50**	**300**	**17**

Elective -III

Elective-3 CSAB 6910/ CSAB6610
1. **Web Designing**
2. **Data Analytics**

IT Infrastructure Management

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To make students understand research, reporting and presentation approaches using the latest ICT tools to examine and critically analyse a combination of the technical and management issues in contemporary infrastructure management, with a focus on business alignment.
2. IT infrastructure Management evaluates new ICTs and case studies in the context of enterprise architecture to the learners.
3. It is suitable for combinations of students in information technology, business administration and electronic commerce.

Detailed Syllabus:

UNIT I

Definitions, Infrastructure, management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client- server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.

UNIT II

Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).

UNIT III

Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management.

UNIT IV

Configuration Management, Service desk, Incident management, Problem management, Change management, Release management.

UNIT V

Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management. Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention.

Course Outcomes:
After completion of the course students are expected to be able to:

1. Be able to describe the business value and processes of ICT services in an organisation and apply that knowledge and skill with initiative to a workplace scenario;
2. Be able to investigate, critically analyse and evaluate the impact of new and current ICT services to an organisation;
3. Be able to describe how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organisation;
4. Be able to demonstrate the technical and communications skills that contribute to the operation of ICT services in an organisation;
5. Be able to reflect critically on the role of an enterprise architect in an organisation;
6. Be able to synthesise the theoretical, technical and management issues that deliver ICT services to an organisation.

Elective III

Web Designing

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Internal Assessment Test	30 Marks
Total Credits	3	End-Semester Examination	70 Marks

Course Objectives:

The objectives of this course are

To provide insight into emerging technologies to design and develop state of - the art web applications using client-side scripting, server-side scripting, and database connectivity to the students.

Detailed syllabus:

UNIT I

HTML5:

Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors, FORMs in HTML, Interactive Elements, Working with Multimedia - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page

UNIT II

CSS:

Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an element.

UNIT III

JavaScript:

Using JavaScript in an HTML Document, Programming Fundamentals of JavaScript – Variables, Operators, Control Flow Statements, Popup Boxes, Functions – Defining and Invoking a Function,

Defining Function arguments, Defining a Return Statement, Calling Functions with Timer, JavaScript Objects - String, RegExp, Math, Date, Browser Objects - Window, Navigator, History, Location, Document, Cookies, Document Object Model, Form Validation using JavaScript.

UNIT IV

XML:

Comparing XML with HTML, Advantages and Disadvantages of XML, Structure of an XML Document, XML Entity References, DTD.

UNIT V

XSLT: XSLT Elements and Attributes - xsl: template, xsl:apply-templates, xsl:import, xsl:call-template, xsl:include, xsl:element, xsl:attribute, e xsl:attribute-set, xsl:value-of.

Text Book(s):

1) HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press
2) Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India.
3) PHP: A Beginners Guide, Vikram Vaswani, TMH

Additional Reference(s):

1) HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY
2) Learn to Master HTML 5, scriptDemics, StarEdu Solutions Pvt Ltd.
3) Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'Reilly
4) PHP, MySQL, JavaScript & HTML5 All-in-one for Dummies, Steve Suehring, Janet Valade Wiley

Course Outcomes:
After completion of the course students will be able to:

1. To help students design valid, well-formed, scalable, and meaningful pages using emerging technologies.
2. To make students understand the various platforms, devices, display resolutions, viewports, and browsers that render websites

3. To guide and teach the students to develop and implement client-side and server-side scripting language programs.

4. To develop and implement Database Driven Websites. Design and apply XML to create a markup language for data and document centric applications.

Data Analytics

Teaching Scheme		Evaluation Scheme	
Lectures	**3 Hrs/Week**	**Internal Assessment Test**	**30 Marks**
Total Credits	**4**	**End-Semester Examination**	**70 Marks**

Course Objectives:

The objectives of this course are

1. To guide and teach the students to develop problem solving abilities using Mathematics
2. To illustrate students how to apply algorithmic strategies while solving problems
3. To develop time and space efficient algorithms
4. To make students study algorithmic examples in distributed, concurrent and parallel environments

Detailed syllabus:

UNIT I

Introduction:
Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6- Opearationalize. Case Study: GINA

UNIT II

Statistical Methods for Evaluation
Hypothesis testing, difference of means, wilcoxon rank–sum test, type 1 type 2 errors, power and sample size, ANNOVA. Advanced Analytical Theory and Methods: Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters, diagnostics, reasons to choose and cautions.

UNIT III

Advanced Analytical Theory and Methods:
Association Rules- Overview, a-priori algorithm, evaluation of candidate rules, case study-transactions in grocery store, validation and testing, diagnostics. Regression- linear, logistics, reasons to choose and cautions, additional regression models

UNIT IV

Decision trees
Overview, general algorithm, decision tree algorithm, evaluating a decision tree, Naïve Bayes – Bayes" Algorithm, Naïve Bayes" Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods

UNIT V

Analytics for unstructured data
Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables

References:
1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication, ISBN: 978-1-118-16430-3
3. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866.

Course Outcomes:

On completion of the course, student will be able to
1. Write case studies in Business Analytic and Intelligence using mathematical models.
2. Present a survey on applications for Business Analytic and Intelligence.
3. Provide problem solutions for multi-core or distributed, concurrent/Parallel environments.

Project Work

Teaching Scheme		Evaluation Scheme	
Lectures	20 Hrs/Week	Internal Assessment Test	60 Marks
Total Credits	10	End-Semester Examination	140 Marks

Project Guidelines

☐ The Bachelor of Computer Applications (BCA) programme prepares the learners to take up positions as Programmers, Systems Analysts, Systems Designers in the field related to computer application and information technology or learners may go for higher studies in this area.

☐ The theoretical background of various courses provides you the necessary foundation, principles, and practices to develop effective ways to solve computing problems.

☐ The hands-on experience gained from the practical courses provide you the knowledge to work with various operating systems, programming languages and software tools.

☐ This project work is kept in the BCA program to give you an opportunity to develop quality software solutions.

☐ During the development of the project you should be involved in all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems.

☐ The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develop a good understanding of SDLC.

☐ The BCA learners are encouraged to involve themselves completely on the project work in their Fifth semester. It is advised to learners to develop their project for solving problems of the software industry or any research organization.

☐ Doing this will give more exposure to handling real life problems of project development.

Learners should take this project work very seriously.

☐ Topics selected, should be complex and large enough to justify as a **BCA** project. The project should be genuine and original in nature and should not be copied from anywhere else.

☐ Learners, who wish to do their Project Report from any organization, are required to take NOC from the concerned organization, to carry out the Code of the Project done.

☐ The project covers Study of existing system & System Requirements, Analysis, Design and Coding. Learners should submit their Project Reports as per the guidelines.

☐ **Project Reports which are not as per the guidelines will not qualify for evaluation.**

Objective of the Project

1. To train the learner to independently formulate and solve a social, philosophical, Commercial, or technological problem and present the results in written and oral form.
2. To expose learners to the real life problems in the World of Work.
3. To provide opportunities to learners to interact with people and understand human relations.

Project Scheduling

Learners are supposed to complete their project work within a period of 6 months.

Activity	Date
Apply for Project	After completed theory courses of 4st Sem
Submission of Project Proposal	Within one month from apply the project work
Approval of Project work	Within 15 days from submission of project synopsis or proposal.
Start the project	Immediately after approval of the project.
Project Reporting	At the end of 5th month from start
Submission of Project Report	On or before 20 days of the end of examination.
Examination of Project Work	Date will be announced by the University.

About the Project

a. Project carries 4 credit points.
b. At the end of the project, learners should prepare a written document of their project report.
c. Learners can develop their project in the form of a group of 1 to 2 learners.
d. Project work carries marks total 200 marks:

Project Report	140
Presentation and Demonstration	30
Viva	30

A. Understanding the significance of Project

Most of the learners are under the impression that if a good layout is proposed then it will help them in scoring good marks but the quality of the project is analyzed by proper write-ups. It

provides an opportunity for learners to demonstrate originality and to plan and organize the project work and put the practical approach of all the topics studied in the entire curriculum.

B. Meaning of Project

A project is a study of factual information for comprehending and applying the various concepts of the course into practice. Its main purpose is not to generalize but to study the situation with a practical orientation.

C. Steps in Project Formulation

    a. System Study

    b. System Analysis

    c. System Designing

    d. System Development

    e. Implementation and Testing

D. Project Supervisor(Guide) Projects can be guided by any:

A person having B.E/B.Tech (Computer Science), MCA, M.Sc (Computer Science) with minimum 2 years' experience in Industry / Teaching.

E. Project Proposal

A proposal as per the format given should be prepared once the topic is selected. It should not be more than 10 pages and need not be sent separately. The format for the same is:

    a. Title of Project
    b. Name of learner or group
    c. Objectives
    d. Problem Statement
    e. Software platform.
    f. Hardware platform
    g. Methodology and Procedure of Work
    h. Detailed information of Guide (Name, Address, qualification and Experience)

F. No Objection Certificate:

If the project is carried out in a company or organization, then a certificate for no objection of the same needs to be presented. It should mention that the organization has no objection in publishing the findings of the project study. The certificate should contain the name of authority with signature and company stamp and should be given on the company's letterhead and duly signed by authorized signatory.

G. Format of the project

a. Preliminary pages

1. Cover Page
2. Title Page
3. Completion Certificates
4. Acknowledgement
5. Requirement Analysis
6. Project Analysis
7. Data Flow Diagram
8. Project Design
9. ER Diagram
10. Table Design
11. Reports

b. Body of the project

☐ Containing textual and graphical contents of the project.

c. Bibliography

☐ Reference List

☐ Appendices

H. Suggested list of topics for Project Report

A sample list of topics for the BCA General Project is provided below. This is just a suggested list and learners are free to choose any other IT project relevant to the BCA curriculum. Learners may choose any programming language such as C, JAVA, PHP, Android etc. There is no compulsion on choosing the project and the software language for the project.

• Employee Record System

• Library Management System

• Learner Record System

• Hotel Reservation System

• EBook Shopping

• Event Management System

• Hostel Management System

• Bus Ticket Reservation System

• Online Food Ordering System

- RTO Management
- Leave Management System
- Banking System
- Stock Management System
- Mailing Server
- Social Networking
- Online Discussion Forum
- Call Blocker
- Mobile Sensor
- Call Recorder
- Mobile Thesaurus
- Mobile Invoice
- Group Alarm System
- Shop Management etc.

I. Technical Specifications of Project Report Length:

1. The length of the report should be between 100-150 pages including the cover page, summary, table of contents, list of figures, list of tables, and acknowledgement.
2. **Script and Page Format** : The report should be typed using a Word Processor on standard A4 (210 mm x 297 mm) paper size. A conventional font, size 12-point and line spacing of 1.5 mm should be used.
3. **Margins** :Left-hand margins should have a width of not less than 38 mmt o facilitate binding. The right-hand, the top, and the bottom should be 25 mm. Each page must be typed in one side, leaving a wide margin.
4. **Paper and Print Quality :**Paper and print quality are important for successful legibility. The report can be printed on a standard quality paper, (e.g., photocopy paper)
5. **Pagination :** Positioning of page numbers should be on the top right hand side. Pages starting from the summary until the last list of tables should be numbered using Latin numbers (I, II, III, IV,…). Pages starting from the Introduction until the appendices should be numbered using numbers (1, 2, 3…). Pages with figures and tables or illustrations must be also numbered.

6. **Guard pages/blank pages at the front and back.**

7. **Binding :** The report should be hard bound.

8. **Number of copies :** Three copies should be submitted – self copy, University copy, Supervisor (Faculty member in charge) Copy.