ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for BCA-AIML

Semester 1

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
25CS101	Fundamentals of IT	4	0	0	4	70	30	0	100
25CS102	C Programming	4	0	0	4	70	30	0	100
25MT101	Discrete Mathematical Structure	4	0	0	4	70	30	0	100
25EN102	Business Communication	3	1	0	4	70	30	0	100
25CM101	Accounting and Financial Management	4	0	0	4	70	30	0	100
Practical									
25CS191	IT Lab	0	0	2	2	0	30	70	100
25CS192	C Programming Lab	0	0	2	2	0	30	70	100
	Total				**24**	**350**	**210**	**140**	**700**

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Detailed Syllabus

FUNDAMENTALS OF IT

Code: 25CS101
Max Marks: 70

Course Objectives: The objective of the course is to understand basic computer hardware and software components, learn operating systems, networks, and data storage concepts and develop skills in using common IT tools and applications.

UNIT I **(10 Hrs)**

Fundamentals of Computers: Definition and Characteristics of Computer System. Computer Generation from First Generation to Fifth Generation. Classifications of Computers: Micro, Mini, Mainframe and super computers.
Computer Hardware: Major Components of a digital computer, Block Diagram of a computer, Input-output devices, Description of Computer Input Units, Output Units, CPU.
Computer Memory: Memory Hierarchy, Primary Memory – RAM and its types, ROM and its types, Secondary Memory, Cache memory. Secondary Storage Devices - Hard Disk, Compact Disk, DVD, Flash memory.

UNIT II **(10 Hrs)**

Interaction with Computers: Computer Software: System software: Assemblers, Compilers, Interpreters, linkers, loaders.
Application Software: Introduction to MS Office (MS-Word, MS Power point, MS-Excel).
Operating Systems: Elementary Operating System concepts, Different types of Operating Systems.
DOS: Booting sequence; Concepts of File and Directory, Types of DOS commands.
Computer Languages: Introduction to Low-Level Languages and High-Level Languages.

UNIT III **(10 Hrs)**

Computer Number System: Positional and Non-positional number systems, Binary, Decimal, Octal and Hexadecimal Number Systems and their inter-conversion.
Binary Arithmetic: Addition, subtraction, multiplication and division. Use of complement method to represent negative binary numbers, 1's complement, 2's complement, subtraction using 1's complement and 2's complement. Introduction to Binary Coded Decimal (BCD), ASCII Codes, EBCDIC codes.

UNIT IV **(10 Hrs)**

Computer Network & Internet: Basic elements of a communication system, Data transmission modes, Data Transmission speed, Data transmission media, Digital and Analog Transmission, Network topologies, Network Types (LAN, WAN and MAN), Basics of Internet and Intranet.
Internet: Terminologies related to Internet: Protocol, Domain name, Internet Connections, IP address, URL, World Wide Web. Introduction to Client-Server Model, Search Engine, Voice over Internet Protocol (VOIP), Repeater, Bridge, Hub, Switch, Router, Gateway, Firewall, Bluetooth technology.
Advanced Trends in IT Applications: Brief Introduction to Cloud Computing, Internet of Things, Data Analytics, AI and Machine Learning.

Textbook:

1. P. K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 1992.
2. Anita Goel "Computer Fundamentals", Pearson.

Reference Books:

1. B. Ram, "Computer fundamentals Architecture and Organization", New Age Intl.
2. Alex Leon & Mathews Leon, "Introduction to Computers", Vikas Publishing.
3. Norton Peter, "Introduction to Computers", 4th Ed., TMH, 2001.
4. Vikas Gupta, "Comdex Computer Kit", Wiley Dreamtech, Delhi, 2004.

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C PROGRAMMING

Code: 25CS102
Max Marks: 70

Course Objectives: The objective of the course is to learn the syntax and structure of the C programming language, develop problem-solving and logic-building skills through coding and write, compile, debug, and execute C programs.

UNIT I **(8 Hrs)**

Computer Programming: Basic Programming concepts, Modular programming and structured programming, Problem solving using Computers, Concept of flowcharts and algorithms.
Overview of C: Introduction, Importance of C, Sample C Programs, Basic structure of C programs, Programming style, Executing a C Program.
Constants, Variables and Data types: C Tokens, keywords, and identifiers, constants, variables, datatypes, declaration of variables, assigning values to variables, defining symbolic constants.
Operators and Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, increment and decrement operators, conditional operator, bitwise operators, type conversion in expressions, operator precedence and associativity.
Mathematical functions.

UNIT II **(8 Hrs)**

Input and Output statements, reading a character, writing a character, formatted input, formatted output statements.
Decision-making, Branching and Looping : Decision making with IF statement, simple IF statement, The IF-ELSE statement, nesting of IF .. ELSE statements, The ELSE -IF ladder, The switch statement, The operator, The GOTO statement, The WHILE statement, The DO statement, The FOR statement, Jumps in loops.

UNIT III **(8 Hrs)**

Arrays: One dimensional arrays, Two-dimensional arrays, Initializing arrays, Programs based on arrays such as sorting, Fibonacci sequence, Matrix operations, etc.
Handling of Characters and Strings: Declaring and initializing string variables, Reading string from terminal, Writing string to screen, Arithmetic operations on characters, Putting strings together. Comparison of two strings, Character and string handling functions.

UNIT IV **(8 Hrs)**

User defined functions: Need for user-defined functions, A multi-functional program, The form of 'C' function, Return values and their types, Calling a function, Category of functions: No arguments and no return values, Arguments but no return values, Arguments with return values, Nesting of functions, Recursion, Functions with arrays as parameters.

UNIT V **(8 Hrs)**

Structure and Union: Structure definition, Giving values to members, Structure initialization; Comparison of structure variables, Array of structures, Array within structure, Union.
Pointers: Understanding pointers, Accessing the address of variables, Declaring and initializing pointers, Accessing a variable through its pointer.

Textbook:

1. Kamthane, Programming with ANSI and Turbo C; Pearson Education 2003

Reference Books:

1. E. Balaguruswamy. : Programming in ANSI C", Tata McGraw-Hill (1998)
2. Yeshvant Kanetkar: "Let us C"
3. V.Rajaraman.: "Programming in C", PHI (EEE) (2000)
4. Rajesh Hongal : "Computer Concepts & C language"
5. Brain Kernighan & Dennis M. Ritchie "ANSI C Programming" (PHI)

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DISCRETE MATHEMATICAL STRUCTURE

Code: 25MT101
Max Marks: 70

Course Objectives: The objective of the course is to understand fundamental concepts like logic, sets, relations, and functions, apply mathematical reasoning and proof techniques and use discrete structures in computer science applications.

UNIT I **(10 Hrs)**

SETS: Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Operations on Sets: Union, Intersection difference and Complements of Sets, Algebra of sets, Cartesian product, Simple applications.

RELATION AND FUNCTIONS: Properties of Relations, Equivalence Relation, Partial Order Relation, Composition of relations and Representation of relations using digraph and Matrix, Function: Domain and Range, onto, into and One to One Functions, Composite and Inverse Functions, Hashing functions, Recursive function.

PROPOSITIONAL LOGIC: Introduction, Proposition, First order logic, Basic logical operations, Truth tables, Tautologies, Contradictions, Algebra of Propositions, Logical implications, Logical equivalence, Predicates, Universal and existential quantifiers.

UNIT II **(10 Hrs)**

PARTIAL ORDER RELATIONS AND LATTICES: Partial Order Sets, Totally ordered set, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal elements, Greatest lower bound, least upper bound, Lattices and Algebraic Structure, Principle of Duality, Elementary Properties of Lattices, Atoms. Sub lattices, Bounded lattice, Distributed & Complemented Lattices, Isomorphic lattices. Boolean lattice.

UNIT III **(10 Hrs)**

COMBINATORICS: Introduction, Basic Counting Principles, Permutations, Permutations of things not all different, Circular Permutations, Combinations, Restricted Permutations and Combinations, Derangement, Pascal's Triangle, Binomial Theorem (only for natural Numbers).

RECURRENCE RELATIONS: Introduction, Order of Recurrence Relations, Degree of Recurrence Relations, Linear Homogeneous Recurrence Relations, Non Homogeneous Recurrence Relations, Solution of linear homogeneous and non-non homogeneous recurrence relations.

UNIT IV **(10 Hrs)**

GRAPHS: Introduction, Degree of a vertex of a graph, Handshaking Theorem, Types of Graphs, Sub graph, Matrix representation of a graph: adjacent and incidence matrices, Isomorphic graphs, Path and circuit (Floyd's and Warshall algorithms), Connected graph, Hamiltonian graph, Euler graph, Graph coloring (Vertex, Edges and Map).

Textbook:

1. Rosen, K.H., Discrete Mathematics and its Applications, McGraw Hill Education, 8th edition 2021
2. Kolman, Busby and Ross, "Discrete Mathematical Structures", Pearson, 10th edition 2015
3. Babu Ram, "Discrete Mathematics", Pearson Education, 1st edition 2010

Reference Books:

1. D. S. Malik, M. K. Sen, "Discrete Mathematics" Cengage Learning, 2012
2. RB2. S.K. Sarkar "A Text Book of Discrete Mathematics" S. Chand Publications, 9th edition 2019
3. RB3. Singh J. P. "Discrete Mathematics for Undergraduates" ANE Books, 1st edition, 2013
4. RB4. Tremblay J.P. and Manohar, R., "Discrete Mathematical Structures with Applications to Computer Science" Tata McGraw Hill

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BUSINESS COMMUNICATION

Code: 25EN102
Max Marks: 70

Course Objectives: The objective of the course is to develop effective verbal and written communication skills, understand professional communication in business settings and improve interpersonal and presentation skills.

UNIT I **(10 Hrs)**

Concepts and Fundamentals: Introduction to Technical Communication, Need and importance of communication, Channel, Distinction between general and technical communication, Nature and features of technical communication, Seven Cs of communication, Types of Technical communication, Style in technical communication, Technical communication skills, Language as a tool of Communication, History of development of Technical Communication, Computer Aided Technical Communication

UNIT II **(10 Hrs)**

Oral Communication: Principles of effective oral communication, Introduction of Self and others, Greetings, Handling Telephone Calls Interviews: Meaning & Purpose, Art of interviewing, Types of interview, Interview styles, Essential, Techniques of interviewing, Guidelines for Interviewer, Guidelines for interviewee. Meetings: Definition, Kind of meetings, Agenda, Minutes of the Meeting, Advantages and disadvantages of meetings/ committees, Planning and organization of meetings. Project Presentations: Advantages & Disadvantages, Executive Summary, Charts, Distribution of time (presentation, questions & answers, summing up), Visual presentation, Guidelines for using visual aids, Electronic media (power-point presentation). The technique of conducting Group Discussion and JAM session.

UNIT III **(10 Hrs)**

Written Communication: Overview of Technical Writing: Definition and Nature of Technical Writing, Basic Principles of Technical Writing, Styles in Technical Writing.
Note – Making, Notice, E-mail Writing.
Writing Letters: Business letters, Persuasive letters- Sales letters and complaint letters, Office memorandum, Good news and bad news letters.
Report Writing: Definition & importance; categories of reports, Elements of a formal report, style and formatting in report.
Special Technical Documents Writing: Project synopsis and report writing, Scientific Article and Research Paper writing, Dissertation writing: Features, Preparation and Elements.
Proposal Writing: Purpose, Types, characteristics and structure.
Job Application: Types of application, Form & Content of an application, Drafting the application, Preparation of resume.

UNIT IV **(10 Hrs)**

Soft Skills: Business Etiquettes – Professional Personality, Workplace Protocols, Cubicle. Non-Verbal Communication: Kinesics and Proxemics, Paralanguage.
Interpersonal Skills.
Language Skills: Improving command in English, improving vocabulary, Choice of words, Common problems with verbs, Adjectives, adverbs, Pronouns, Tenses, Conjunctions, Punctuations, Prefix, Suffix, Idiomatic use of prepositions. Sentences and paragraph construction, Improve spellings, Common errors and misappropriation, Building advanced Vocabulary (Synonyms, Antonyms), Introduction to Business English.

Textbook:

1. Kavita Tyagi and Padma Misra , "Advanced Technical Communication", PHI, 2011
2. P. D. Chaturvedi and Mukesh Chaturvedi, "Business Communication – Concepts, Cases and Applications", Pearson, second edition.
3. Rayudu, "C. S- Communication", Himalaya Publishing House, 1994.
4. Asha Kaul, "Business Communication", PHI, second edition.

Reference Books:

1. Raymond Murphy, "Essential English Grammar- A self study reference and practice book for elementary students of English" , Cambridge University Press, second edition.
2. Manalo, E. & Fermin, V. (2007). Technical and Report Writing. ECC Graphics. Quezon City.
3. Kavita Tyagi and Padma Misra , "Basic Technical Communication", PHI, 2011.
4. Herta A Murphy, Herbert W Hildebrandt and Jane P Thomas, "Effective Business Communication", McGraw Hill, seventh edition.

ACCOUNTING AND FINANCIAL MANAGEMENT

Code: 25CM101
Max Marks: 70

Course Objectives: The objective of the course is to understand basic accounting principles and financial statements, analyze financial data for decision-making and learn budgeting, costing, and financial planning concepts.

UNIT I **(08 Hrs)**
Introduction – Principles – Concepts & Conventions – Double entry system of accounting – Journal – Ledger. Preparation of trial balance. Subsidiary Books with special reference to simple cash book and three column cash book.

UNIT II **(08 Hrs)**
Final accounts of sole trader: Adjusting entries, Including reserve for bad debts, Reserve for discount on debtors and creditors, Preparation of final accounts.

UNIT III **(08 Hrs)**
Introduction – Meaning, Scope, Functions of finance manager. Unit Costing: Preparation of cost sheet.

UNIT IV **(08 Hrs)**
Ratio analysis: Meaning of ratio – Advantages – disadvantages – types of ratio – usefulness – liquidity ratios – profitability ratios, Efficiency ratios, Solvency ratios.(Theoretical concepts) Funds Flow Statement: Meaning – concepts of funds flow. Cash flow statement :Meaning, Need – Simple problems on cash flow statement.

UNIT V **(08 Hrs)**
Marginal Costing: Meaning – Definition – Concepts in marginal costing – Marginal equations – P / V ratio – B.E.P – Margin of safety – Sales to earn a desired profit – Problems on above Budgetary control: Meaning – Definition – Preparation of flexible budget and cash budget.

Textbook:

1. Financial Accounting, Ashis Bhattacharya, Prentice-Hall India Publication.
2. Prasanna Chandra, Financial Management, Tata McGraw-Hill Publications

Reference Books:

1. "Book Keeping and Accountancy" Choudhari, Chopde.
2. "Cost Accounting": Choudhari, Chopde.
3. "Financial Management" Text and Problems: M.Y.Khan, P.K. Jain.
4. "Financial Management Theory & Practice" Prasanna Chandra Tata McGraw-Hill.
5. Managerial Economics & Financial Analysis, Siddiqui S.A. Siddiqui A.S. New Age.

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IT LAB

Code: 24CS191
Max. Marks: 70

(BASED ON 25CS101) Fundamentals of IT:
Core Practicals (Implement minimum 10 out of 15 practicals)

1. To explore the System settings - Personalisation, System, Devices, Apps, Network & Internet.
2. To practice basic DOS commands like cd, md, dir, erase, cls, copy, date etc.
3. To explore Windows Explorer functionalities like create, rename, move, delete folder and files etc.
4. To practice the use of basic formatting features - Format Painter, Indentation, Line spacing, background color, find, replace, dictate commands.
5. To practice the use of Bullets, numbering, multilevel lists and use of Table Feature- Insert table with rows and columns, draw tables, excel spreadsheet and quick tables etc.
6. To practice the use of Insert Features – add picture, Chart, SmartArt, WordArt, Equation, Symbols, Header and Footer, Page Numbering etc. and the use of Design Features – Watermark, Page color, Page Border, Themes implementation etc.
7. To practice the use of Layout Features – Margins, Orientation, Size, Columns, Indent, Spacing etc.
8. To practice the use of Mail Merge Feature to generate Envelops and Labels.
9. To practice the use of Excel basic formatting features – Wrap Text, Insert and Delete (Cells, Sheet, Row or Column), Format – Cell Height, Cell Width, Hide, Un Hide Cell, Protection, Freeze and Unfreeze panes, Macros etc.
10. To practice the use of Insert Features- Pivot Table, Pivot Chart, Picture, Chart and its formatting and Design and the use of Page Layout Features- Margins, Orientation, Page Break , Background, Height and Width of Cells.
11. To practice the use of Formula Features – user defined function, pre-defined functions – Logical, Date, Time, Maths and the use of Data Manipulation Features – Sort, Filter, Advanced Filters, Whatif analysis.
12. To practice the creation of Blank presentation and Selecting Themes and the use of the basic design features – Adding New Slides, Reuse slides, Slides layout etc.
13. To practice the use of Insert Features – add pictures, screenshots, shapes, wordart, audio, video, date-time etc. and use of Design Features- Changing the theme of presentation, format background and design ideas.
14. To practice the use of Transition features to be applied on Slides content, setting sound, duration etc. and the use of Animation Features to be applied on presentation of Slide, set animation timings and rehearse etc.
15. To practice the use of Slide Show Features – Custom Slide Show, Rehearse Timing etc.

Application Based Practicals (Implement minimum 5 out of 8 practicals)

16. Create a Folder by your name in your system, store all the work done in this semester inside that folder.
17. Create your Resume using basic formatting features like : table, bullets, wordart etc.
18. Design an Invitation to Birthday Party using mail merge features send the invitation to 10 friends.
19. Write an Article for Magazine with 3 columns and hyperlink.
20. Create your own marksheet using basic formatting features.
21. Create a list of marks of 10 students create charts and pivot table.
22. Prepare a Sales summary and use features like sort, filter etc. to manipulate the data.
23. Create a Power Point Presentation on any topic of your choice using animation and transition features.

Note:

1. **In total 15 practical to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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C PROGRAMMING LAB

Code: 24CS192 B
Max. Marks: 70

(BASED ON 25CS102) C Programming:
Core Practicals (Implement minimum 8 out of 10 practical)

1. Write a program to convert temperature from Celsius to Fahrenheit by taking input from the user.
2. Write a program to find the greatest number among 3 numbers given by the user.
3. Write a program to check if a given number is a prime number or not.
4. Write a program to display the following pattern up to N rows, taking the value of N from the user:

```
1
2   3
4   5   6
7   8   9   10
```

5. Write a program to input marks of 50 students using an array and display the average marks of the class.
6. Write a program to search for a number entered by the user in a given array and display the array in ascending order.
7. Write a program to check if a string is palindrome or not.
8. Write a program to add, subtract, multiply and divide two numbers using pointers.
9. Write a program to create a structure for employees containing the following data members: Employee ID, Employee Name, Age, Address, Department and Salary. Input data for 10 employees and display the details of the employee from the employee ID given by the user.
10. Write a program to create two files with names EvenFile and OddFile. Input 20 numbers from the user and save even numbers in EvenFile and odd numbers in OddFile.

Application Based Practicals (Implement minimum 5 out of 10 practicals)

11. Write a menu driven program to construct a calculator for following arithmetic operations: addition, subtraction, multiplication, division, average and percentage.
12. Write a menu driven program to perform the following operations:
    (i) Print armstrong numbers upto N,
    (ii) Display prime numbers between 1 to N,
    (iii) Reverse of an integer
13. Write a program to convert a hexadecimal number into a binary number.
14. Write a program to calculate factorial of a number and display fibonacci series upto N terms using recursive functions.
15. Write a program to perform
    (i) matrix addition,
    (ii) matrix multiplication, and
    (iii) Matrix transpose on 2D arrays.
16. Write a program to make use of arrays with structures in the following ways:
    (i) Use array as a structure data member
    (ii) Create array of structure variables
17. Write a program to compare the contents of two files by taking names of the files through command line arguments.
18. WAP to perform I/O and make use of file positioning functions on Binary files. (using fseek, ftell, rewind functions)
19. Write a menu driven program to implement the following string operations:
    (i) Calculate length of a string
    (ii) Concatenate at the end of a given
    (iii) Copy one string to another
    (iv) Compare contents of two strings
    (v) Copy nth character string to another
20. Write a program to read time in string format and extract hours, minutes and second also check time validity

Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**

2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

Theory Paper

Total: 100 Marks
External: 70 Marks
Internal: 30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

Lab

Practical: 100 Marks
External: 70 Marks
Internal:30 Marks

External (Two programs): 70 Marks
- **Program Writing**: 10 + 10 Marks
- **Algorithm& Flowchart**: 5 + 5 Marks
- **Program Execution**: 15 + 15 Marks
- **Viva**: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
- **Record**: 5 Marks
- **Attendance**: 5 Marks
- **Program Writing**: 15 Marks
- **Program Execution**: 15 Marks
- **Viva**: 10 Marks

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Syllabus for BCA-AIML

Semester 2

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**External Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
25CS201	Data Structure and Algorithm Using 'C'	4	0	0	4	70	30	0	100
25CS202	Database Management System	4	0	0	4	70	30	0	100
25CS203	Web Based Programming	4	0	0	4	70	30	0	100
25GN201	Human Values and Ethics	2	0	0	2	70	30	0	100
Skill Enhancement Course (SEC-1) (Choose any one)									
25CS211	Front End Design Tool Lab VB.Net	2	0	1	3	70	30	0	100
25CS212	Statistical Analysis using Excel	2	0	1	3	70	30	0	100
25CS213	Designing Lab Photoshop	2	0	1	3	70	30	0	100
Practical									
25CS291	Data Structures Using C Lab	0	0	2	2	0	30	70	100
25CS292	Database Management System Lab	0	0	2	2	0	30	70	100
25CS293	Web Technologies Lab	0	0	2	2	0	30	70	100
	Total				**23**	**350**	**240**	**210**	**800**

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Detailed Syllabus

DATA STRUCTURE AND ALGORITHM USING C

Code: 25CS201
Max Marks: 70

Course Objectives: The objective of the course is to learn fundamental data structures and their applications, implement algorithms for searching, sorting, and recursion in C and analyze algorithm efficiency and performance.

UNIT I **(14 Hrs)**
Linear Data Structures- Static: Introduction to Algorithms- Attributes, Design Techniques, Time Space Trade Off, Data Structures, Classification and Operations of Data Structures.
Arrays: Single Dimension, Two-Dimension and Introduction to Multi-Dimensional, Memory Representation, Address Calculation, Sparse Matrices- Types, Representation.
Searching and Sorting: Linear and Binary Search, Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Elementary Comparison of Searching and Sorting Algorithms.
Hashing: Hash Table, Hash Functions, and Collision Resolution.

UNIT II **(10 Hrs)**
Linear Data Structures- Dynamic
Introduction: Dynamic Memory Allocation, Dynamic Memory versus Static Memory Allocation.
Linked List Types: Singly Linked List, Doubly Linked List, Header Linked List, Circular Linked List.
Operations: Creation, Insertion, Deletion, Modification, Searching, Sorting, Reversing, and Merging.

UNIT III **(6 Hrs)**
Abstract Data Types:
Stacks: Introduction, Static and Dynamic Implementation, Operations, Applications- Evaluation and Conversion between Polish and Reverse Polish Notations.
Queues: Introduction, Static and Dynamic Implementation, Operations, Types- Linear Queue, Circular Queue, Doubly Ended Queue, Priority Queue.

UNIT IV **(10 Hrs)**
Non-Linear Data Structures:
Introduction to Graphs: Notations & Terminologies, Representation of Graphs- Adjacency Matrix, Incidence Matrix and Linked Representation.
Trees: Notations & Terminologies, Memory Representation, Binary Trees Types- Complete, Full, Strict, Expression Binary Tree, Tree Traversals (Recursive), Binary Search Tree and Basic Operations.
Introduction and Creation (Excluding Implementation): AVL Tree, Heap Tree, M- Way Tree, and B Tree.

Textbook:

1. Schaum's Outline Series, "Data Structures", TMH, Special Indian Ed., Seventeenth Reprint, 2014.
2. Y. Langsam, M. J. Augenstein and A.M. Tanenebaum, "Data Structures using C and C++", Pearson Education India, Second Edition, 2015.
3. D. Samanta, "Classic Data Structures", PHI, Second Edition, 2009.

Reference Books:

1. Ashok N kamthane "Introduction to Data Structures in C", Pearson, Third Edition, 2009.
2. E. Horowitz and S. Sahni, "Fundamentals of Data Structures in C". Universities Press, Second edition, 2008.
3. D. Malhotra and N. Malhotra, "Data Structures and Program Design using C", Laxmi Publications, Indian adapted edition from Mercury Learning and Information-USA, First edition, 2018.
4. Y. Kanetkar "Data Structures through C", BPB Publication, Third Edition, 2019.
5. R.F Gilberg, and B A Frouzan- "Data Structures: A Pseudocode Approach with C", Thomson Learning, Second Edition, 2004.
6. A. K. Rath, and A.K. Jagadev, "Data Structures and Program Design Using C", Scitech Publications, Second Edition, 2011.

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DATABASE MANAGEMENT SYSTEM

Code: 25CS202
Max Marks: 70

Course Objectives: The objective of the course is to understand database concepts, models, and architectures, design and implement relational databases using SQL and learn normalization, indexing, and transaction management.

UNIT I **(10 Hrs)**

Introduction: An overview of database management system, Characteristics of database approach, DBMS architecture, client/server, data Models, Introduction to Distributed Data processing, schema and instances, data independence.

Data Modelling using Entity Relationship Model: Basic introduction about the terminologies like Entity, Entity types, Entity set, Notation for ER diagram, Attributes and keys, Types of attributes (composite, derived and multivalued attributes) and keys (Super Key, candidate key, primary key), Relationships, Relation types, Weak entities, Enhanced E-R, Specialization and Generalization.

UNIT II **(13 Hrs)**

Introduction to SQL: Overview, Characteristics of SQL. Advantage of SQL, SQL data types and literals.
Types of SQL commands: DDL, DML, DCL. Basic SQL Queries.
Logical operators: BETWEEN, IN, AND, OR and NOT.
Null Values: Disallowing Null Values, Comparisons Using Null Values.
Integrity constraints: Primary Key, Not NULL, Unique, Check, Referential key.
Introduction to Nested Queries, Correlated Nested Queries, Set-Comparison Operators, Aggregate Operators: The GROUP BY and HAVING Clauses.
Joins: Inner joins, Outer Joins, Left outer, Right outer, full outer joins.
Overview of other SQL Objects: Views, Sequences, Indexes, Triggers and stored procedure.

UNIT III **(10 Hrs)**

Relational Data Models: Relational model terminology domains, Attributes, Tuples, Relations, Characteristics of relations, Relational constraints Domain constraints, Key constraints and Constraints on null, Relational DB schema. Codd's Rules.
Relational Algebra: Basic operations selection and projection.
Set Theoretic Operations: Union, Intersection, Set difference and division (Order, Relational calculus: Domain, Tuple, Well Formed Formula, Specification, Quantifiers).
Join operations: Inner, Outer, Left outer, Right outer, and Full outer join.
ER to relational mapping: Steps to map ER diagram to relational schema.
Data Normalization: Functional dependencies, Armstrong's inference rule, & Normalization (Up to BCNF)

UNIT IV **(7 Hrs)**

Transaction Processing: Definition of Transaction, Desirable ACID properties.
Database recovery and Database Security: System failure, Backup & recovery Techniques, Authentication, Authorization.
Overview of Query by Language, No Sql databases.

Textbook:

1. R. Elmarsi and SB Navathe, "Fundamentals of Database Systems", Pearson, 5th Ed.
2. Singh S.K., "Database System Concepts, design and application", Pearson Education [TB3] TB3.
3. Ramakrishnan and Gherke, "Database Management Systems", TMH.
4. Bipin Desai, "An Introduction to Database Systems", Galgotia Publications, 1991.

Reference Books:

1. Abraham Silberschatz, Henry Korth, S. Sudarshan, "Database Systems Concepts", 6th Edition, McGraw Hill, 2010.
2. Jim Melton, Alan Simon, "Understanding the new SQL: A complete Guide", Morgan Kaufmann Publishers, 1993.
3. A. K. Majumdar, P. Battacharya, "Database Management Systems', TMH, 2017.

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WEB BASED PROGRAMMING

Code: 25CS203
Max Marks: 70

Course Objectives: The objectives of the course is to learn basics of HTML, CSS, JavaScript, and server-side scripting, build and deploy interactive web applications and understand client-server architecture and web protocols.

UNIT I **(8 Hrs)**

Introduction: World Wide Web, Client Server computing concepts. Web Client and Web Server, Client Side and server-side Scripting Languages.
HTML Overview: Introduction to HTML, HTML Document structure tags, HTML comments, Text formatting, inserting special characters, Anchor tag, Adding images and Sound, Lists types of lists, Tables, Frames and Floating frames, Developing Forms, Image maps.

UNIT II **(12 Hrs)**

Cascading Style Sheet: Types of Style Sheets – Internal, inline and External style sheets, creating styles, link tag, CSS Properties, CSS Styling, Style Selector- Id, class name and Pseudo Class.
Bootstrap Basics: Introduction to Bootstrap, Responsive web design, Linking with Bootstrap, container class, grids, tables, images, buttons, typography classes, jumbotron, glyphicons.
Introduction to Java Script: Data Types, Control Statements, operators, dialog boxes, built in and User Defined Functions, Objects in Java Script, Handling Events, basic validations, Document Object Model, Browser Object Model.

UNIT III **(12 Hrs)**

Introduction to web applications, Client-Side Scripting Vs Server-Side Scripting, Web Servers: Local Servers and Remote Servers, Installation Process - WAMP, LAMP, XAMPP & MAMP Server, Static website vs Dynamic website development.
Introduction to PHP: Data types, Variables, Super Global Variables, Constants, Comments, Operators and Expressions, Regular Expression, Advantages of PHP.
Control statements: Conditional Statement -if else, if elseif else, nested if, switch case, PHP Loops – for, while, do while and foreach loop.
Arrays: Indexed Array, Associate Array, Multi-dimensional Array, Array pre-defined Functions.
Functions: Defining and Calling Functions, Passing by Value and passing by references, Inbuilt Functions, variable scope, Mail function, PHP Errors
Working with Forms: Get and Post Methods, HTML form controls and PHP, State Management: Cookies, Session, Query String, Hidden Field.

UNIT IV **(8 Hrs)**

PHP Database Connectivity: Using PHP to Access a Database, Relational Databases and SQL, PHP Data Objects, MySQLi Object Interface, SQLite, MongoDB.
Introduction to MYSQL, creating database and other operations on database, Querying a MySQL database with PHP database, Connecting to a database, Parsing of the query results, Checking data errors.

Textbook:

1. The complete reference HTML and CSS, by Thomas A powell, TMH publication.
2. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Pearson
3. Internet and World Wide Web Deitel HM, Deitel, Goldberg, Third Edition.
4. Bootstrap: Responsive Web development, Jake Spurlock, O’reilly, First Edition
5. Programming PHP: Creating Dynamic Web Pages, Kevin Tatroe. Peter Macintyre, Rasmus Lerdorf, O'Reilly, Third Edition

Reference Books:

1. HTML Black Book, Stephen Holzner, Wiley Dreamtech.
2. Rajkamal, “Web Technology”, Tata McGraw-Hill, 2001.
3. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Pearson.
4. Professional PHP Programming, Jesus Castagnetto, Harish Rawat, Sascha Schumann, Chris Scollo, Deepak Veliath - Wrox Publications.
5. PHP 5 Advanced, Larry Ullman, Peachpit Press.
6. Core PHP Programming. Leon Atkinson (Prentice Hall, ISBN 0130463469).

7. Beginning PHP5 and MySQL: From Novice to Professional, W. Jason Gilmore, 2004, Apress, ISBN: 1-893115- 51-8.

HUMAN VALUES AND ETHICS

Code: 25GN201
Max Marks: 70

Course Objectives: The objective of the course is to understand the importance of ethics and human values in life and profession, develop moral reasoning and ethical decision-making and promote responsibility, respect, and integrity.

UNIT I **(5 Hrs)**
Introduction to human values:

- Understanding the need, Basic guidelines, Process of Value Education.
- Understanding the thought-provoking issues- Continuous happiness and Prosperity.
- Right understanding- relationship and physical facilities, Choice making- choosing, Cherishing and Acting.
- Understanding values- Personal Values, Social values, Moral values and Spiritual values, Self-Exploration and Awareness leading to Self-Satisfaction; Tools for Self-Exploration.

UNIT II **(5 Hrs)**
Harmony and role of values in family, society and human relations

- Understanding harmony in the Family- the basic unit of human interaction; Understanding values in human- human relationship; Understanding harmony in the society-human relations.
- Interconnectedness and mutual fulfilment; Coexistence in nature.
- Holistic perception of harmony at all levels of existence-universal harmonious order in society.
- Visualizing a universal harmonium order in society- undivided society (Akhand Samaj), universal order (SarvabhaumVyawastha)- from family to world family.

UNIT III **(5 Hrs)**
Coexistence and role of Indian Ethos:

- Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature.
- Ethos of Vedanta; Application of Indian Ethos in organizations in management; Relevance of Ethics and Values in organizations in current times.

UNIT IV **(5 Hrs)**
Professional ethics

- Understanding about Professional Integrity, respect and equality, Privacy, Building Trusting relationships, Co-operation, Respecting the competence of other profession.
- Understanding about taking initiative, Promoting the culture of openness, Depicting loyalty towards goals and objectives.
- Ethics at the workplace: - cybercrime, plagiarism, sexual misconduct, fraudulent use of institutional resources, etc.
- Ability to utilize the professional competence for augmenting universal human order.

Textbook:

1. A Textbook on Professional Ethics and Human Values by R S Naagarazan.
2. A Foundation Course in Human Values and Professional Ethics by R.R. Gaur, R. Sangal, G.P. Bagaria.
3. Indian Ethos and Modern Management by B L Bajpai New Royal Book Co., Lucknow., 2004, Reprinted 2008.

Reference Books:

1. A N Tripathy, 2003, Human Values, New Age International Publishers
2. Human Values and Professional Ethics by Vaishali R Khosla, Kavita Bhagat
3. I.C. Sharma. Ethical Philosophy of India Nagin & co Julundhar

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FRONT END DESIGN TOOLS LAB VB.NET

Code: 25CS211
Max Marks: 70

Course Objectives: The objective of the course is to learn to design user-friendly graphical interfaces using VB.Net, develop event-driven applications with forms and controls and implement basic logic and database connectivity in front-end design.

UNIT I **(15 Hrs)**

Introduction to Visual Basic .Net Framework: . Net Architecture, Features of .Net, Advantages of .Net, .Net Framework, CLR, CTS, CLS, Assemblies, Memory management issues – Garbage Collector and collection process. Introduction to Visual Basic.Net IDE: Creating a project, Types of project in .Net, Exploring and coding a project, Solution explorer, toolbox, properties window, Output window, Object Browser.
Programming Basics: Variable, Data Types, Conditional Constructs, Loop Statements, Creating Console Application.

UNIT II **(5 Hrs)**

Introduction to GUI Environment and understand the working of commonly used controls - their properties, methods and events.

UNIT III **(5 Hrs)**

Introduction to Data Structures: Array, ArrayList, Structure and Enumeration. Introduction of Exception handling - structured and unstructured.

UNIT IV **(5 Hrs)**

Procedure and function. Introduction to Object Oriented Programming: OOPS Concepts, Creation of Class, Interface and Namespace.

List of Practicals

Core Practicals (Implement minimum 10 out of 15 practicals)

1. Create console application showing the use of conditional constructs - if, if-else, if-elseif-else, nested if, select case.
2. Create console application showing the use of loops –Do While..Loop, Do Until … Loop, While... Wend, For … Next, For Each … Next.
3. Create a simple windows application showing the use of TextBox, Button, Label Controls, Radio Button, Check Box, Combo Box and List Box Controls
4. Create a windows application showing the use of Image, Timer, Panel, Scroll bar, Status Bar Controls.
5. Create an MDI application showing the use of multiple forms, toolbar, menu, status bar, RichText Box, Dialog Controls.
6. Create console/windows application to showing the use of Structured Exception handling- try..end try, catch, finally.
7. Create console/windows application to showing the use of Unstructured Exception handling- On Error, Resume Next etc.
8. Create console/windows application showing the use of Array class - its methods and properties.
9. Create console/windows application showing the use of Array List - its methods and properties.
10. Create console/windows application showing the use of Enumeration, Constants and Structures.
11. Create console/windows application showing the declaration and use of user defined functions.
12. Create console/windows application showing the use of different argument passing mechanism – ByVal, ByRef, Optional and Paramarray.
13. Create console/windows application showing the declaration and use of Class with Data members, Function Member, Constructor Member, Destructor Member, Event Member, Property Member, Shared Member, Type Member.
14. Create console/windows application showing the implementation of Inheritance.
15. Create console/windows application showing the use of Polymorphism.

Application Based Practicals (Implement minimum 5 out of 10 practicals)

16. Write a Program to find diameter, circumference and area of circle using procedure.
17. Write a Program to find maximum between three numbers using select case and if--else.
18. Create Basic calculator with all the functionalities.
19. Create a basic Digital or Analog Clock using Timer, Image, Button, ComboBox and other relevant controls.

20. Write a Program to find second largest element and second smallest element in an array.
21. Write a program to create an arraylist of 10 elements. Create a procedure to add new element at the specific location in the arraylist and display the updated arraylist.
22. Write a program to validate the username and password entered by user and create userdefined exception to prompt message on three consecutive wrong password entries.
23. Create a Class Box with following private data members length, breadth, height andfunction getVolume, and public member functions input and output. Create an object of class and call appropriate functions.
24. Create a class Rectangle, with protected members width and height, public procedure setWidth and setHeight, getArea. Inherit it in another Class ShrinkRectangle with a data member shrink factor. Create object of the class and call appropriate member functions. Create appropriate class to demonstrate overloading of function 'area' for finding area of a circle, square, rectangle and a triangle.
25. Create a class Book with data members: BookId, BookName, Cost, Pages. Member property to add data to all its data members, function to find cost per page. Create five objects of 5 books and find total cost.

Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

STATISTICAL ANALYSIS USING EXCEL

Code: 25CS212
Max Marks: 70

Course Objectives: The objective of the course is to apply Excel functions for statistical data analysis, use charts, pivot tables, and descriptive statistics tools and perform regression, correlation, and hypothesis testing.

UNIT I **(10 Hrs)**

Introduction to Statistics: Defining statistics, Importance of Statistics, application of statistics in real life scenarios. The skills and characteristics needed to deal with the data. The importance of IT tools in the usage of statistical data. MS Excel as the IT tool for dealing with statistical data. Features of MS Excel.

UNIT II **(10 Hrs)**

Introduction to MS Excel. Basic structure of MS Excel. Cells, range, Tabs and the importance of formulae in MS Excel for dealing with statistical data. Introduction to Data analysis tab and the various statistical features available in data analysis tab. Installing Data analysis tab. using statistical functions of MS Excel for data analysis.

UNIT III **(5 Hrs)**

The application of Measures of central tendency by using MS Excel. Frequency distribution, Graphical representation of data along with formatting features of various graphs. Measures of Central Tendency with its illustration in MS Excel.

UNIT IV **(5 Hrs)**

The measures of Dispersion by using MS Excel. The consolidation of data by using Pivot table, the Data table, Scenarios, and Goal seek functions by using data to predict future scenarios. The illustration of correlation and regression in predicting.

Textbook:

1. Understanding Educational Statistics Using Microsoft Excel and SPSS. Edition No. 1, Martin Lee Abbott, John Wiley and Sons. Ltd, 2011.
2. Statistics for Management Using Microsoft Excel, Ash Narain Sah, John Wiley, 2018.

Reference Books:

1. Statistics with Microsoft Excel by Dretzke, Beverly Jean, Prentice Hall, 2019.
2. Applied Statistics with Microsoft Excel, Gral Keller, Cengage, 2015.

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List of Practicals

1. Enter the marks of 20 students in the given order:
   - Serialnumber
   - Nameofthe student
   - Nameofthe college
   - Class
   - Subject-1
   - Subject-2
   - Subject-3
   - Subject-4

In a separate column, perform the following operations. Calculate the following:

a. Total marks of all the subjects
b. Percentage of marks for each of the students
c. Allotment of grades based on the criterion:
   - If the marks are more than 75% then the result is "Pass" else "Fail"
d. Now in other column allot the grades based on the following criterion:
   - If the marks are more than 90% then grade is "A"
   - If the marks are more than or equal to 75 and less than 90% then the grade is "B" else the grade if "C" provided that the result is "Pass".

2. From the following table, calculate the following:

City	Number of Schools	Number of candidates
NewDelhi	300	30000
Mumbai	450	45000
Bengaluru	500	48000
Chennai	480	67000
Trivandrum	459	77000

   - The average number of students in the entire distribution
   - The standard deviation of the distribution
   - The correlation coefficient between the number of schools and the number of candidates
   - The regression equation between number of students and number of candidates

3. From the following table, calculate the following:

Base City	Department	Client	Location	Nationality
New Delhi	Marketing	Adidas	New York	American
Mumbai	Advertising	Hilfiger	London	English
Bengaluru	Human Resource	Woodland	Paris	Spanish
Chennai	Human Resource	Nike	Sydney	Dutch
Trivandrum	Advertising	Allen Solley	Frankfurt	Japanese
New Delhi	Quality Control	Adidas	New York	American
Mumbai	Advertising	Hilfiger	Seoul	Korean
Bengaluru	Human Resource	Woodland	Paris	Spanish
Chennai	Human Resource	Nike	Sydney	Dutch
Trivandrum	Advertising	Armani	Frankfurt	Russian
New Delhi	Marketing	Adidas	New York	American
Mumbai	Production	Hilfiger	Copenhagen	English
Bengaluru	Human Resource	Woodland	Paris	Spanish
Chennai	Human Resource	Nike	Sydney	Russian
Trivandrum	Advertising	Gucci	Frankfurt	Japanese
New Delhi	Quality Control	Adidas	New York	American
Mumbai	Advertising	Hilfiger	London	Korean
Bengaluru	Human Resource	Woodland	Paris	Spanish
Chennai	Human Resource	Nike	Sydney	Dutch
Trivandrum	Advertising	Allen Solley	Frankfurt	Japanese

Using Pivot table, determine

- The number of Nationality per Location
- The number of Department/location/ client
- The number of client/location/ nationality

4. From the following table, calculate the following:

Qty↓/Price→	**10**	**20**	**30**	**40**
25	**250**	**500**	**750**	**1000**
35	**350**	**700**	**1050**	**1400**
45	**450**	**900**	**1350**	**1800**
55	**550**	**1100**	**1650**	**2200**
65	**650**	**1300**	**1950**	**2600**

Using Datatable, prepare the above tabular distribution

5. Using the Goal seek function of Excel, prepare the following table for calculating the amount based on the simple interest formula.

Principal Amount	
Rate	
Time	2
Amount	1040

Simulate the amount by differing values of

- Principle amount
- Rate
- Time

DESIGNING LAB PHOTOSHOP

Code: 25CS213
Max Marks: 70

Course Objectives: The objective of the course is to learn basic tools and features of Adobe Photoshop, create and edit digital graphics and layouts and apply design principles to produce visually appealing content.

UNIT I **(8 Hrs)**
Introduction to graphic designing, Input/output Technologies, Colour Coding: RGB, CMYK, Grayscale, Bitmap, Color Channel, Resolution, Printing Templates, Raster Images, Vector Images, Measurement Units & Conversion, Introduction to Adobe suite & Photoshop.

UNIT II **(8 Hrs)**
Introduction to graphic designing, Input/output Technologies, Colour Coding: RGB, CMYK, Grayscale, Bitmap, Colour Channel, Resolution, Printing Templates, Raster Images, Vector Images, Measurement Units & Conversion, Introduction to Adobe suite & Photoshop.

UNIT III **(7 Hrs)**
Introduction to Shapes & Shape Tools, Path & Direct Selection Tools, Pen Tool, Image Editing Tools, Layers Style, Filters, Blend Modes, Image Adjustment Options, Window Menu Options, Layer Mask.

UNIT IV **(7 Hrs)**
Introduction to Photoshop Filter: Blur, Distort, Noise, Render, Sharpen, Stylize, Exporting Images & PDF, Introduction to GIF & Timeline Window, Importing/Exporting CorelDraw Files from Photoshop.

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List of Practicals
Core Practicals (Implement minimum 8 out of 10 practicals)

1. Create a file to demonstrate the use of layers, groups & smart objects.
2. Create a photo frame in Photoshop.
3. Take an image of basic shape (square, triangle, circle, rectangle and parallelogram) in Photoshop & extract these shapes from the image to different layers using marquee
4. Create a custom brush preset in Photoshop.
5. Create a custom pattern preset in Photoshop.
6. Create a visiting card for yourself in Photoshop. (size=3.5 x 2 inch., color coding: CMYK)
7. Create a file having two images (rename the layer as foreground & background image) in two different layers. Blur the background image & place the foreground image over the background image in a way both layers are visible.
8. Create a border design using a brush tool.
9. Create basic shapes (square, triangle, circle, rectangle and parallelogram) in Photoshop on a single layer using the shape tools.
10. Create a simple GIF in Photoshop.

Application Based Practicals (Implement minimum 5 out of 10 practicals)

11. Create a digital invitation card in Photoshop and export it in PDF Format. Use the Photograph (Practical 7) or GIF (Practical 10) and border (Practical 8) along with other features of Photoshop as per your requirements. (size=A8 or A4, color coding: RGB)
12. Create a custom Desktop background in Photoshop.
13. Create a water drop and heart shape in Photoshop using the shapes tools or Pen Tool.
14. Create a "Save Water" Poster from the shapes created in Practical 13. (size=A8 or A4, color coding: CMYK)
15. Perform Digital Makeup on the Photograph of some celebrity in Photoshop.
16. Create a cartoon character in Photoshop using the Shape and Pen Tools.
17. Create a chocolate bar with the brand name in Photoshop. The individual cube of the chocolate must have a 3D Visual Effect.
18. Create your company logo in Photoshop.
19. Create a magazine Cover in Photoshop.
20. Create a Thanks Giving card & export it in Pdf (size=A8 or A4, color coding: RGB)

Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

1. Make following five different web pages:
   i. Formatting Styles and Headings: Include Bold, italics, Underline, Strike, Subscript, superscript and all six type of headings
   ii. Font Styles and Image tag
   iii. Marquee: Move text, image and hyperlink
   iv. Other tags: br, hr, pre, p

   Include following specifications:
   - In all these web pages only mention about use, attributes apply them.
   - Insert a background image on homepage.
   - Make all the topics as hyperlinks and go to some other page for description.
   - Insert a marquee showing HTML Tutorial as moving text.
   - Use different font style for different topics.
   - On every page, make a hyperlink for going back to home page and internal link also.

2. Create an unordered list nested inside ordered list and apply the following:
   - Insert an image of Main item on top right corner of web page.
   - Display heading as a marquee.
   - Use different font styles and colors for different ordered list items.
   - Insert horizontal line after each ordered item.

3. Design a table with row span and column span and make use of attributes colspan, rowspan, width, height, cellpadding, cellspacing etc.
4. Design following frame:

<table>
<tr><td rowspan="4">MAIN MENU
Topic 1
Topic 2
Topic 3</td><td>Explanation

View Example</td></tr>
<tr><td>Example</td></tr>
</table>

5. Make an image map showing the usage of shape, coords, href attributes in mapdefinition. Link each hotspot to their respective details. All the web pages should be designed with proper background color, images, font styles and headings.
6. Design Student registration form for admission in college.
7. Create a webpage and show the usage of inline and internal style sheet and external style sheet?
8. Create a webpage containing a background image and apply all the background styling attributes?
9. Create a webpage showing the usage of font styling attributes
10. Create a webpage and apply all Text styling attributes use Id and class selector.
11. Create a webpage and implement all list styling attributes.
12. Create a Webpage with three equal columns.
13. Create a webpage containing bootstrap table.
14. Create a webpage containing various types of images.
15. Create a webpage containing various types of buttons
16. Create a webpage containing various, typography classes.
17. Create a webpage containing to display the heading using. Jumbotron.
18. Write a program to show the usage of inbuilt functions and dialog boxes.
19. Write a program to show the usage of alert box and confirm box
20. Write a program to implement event handling using onclick, onmouseover and onmouseout events.
21. Write a program to show the usage of all the date, math and string object functions
22. WAP to display the bookstore details in XML with CSS and internal DTD.
23. WAP to format the Teacher details in XML with CSS using external DTD

Application Based Practical

24. Design the registration form for a web site and when the user clicks on submit button the login form should be appeared on the screen (use external javascript file).
25. Design a website and apply all the features of HTML, css, javascript and bootstrap to make the website attractive.
26. Write a JavaScript function that creates a table, accept row, column numbersfrom the user, and input row-column number as content (e.g. Row-0 Column-0) of a cell.
27. Zebra-striped Tables: Setting different background colors for alternate rows is a popular technique to improve the readability of tables that has large amount of data. This is commonly known as zebra-striping a table. Make use of pseudo classes to create zebra stripped Table.
28. Create a Questionnaire related to any topic of your choice by using Form Elements.

Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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DATA STRUCTURE USING C LAB

Code: 24CS291
Max. Marks: 70

(BASED ON 25CS201) Data Structure and Algorithm Using 'C':
Core Practicals (Implement minimum 8 out of 10 practicals)

1. WAP to implement following operation on one dimensional array (i) Insertion (ii)Deletion (iii) Traversal (iv) Reverse (v) Merge.
2. WAP to Sort an array using menu driven:
   (i) BUBBLE SORT (ii) MERGE SORT (iii) INSERTION SORT (iv) SELECTION SORT.
3. WAP to implement a Singly Linked List.
4. WAP to implement a Circular Linked Lists.
5. WAP to implement Doubly Linked Lists.
6. Write a menu driven program to implement (i) Static Stack (ii) Dynamic Stack.
7. WAP to implement a: (i) Static (ii) Dynamic Circular Queue.
8. WAP to implement a: (i) Static (ii) Dynamic De-Queue..
9. Implement recursive algorithms for the following operations on Binary SearchTree.
   (i) Insertion
   (ii) Searching
10. Implement recursive algorithms for BST traversal- Inorder, Preorder, Postorder.

Application Based Practicals (Implement minimum 5 out of 8 practicals)

11. WAP to search & display the location of an element specified by the user, in anarray using: (i) Linear Search (ii) Binary Search technique.
12. WAP to accept a matrix from user, find out matrix is sparse or not and convertinto triplex matrix.
13. WAP to implement Polynomial addition operation using linked list.
14. Write a C program to create two linked lists from a given list in following way:
    INPUT List:- 1 2 3 4 5 6 7 8 9 10 OUTPUT:-
    First List:- 1 3 5 7 9
    Second List:- 2 4 6 8 10
15. WAP to implement Student Database using Linked List with the following structure:
    - Name
    - Rollno
    - Marks of 5 subjects
    - Average
    - Result, If the average < 50, then print 'Fail', otherwise 'Pass'
16. Write a program to convert Infix to equivalent (i) Prefix expression (ii) Postfix expression
17. Write a program to evaluate (i) Prefix Expression (ii) Postfix Expression using stack.
18. Let us assume a Patient's coupon generator for the Doctors' clinic. The patients are given the coupons on first-come-first-serve basis. After the visit of a patient, patient-ID is kept stack-wise. At the end of the day, the count is generated from the stack. Construct a menu-based program for patients' coupons generator using an approprotae data structure.
19. WAP to implement an expression tree. (For example: (a + b / (c * d) – e)).
20. Sometimes a program requires two stacks containing the same type of items. Suppose two stacks are stored in separate arrays, then one stack might overflow while there is considerable unused space in the other. A neat way to avoid this problem is to put all spaces in one stack and let this stack grow from one end of the array, and the other stack starts from the other end and grows in the opposite direction, i.e., toward the first stack. In this way, if one stack turns out to be large and the other small, then they will still both fit, and there will be no overflow until all space is used. Declare a new structure that includes these two stacks and perform various stack operations.

Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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DATABASE MANAGEMENT SYSTEM LAB

Code: 24CS292
Max. Marks: 70

(BASED ON 25CS202) Database Management System:
Core Practicals (Implement All the mentioned practicals)
The following are two suggestive databases. The students may use any one or both databases for their core practicals. However, the instructor may provide any other databases for executing these practical.

1.COLLEGE DATABASE:
STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec)
CLASS (USN, SSID)
SUBJECT(Subcode,Title,Sem,Credits)
IA MARKS (USN, Subcode, SSID, Test1, Test2, Test3, Final IA)

2.COMPANY DATABASE:
EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)
DLOCATION (DNo, DLoc)
PROJECT (PNo, PName, PLocation, DNo)
WORKS_ON (SSN, PNo, Hours)

1. Draw an E-R diagram from given entities and their attributes.
2. Convert the E-R diagram in to a Relational model with proper constraints.
3. Write queries to execute following DDL commands:
   CREATE: Create the structure of a table with at least five columns
   ALTER: Change the size of a particular column.
   Add a new column to the existing table.
   Remove a column from the table.
   DROP: Destroy the table along with its data.
4. Write queries to execute following DML commands:
   INSERT: Insert five records in each table.
   UPDATE: Modify data in single and multiple columns in a table.
   DELETE: Delete selective and all records from a table
5. Write queries to execute following DML command:
   SELECT: Retrieve the entire contents of the table.
   Retrieve the selective contents (based on provided conditions) from a table.
   Retrieve contents from a table based on various operators i.e. string operators, logical operators, conditional operators and Boolean operators.
   Sort the data in ascending and descending order in a table on the basis of one column or more than one column.
6. Create table using following integrity constraints:
   - PrimaryKey
   - Unique Key
   - Not Null
   - Check Default
   - Foreign Key
7. Write queries to execute following Aggregate functions:
   Sum, Avg, Count, Minimum and Maximum value of a numeric column of a table using aggregate function.
8. Retrieve data from a table using alias names.
9. Retrieve data of a table using nested queries.
10. Retrieve data from more than one table using inner join, left outer, right outer and full outer Joins.
11. Create view from one table and more than one table.
12. Create index on a column of a table.

Application Based Practicals

13. Consider the Insurance company's Database given below. The primary keys are underlined and the data types are specified.
    PERSON (driver_id#: string, name: string, address: string)

CAR (reg no : string, model: string, year: int)
ACCIDENT (report_number:int, acc_date: date, location: string)
OWNS (driver_id#: string, reg no: string)
PARTICIPATED (driver_id#: string, reg no: string, report_number: int, damage_amount: number (10, 2))

(i) Create the above tables by properly specified the primary key and the foreign key
(ii) Enter at least five tuples for each relation
(iii) Demonstrate how you can
  a) Update the damage amount for the car with a specific reg no, the accident with report number 12 to 25000.
  b) Add a new accident to the database.
(iv) Find the total number of people who owned cars that were involved in accident in 2002.
(v) Find the number of accident in which cars belonging to a specific models were involved.

14. Consider the following schema of a library management system. Write the SQL queries for the questions given below:
Student (Stud_no: integer, Stud_name: string)
Membership (Mem_no: integer, Stud_no: integer)
Book_(book_no: integer, book_name: string, author: string)
lss_rec_(iss_no: integer, iss_date: date, Mem_no: integer, book_no: integer)
(i) Create the tables with the appropriate integrity constraints.
(ii) Insert around 10 records in each of the tables.
(iii) Display all records for all tables.
(iv) List all the student names with their membership numbers.
(v) List all the issues for the current date with student and Book names.
(vi) List the details of students who borrowed book whose author is Elmarsi & Navathe.
(vii) Give a count of how many books have been bought by each student.
(viii) Give a list of books taken by student with stud_no as 1005.
(ix) Delete the List of books details which are issued as of today.
(x) Create a view which lists out the iss_no, iss_date, stud_name, bookname.

15. Use the relations below to write SQL queries to solve the business problems specified.
CLIENT (clientno#, name, client_referred_by#)
ORDER (orderno#, clientno#, order_date, empid#)
ORDER_LINE (orderno#, orderlinenumber#, item_number#, no_of_items, item_ cost, shipping_date)
ITEM (item_number#, item_type, cost)
EMPLOYEE (empid#, emp_type#, deptno, salary, first name, last name)
Notes:
a. Column followed by # is the primary key of the table.
b. Each client may be referred by another client. If so, the client number of the referring client is stored in referred_by.
c. The total cost for a particular orderline=no_of_items*item_cost.c.

16. Write queries for the following:
(i) Create all the above tables.
(ii) Insert at least five records.
(iii) Display all the rows and columns in the CLIENT table. Sort by client name in reverse alphabetical order.
(iv) Display the item number and total cost for each order line (total cost = no of items X item cost). Name the calculated column TOTAL COST.
(v) Display all the client numbers in the ORDER table. Remove duplicates.
(vi) Display the order number and client number from the ORDER table. Out put the result in the format. Client <clientno> ordered <orderno>
(vii) Display full details from the ORDER_LINE table where the item number is (first condition) between 1 and 200 (no > or < operators) OR the item number is greater than 1000 AND (second condition) the item cost is not in the list 1000, 2000, 3000 OR the order number is not equal to 1000.
(viii) Display the client name and order date for all orders.
(ix) Repeat query (6) but also display all clients who have never ordered anything.
(x) Display the client name and order date for all orders using the join keywords.

(xi) Display the client name and order date for all orders using the JOIN method.
(xii) Display the client number, order date and shipping date for all orders where the shipping date is between three and six months after the order date.
(xiii) Display the client number and name and the client number and name of the person who referred that client.
(xiv) Display the client name in upper case only and in lower case only.
(xv) Display the second to fifth characters in each client name.

Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirements of the course.**

WEB TECHNOLOGIES LAB

Code: 24CS293
Max. Marks: 70

(BASED ON 25CS203) Web Based Programming:
Core Practicals

1. Write regular expressions including modifiers, operators, and metacharacters.
2. Write a program to show the usage of nested if statement.
3. Write a Program in PHP for type Casting Of a Variables.
4. Write a program to create a menu driven program and show the usage of switch-case.
5. Write a program to show the usage of for/while/do while loop.
6. Write a program to perform all four types of sorting.
7. Write a program to implement Array-pad(), array_slice(), array_splice(), list() functions. (use for each wherever applicable)
8. Write a program to show the application of user defined functions.
9. Write a program that Passes control to another page (include, require, exit and die functions).
10. Write a program to validate the form data using Filter_var() function.
11. Write a program to show the usage of Cookie.
12. Write a program to show the usage of Session.
13. Write a program to implement oops concepts.
14. Do Form handling In PHP Design a personal Information form , then Submit & Retrieve the Form Data Using $_GET(), $_POST() and $_REQUEST() Variables.
15. Design A Login Form and Validate that Form using PHP Programming
16. Create Admin Login, Logout form using session variables.
17. Write a program to create a file.
18. Write a program that use various PHP library functions, and that manipulate files and directories.
19. Write a program to read and display the content of previously created file.
20. Write a program to modify the content of an existing file.
21. Create a web page and which provides File uploading and downloading a file.
22. Design a from which upload And Display Image in PHP.
23. Use phpMyAdmin and perform the following:
24. Write a program to create a mysql database.
25. Write a program to create a table and insert few records into it using form.
26. Write a program to select all the records and display it in table.
27. Write a program to modify (delete/modify/add) a table.
28. Write a PHP script, to check whether the page is called from 'https' or 'http'.

Application Based Practicals:
Note:

1. **In total 15 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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Theory Paper

Total: 100 Marks
External: 70 Marks
Internal: 30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

Lab

Practical: 100 Marks
External: 70 Marks
Internal: 30 Marks

External (Two programs): 70 Marks
- **Program Writing**: 10 + 10 Marks
- **Algorithm& Flowchart:** 5 + 5 Marks
- **Program Execution**: 15 + 15 Marks
- **Viva**: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
- **Record**: 5 Marks
- **Attendance**: 5 Marks
- **Program Writing**: 15 Marks
- **Program Execution**: 15 Marks
- **Viva**: 10 Marks

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Syllabus for BCA-AIML

Semester 3

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**External Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS301	Object Oriented Programming with C++	4	0	0	4	70	30	0	100
24CS321	Basics of Python Programming	4	0	0	4	70	30	0	100
24CS303	Computer Networks	4	0	0	4	70	30	0	100
24GN101	Environmental Studies	2	0	0	2	70	30	0	100
Skill Enhancement Course (SEC-2) (Choose any one)									
24CS311	Designing Lab Corel Draw	0	2	0	2	70	30	0	100
24CS317	Natural Language Processing	0	2	0	2	70	30	0	100
Discipline Specific Elective (DSE-1) (Choose any one)									
24CS323	SAD (System Analysis & Design)	4	0	0	4	70	30	0	100
24CS322	Cyber Ethics	4	0	0	4	70	30	0	100
Generic Elective-1 (Choose any one)									
24MG101	Principles of Management & Organizational Behavior	2	0	0	2	70	30	0	100
24MG102	Probability & Statistics	2	0	0	2	70	30	0	100
Practical									
24CS391	C++ Lab	0	0	2	2	0	30	70	100
	Total				**24**	**490**	**240**	**70**	**800**

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Detailed Syllabus

OBJECT-ORIENTED PROGRAMMING WITH C++

Code: 24CS301
Max Marks: 70

Course Objectives: The objective of the course is to understand the Fundamentals of Object-Oriented Programming (OOP), master C++ Language Syntax and Semantics, design and Implement Classes and Objects, apply Object-Oriented Concepts in Program Design, handle Data Using Advanced Features, develop Reusable and Modular Code, build Real-World Applications and understand the Standard Template Library (STL

UNIT I **(10 Hrs)**

Object Oriented Paradigm: Procedural vs. object-oriented development, Basic concepts of object-oriented programming, Applications and benefits of OOP, Comparison between C and C++.

Beginning with C++: Stream based I/O, Literals- constant qualifiers, Operators in C++, Reference variable, Functions, Default arguments, Parameter passing by value, Reference and pointer, Inline functions, Type conversion, Basic C++ programs, New, Delete operators- basic use and dynamic memory allocation for arrays.

UNIT II **(10 Hrs)**

Classes and Objects: C++ class declaration, Access specifiers, Member functions, Arrays within a class, Array of objects, Memory allocation of objects, Passing objects as arguments, Returning objects from functions, Function overloading, Static data and member functions, Friend function and friend class, This pointer.

Constructors & Destructors: Introduction to constructor and destructor, Parameterized constructor, Constructor with default arguments, Multiple constructors in a class, Copy constructor.

UNIT III **(10 Hrs)**

Inheritance: Types of inheritance, Derivation – public, private & protected, Ambiguity resolution (function overriding), Aggregation, Composition v/s Classification, Virtual base class, Constructor and destructor in derived classes.

Polymorphism: Types of polymorphism, early v/s late binding, Virtual Functions: Need for virtual functions, Pointer to derived class objects, Pure virtual functions, Abstract classes.

Operator Overloading: Overloading unary operators, Nameless objects, Overloading binary operators, Overloading with friend functions, Conversion between basic types and user-defined types.

UNIT IV **(10 Hrs)**

Parametric polymorphism: Generic Programming with Templates, Introduction, Function templates/generic functions, Characteristics, Overloading of template functions, Class templates, Template arguments.

Exception Handling: Exception-handling model, Types of exception, Catching and Handling exceptions, Generic catch, Rethrowing an exception, Specifying exceptions for a function.

Streams & Files: C++ Streams, Basic stream classes, C++ predefined streams, I/O operations, Unformatted console I/O operations, Manipulators, Opening and closing a file- different modes and methods, Error handling during file operations, File pointers and their manipulations, Sequential access to file, Random input and output operations, Persistent objects, Command line arguments.

Textbook:

1. K. R. Venugopal, Rajkumar, T. Ravishanker, “Mastering C++”, TMH
2. E. Balagurusamy, “Object Oriented Programming with C++”, McGraw-Hill Education

Reference Books:

1. Ashok N. Kamthane, “Object-Oriented Programming with ANSI And Turbo C++”, Pearson Education.
2. Schildt Herbert, “C++: The Complete Reference”, Tata McGraw Hill.
3. R. Lafore, “Object Oriented Programming using C++”, Galgotia Publications.

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BASICS OF PYTHON PROGRAMMING

Code: 24CS321
Max Marks: 70

Course Objectives: The objectives of the course is to understand Python Fundamentals, write and Execute Python Programs, work with Control Structures, use Functions and Modules, Manipulate Data Structures, Handle Files and Exceptions, Work with Strings and Regular Expressions, Introduce Object-Oriented Concepts, Foster Problem-Solving and Debugging Skills and Prepare for Advanced Topics

UNIT I: Introduction to Python **(5 Hrs)**

Installing Python, basic syntax, interactive shell, editing saving and running a script; The concept of data types, variables, assignments; Immutable variables; Numerical types, Operators (Arithmetic Operator, Relational Operator, Logical or Boolean Operator, Assignment Operator, Ternary Operator, Bitwise Operator, Increment or Decrement Operator) and expressions; Comments in the program, Understanding error messages.

UNIT II: Creating Python Programs **(5 Hrs)**

Input and Output Statements, Control Statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass).

Function: Defining a function, calling a function, types of function, Function Arguments, Anonymous Functions, global and local variables, Recursion.

UNIT III: Data Structures of Python **(6 Hrs)**

Manipulating files and directories, os and sys modules, text files: reading/writing text and numbers from/to a file, creating and deleting a formatted file (csv or tab-separated).

String Manipulations: subscript operator, indexing, slicing a string; strings and number system: converting string to numbers and vice-versa, Binary, octal and hexadecimal numbers.

Basic list operators, replacing, inserting and removing an element, searching and sorting lists, accessing tuples, Operations, Working Functions and Methods, dictionary literals, Adding and Removing keys, accessing and replacing values, traversing dictionaries.

Data Structures using Lists: Elementary Data Representation- Linear List Array, Stacks, Queues, Linked Lists, and Trees.

UNIT VI: Modules **(4 Hrs)**

Importing module, Math module, Random Module, Packages, Composition.

Exception Handling: Exception, Exception Handling, except clause, try, finally clause, User-Defined Exceptios.

Textbook:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to think like a computer scientist: Learning with Python", Freely available online, 2012
3. Luca Massaron John Paul Mueller, Python for Data science For Dummies, Wiley,2ed,2019

Reference Books:

1. https://docs.python.org/3/tutorial/index.html
2. http://interactivepython.org/courselib/static/pythonds

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COMPUTER NETWORKS

Code: 24CS303
Max Marks: 70

Course Objectives: The objectives of the course is to Understand Basic Networking Concepts, Explain Network Models and Architecture, Understand Data Communication Fundamentals, Explore Network Devices and Components, Study IP Addressing and Subnetting, Understand Routing and Switching Concepts, Learn About Transport Layer Protocols, Explore Application Layer Protocols and Services, Understand Network Security Basics and Develop Practical Skills in Networking.

UNIT I **(10 Hrs)**

Basic Concepts: Components of data communication, Distributed processing, Line configuration, Topology, Transmission mode and Categories of networks.

OSI and TCP/IP Models: Layers and their functions, Comparison of models.

Transmission Media: Guided and unguided, Attenuation, Distortion, Noise, Throughput, Propagation speed and time, Wavelength, Shannon Capacity.

UNIT II **(10 Hrs)**

Telephony: Multiplexing, WDM, TDM, FDM, Circuit switching, Packet switching and Message switching. Data Link Layer.

Types of errors, Framing (character and bit stuffing), Error detection & Correction methods; Flow control; Protocols: Stop-wait ARQ, Go-Back- NARQ, Selective repeat ARQ.

UNIT III **(10 Hrs)**

Network Layer: Internetworking & Devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway, Modems; **Addressing:** IPv4 and IPv6 addressing, IPv4 subnetting; Routing: Unicast Routing Protocols: RIP, OSPF, BGP; **Routing:** Routing Methods- Static and Dynamic Routing, Routing basic commands, Distance vector protocol, Link state protocol.

UNIT IV **(10 Hrs)**

Transport and upper layers in OSI Model: Transport layer functions and Protocols, Connection management, Functions of session layers, Presentation layer and Application layer.

Textbook:

1. A. S. Tenanbaum, “Computer Networks”; Pearson Education Asia, 4th Ed., 2003.
2. Behrouz A. Forouzan, “Data Communication and Networking”, 2nd edition, Tata Mc Graw Hill.

Reference Books:

1. D. E. Comer, “Internetworking with TCP/IP”, Pearson Education Asia, 2001.
2. William Stallings, “Data and computer communications”, Pearson education Asia, 7th Ed., 2002.

Leinwand, A., Pinsky, B. (2001). Cisco router configuration. United Kingdom: Cisco Press.

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ENVIRONMENTAL STUDIES

Code: 24GN101
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Fundamentals of the Environment, Create Awareness of Environmental Issues, Promote Sustainable Development, Understand the Importance of Natural Resource Management, Learn about Biodiversity and its Conservation, Examine Environmental Legislation and Policies, Explore the Human-Environment Relationship, Encourage Environmental Ethics and Responsibility, Develop Skills for Environmental Problem-Solving and Promote Community Engagement and Environmental Action.

UNIT I: Introduction to Environmental Studies (05 Hrs)

- Environmental studies: Nature, Scope and Importance; Components of environment: atmosphere, hydrosphere, lithosphere, and biosphere; Concept of sustainability and sustainable development.
- Emergence of environmental issues: Climate change, Global warming, Ozone layer depletion, Acid rain etc.; International agreements and programmer: Earth Summit, UNFCCC, Montreal and Kyoto protocols, Convention on Biological Diversity (CBD), Ramsar convention, UNEP, CITES, etc.

UNIT II: Ecosystems and Natural Resources (05 Hrs)

- Definition and concept of Ecosystem; Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem: Physical (energy flow), Biological (food chains, food web, ecological succession), ecological pyramids and homeostasis; Types of Ecosystems: Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries); importance and threats with relevant examples from India.
- Ecosystem services (Provisioning, Regulating, Cultural, and Supporting); Ecosystem preservation and conservation strategies; Basics of Ecosystem restoration.
- Energy resources: Renewable and non-renewable energy sources; Use of alternate energy sources; Growing energy needs; Energy contents of coal, petroleum, natural gas and bio gas; Agro-residues as a biomass energy source.

UNIT III: Biodiversity and Conservation (05 Hrs)

- Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity.
- India as a mega-biodiversity nation; Biogeographic zones of India; Biodiversity hotspots; Endemic and endangered species of India; IUCN Red list criteria and categories.
- Value of biodiversity: Ecological, economic, social, ethical, aesthetic, and informational values of biodiversity with examples.
- Threats to biodiversity: Habitat loss, degradation, and fragmentation; Poaching of wildlife; Man-wildlife conflicts; Biological invasion with emphasis on Indian biodiversity; Current mass extinction crisis.
- Biodiversity conservation strategies: in-situ and ex-situ methods of conservation (National Parks, Wildlife Sanctuaries, and Biosphere reserves.

UNIT IV: Environmental Pollution and Control Measures (05 Hrs)

- Environmental pollution (Air, water, soil, thermal, and noise): causes, effects, and controls; Primary and secondary air pollutants; Air and water quality standards.
- Nuclear hazards and human health risks.
- Solid waste management: Control measures for various types of urban, industrial waste, Hazardous waste, E-waste, etc.; Waste segregation and disposal.

Textbook:

1. Sanjay Kumar Batra, Kanchan Batra, Harpreet Kaur; Environmental Studies; Taxmann's, Fifth Edition.
2. M.M. Sulphey; Introduction to Environment Management; PHI Learning, 2019
3. S.P. Mishra, S.N. Pandey; Essential Environmental Studies; Ane Books Pvt. Ltd. ; Sixth Edition.

Reference Books:

1. Asthana, D. K. (2006). Text Book of Environmental Studies. S. Chand Publishing.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Bharucha, E. (2013). Textbook of Environmental Studies for Undergraduate Courses. Universities Press.

4. Mahapatra, R., Jeevan, S.S., Das, S. (Eds) (2017). Environment Reader for Universities, Centre for Science and Environment, New Delhi.
5. Masters, G. M. & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
6. Odum, E. P., Odum, H. T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.
7. Sharma, P. D. & Sharma, P. D. (2005). Ecology and Environment. Rastogi Publications

DESIGNING LAB COREL DRAW

Code: 24CS311
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Core Concepts of Vector Graphics, Develop Proficiency in CorelDRAW Tools and Interface, Create and Manipulate Graphic Objects, Apply Colors, Fills, and Outlines, Work with Typography and Text Effects, Design Professional Layouts and Compositions, Use Advanced Features for Graphic Design, Understand File Management and Output Formats, Develop Creative and Practical Design Projects and Promote Industry-Relevant Skills and Creativity:

UNIT I **(04 Hrs)**
Introduction to graphic designing, Input/Output Technologies, Color Coding: RGB, CMYK, Grayscale, Bitmap, Color Channel, Resolution, Printing Templates, Rastar Images, Vector Images, Measurement Units & Conversion, Introduction to CorelDraw.

UNIT II **(08 Hrs)**
Introduction to Layers and Groups, Color Picker & Gradients, Status bar, Toolbar, Menu bar, Property bar, Shapes & Shape Tools, Pick & Transform Tools, 3-D Effects: Shadow, Bevel Effects, Extrusion Effects, Perspective Effects, Text Formatting, Colors Styles & Palette, Alignment Controls.

UNIT III **(08 Hrs)**
Importing Images in CorelDraw, Transform Controls, Basics of Printing.
Generating Barcode & QR Code, Calendar, Web Objects, Workspace Customization, Importing/Exporting Objects, Quick Trace, Manual Image Tracing.

Textbook:

1. Gary David Bouton, "CorelDRAW X7: The Official Guide", Corel Press.
2. DT Editorial Services (Author), "CorelDRAW 2018 in Simple Steps", Dreamtech Press.

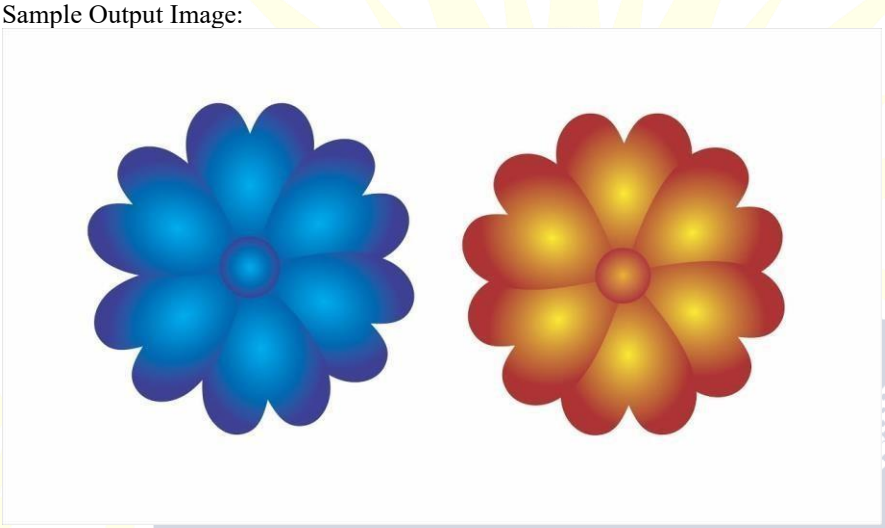
Reference Books:

1. Prof. Satish Jain, M. Geetha, "Corel DRAW Training Guide", BPB Publication.
2. Deke McClelland, "CorelDRAW! 7 For Dummies", Hungry Minds Inc,U.S.
3. Roger Wambolt, "Bring It Home with CorelDRAW: A Guide to In-House Graphic Design", Delmar Cengage Learning.

List of Practicals

Core Practicals (Implement minimum 8 out of 10 practicals)

1. Create a file to demonstrate the use of layers, groups.
2. Create a photo frame in CorelDraw.
3. Take an image of basic shape (square, triangle, circle, rectangle and parallelogram) in Corel Draw & extract these shapes from the image to different layers.
4. Create a QR Code in Corel Draw.
5. Create a flower in Corel Draw with gradient.
   Sample Output Image:



6. Create a visiting card for yourself in CorelDraw. (size=3.5 x 2 inch., color coding: CMYK)
7. Create a Tri-Fold Brochure in CorelDraw for Tours & Travels Company.
8. Create a border design in CorelDraw.
9. Create basic shapes (square, triangle, circle, rectangle and parallelogram) in CorelDraw shape tools.
10. Trace an image of some cartoon character in Corel Draw. (Do not use Quick Trace feature of CorelDraw)

Application Based Practicals (Implement any one out of the suggestive list)

11. Create a digital invitation card in CorelDraw Format. (size=A8 or A4, color coding: RGB)
12. Create a banner for a college event in CorelDraw. (Size: A3, Color Code: CMYK)
13. Create a Calendar for the current year in Corel Draw.
14. Create a Book cover in CorelDraw.
15. Create a Birthday Wishing card in CorelDraw (size=A8 or A4, color coding: RGB)

Note:

1. **In total 10 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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NATURAL LANGUAGE PROCESSING

Code: 24CS317
Max Marks: 70

Course Objectives: This course will enable students to, learn the importance of natural language modelling, understand the Applications of natural language processing, study spelling, error detection and correction methods and parsing techniques in NLP and illustrate the information retrieval models in natural language processing.

UNIT I **(04 Hrs)**

Introduction: What is Natural Language Processing? Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications.
Language Modelling: Statistical Language Model - N-gram model (unigram, bigram), Paninion Framework, Karaka theory.

UNIT II **(04 Hrs)**

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of-Speech Tagging.
Syntactic Analysis: Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing.

UNIT III **(04 Hrs)**

Naive Bayes, Text Classification and Sentiment: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model.

UNIT IV **(04 Hrs)**

Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval. Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.

UNIT V **(04 Hrs)**

Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.

Textbook:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press.
2. Daniel Jurafsky, James H. Martin, "Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2023.

Reference Books:

1. Akshay Kulkarni, Adarsha Shivananda, "Natural Language Processing Recipes – Unlocking Text Data with Machine Learning and Deep Learning using Python", Apress, 2019.
2. T V Geetha, "Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", Pearson, 2024.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer Academic Publishers.

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SYSTEM ANALYSIS & DESIGN

Code: 24CS323
Max Marks: 70

Course Objectives: The primary objective of this course is to provide students with a comprehensive understanding of the processes and techniques involved in the analysis and design of information system. System development life cycle, solving and analytical skills.

UNIT I **(04 Hrs)**

Basic Concept of Systems: Definition and Concepts; Elements of a System: Input, Output Processor, Control, Feedback, Environment, Boundaries and Interface; Characteristics of a System; Types of systems -Physical and Abstract System, Open and Closed Systems, Man-made Systems; Information and its categories

UNIT II **(04 Hrs)**

Information System and System Analyst Information systems: TPS, OAS, MIS, DSS, ESS; System Analyst: Role and need of system analyst, System Analyst as an agent of change. System Development Life Cycle Introduction to SDLC, Various phases: study, analysis, design, development, testing, implementation, maintenance; System documentation: Types of documentation and their importance.

UNIT III **(04 Hrs)**

System Planning and Information Gathering: Initial Investigations, Identification of user needs, Project Identification and Selection; Needs of Information Gathering, Determination of requirements, Information gathering tools: interviews, group communication, questionnaires, presentations and site visits. Feasibility Study Definition, Importance of feasibility study, Types of feasibility study, System selection plan and proposal, Prototyping, Cost-Benefit Analysis: Tools and Techniques.

UNIT IV **(04 Hrs)**

Tools for System Analysis & System Design: Data Flow Diagram (DFD), Logical and Physical DFDs, Developing DFD; System Flowcharts and Structured charts, Structured English, Decision trees and Decision tables. Module specifications, Module Coupling and cohesion, Top-down and bottom-up design; Logical and Physical design, Structured design.

UNIT V **(04 Hrs)**

Maintenance, Testing & System Security: Input and Output Input design: Input data, Input media and devices; Output design; Form Design: Classification of forms, Requirements of Form design. Need of System Testing, Types of System Testing, Quality Assurance; System Conversion, Conversion methods, procedures and controls, System evaluation and performance, Maintenance activities and issues, Audit System Security, Security Threats, Risk Analysis, Control measures, System Audit, Disaster Recovery Planning

Textbook:

1. "System Analysis and Design" by Kenneth E Kendall.
2. "System Analysis & design" by Shelly Cashman.

Reference Books:

1. "System Analysis and Design" by Elias m. Awad.
2. "System Analysis & design" by Perry Edwards.

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CYBER ETHICS

Code:24CS322
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Foundations of Cyber Ethics, Recognize Ethical Issues in Cyberspace, Study Legal and Regulatory Frameworks, Promote Responsible Digital Citizenship, Explore Intellectual Property Rights (IPR), Analyze Cybercrime and Its Ethical Implications, Examine Ethical Issues in Emerging Technologies, Foster Critical Thinking and Ethical Decision-Making, Encourage Professional Integrity and Accountability and Prepare Students for Real-World Ethical Challenges in Technology.

UNIT I **(5 hours)**

Emergence of cyber space. Cyber Jurisprudence, Cyber Ethics, Ethics for IT Workers and IT Users, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics.

UNIT II **(5 hours)**

Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access. Cyberattacks and Cybersecurity, Privacy Issues.

UNIT III **(5 hours)**

Freedom of Expression, Intellectual Property Issues, Ethical Decisions in Software Development, Social Media Ethical issues, Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

UNIT IV **(5 hours)**

Discussion on articles, companies or legal cases that deal with an ethical issue. Students are required to analyze and present at least one multinational company and investigate its ethical policies and practices. These polices can normally be found using any search engine.

Textbook:

1. Cyber Ethics 4.0 Serving Humanity with Values Editors Christoph Stückelberger / Pavan Duggal e-book by Globalethics.net available for download from https://repository.globethics.net/handle/20.500.12424/169317

Reference Books:

The students may refer free e-books or online latest articles, news and legal cases dealing cyber ethical issues for understanding the importance of cyber ethics.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

Code: 24MG101
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Fundamentals of Management, Analyze Organizational Structures and Functions, Study the Decision-Making Process, Gain Knowledge of Organizational Behavior (OB), Examine Individual Behavior in Organizations, Explore Group Behavior and Team Dynamics, Learn Motivation Theories and Leadership Models, Understand Organizational Culture and Change, Develop Managerial and Interpersonal Skills and Apply Management and OB Concepts to Real-World Scenarios.

UNIT I **(03 Hrs)**

Introduction: Meaning, Objectives, Differences between Administration and Management, Levels of Management, Kinds of Managers, Managerial roles, History of Management, Recent trends in Management.

UNIT II **(07 Hrs)**

Planning: Importance, Process, Benefits of Planning, Types of Plans, Planning tools and techniques.
Organizing: Meaning, Types of organizational structures, Traditional structures, Directions in organization structures.
Leading: Meaning, Nature, Traits and Behaviour, Contingency approaches to Leadership, Transformational leadership.
Controlling: Meaning, Importance, Steps in the control process, Types of Control.

UNIT III **(03 Hrs)**

Organizational Behavior: Introduction, Meaning, History of Organizational Behavior, Organizational effectiveness, Organizational learning process, Stakeholders, Contemporary challenges for Organizations.

UNIT IV **(07 Hrs)**

Behavioral Dynamics: MARS Model of individual behavior and performance, Types of Individual behavior. Personality in Organization, Values in the workplace, Types of values, Perception, Meaning, Model of Perceptual process. Motivation: Meaning, Maslow's Hierarchy of Needs, Four Drive Theory of Motivation.
Teams: Advantages of Teams, Model of Team Effectiveness, Stages of Team Development. Power: Meaning, Sources, and Contingencies of Power, Consequences of Power.

Reference Books:

1. MGMT, Chuck Williams & Manas Ranjan Tripathy, 5/e, Cengage Learning, 2013.
2. Organizational Behavior, Steven L. McShane & Mary Ann Von Glinow, 6/e, McGraw Hill Education, 2015.
3. Management & Organisational Behaviour, Laurie J. Mullins, 7/e, Prentice Hall, 2005.
4. Essentials of Management, Koontz, McGraw Hill, 8/e, 2014.
5. Management, John R. Schermerhorn, Jr., 8/e, Wiley India, 2010.
6. Organizational Behaviour, Fred Luthans, 12/e, McGraw Hill International, 2011.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

PROBABILITY AND STATISTICS

Code: 24MT106
Max. Marks: 70

Course Objectives: The course "Probability and Statistics" is designed to provide students with a strong foundation in both probability theory and statistical methods. The course covers key topics such as probability distributions, random variables, statistical inference, hypothesis testing, correlation, regression analysis, and sampling methods. Students will learn how to apply probability concepts to model uncertainty and how to use statistical techniques to analyze and interpret data. Emphasis is placed on understanding concepts like mean, variance, standard deviation, and confidence intervals, as well as mastering the use of statistical tools for data-driven decision-making.

UNIT I **(04 Hrs)**

Algebra of Sets: sets and classes, limit of a sequence of sets, rings, sigma-rings, fields, sigma-fields, monotone classes.
Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems.

UNIT II **(08 Hrs)**

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality, problems.
Special Distributions: Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, Pareto, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems, problems.
The function of a random variable, problems.

UNIT III **(03 Hrs)**

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution, and problems.
Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables, problems.
Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems.

UNIT IV **(05 Hrs)**

Descriptive Statistics: Graphical representation, measures of locations and variability.
Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.
Testing of Hypotheses: Null and alternative hypotheses, the critical and 8 acceptance regions, two types of error, power of the test, the most powerful test and Nyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.

Textbooks:

1. "An Introduction to Probability and Statistics" by V.K. Rohatgi & A.K. Md.E.Saleh.
2. "Introduction to Probability and Statistics" by J.S. Milton & J. C. Arnold.
3. "Introduction to Probability Theory and Statistical Inference" by H. J. Larson.

Reference Books:

1. "Introduction to Probability and Statistics for Engineers and Scientists" by S.M. Ross.
2. "A First Course in Probability" by S.M. Ross.

"Probability and Statistics in Engineering" by W.W. Hines, D.C. Montgomery, D.M. Gpldsman & C. M.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

C++ LAB

Code: 24CS391
Max. Marks: 70

(BASED ON 24CS301) Object Oriented Programming with C++

Core Practicals (Implement minimum 8 out of 10 practicals)

1. WAP to implement 'Inline function'.
2. WAP to implement call by reference and return by reference using class. [Hint. Assume necessary functions].
3. WAP to implement friend function by taking some real life example.
4. WAP to implement 'Function Overloading'.
5. WAP to implement Parameterized Constructor, Copy Constructor and Destructor.
6. WAP to show the usage of constructor in base and derived classes, in multiple inheritance.
7. WAP to show the implementation of 'containership'.
8. WAP to show swapping using template function (Generic).
9. WAP to implement 'Exception Handling'.
10. WAP to read and write values through object using file handling.

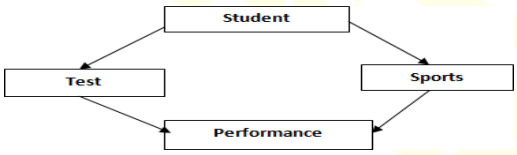
Application Based Practicals (Implement minimum 5 out of 10 practicals)

11. Create a class employee which have name, age and address of employee, include functions getdata() and showdata(), getdata() takes the input from the user, showdata() display the data in following format:

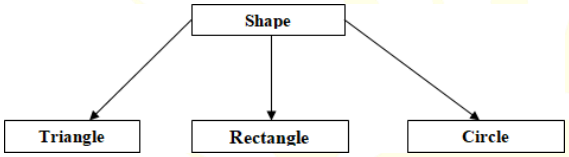
    Name:
    Age:
    Address:

12. Write a class called **C Account** which contains two private data elements, an integer **Account Number** and a floating-point **account Balance** and three-member functions:
    - A constructor that allows the user to set initial values for **Account Number** and **Account Balance** and a default constructor that prompts for the input of the values for the above data numbers.
    - A function called **Input Transaction**, which reads a character value for **Transaction Type** ('D' for deposit and 'W' for withdrawal) and a floating point value for **Transaction Amount**, which updates **Account Balance**.
    - A function called **Print Balance**, which prints on the screen the **Account Number** and **Account Balance.**

13. Define a class *Counter* which contains an int variable *count* defined as static and a static function Display () to display the value of *count*. Whenever an o b j e c t of this class is created *count* is incremented by 1. Use this class in main to create multiple objects of this class and display value of count each time.
14. WAP to add and subtract two complex numbers using classes.
15. Write program to overload Binary + to add two similar types of objects. (Both with and without using friend functions)
16. WAP to implement += and = operator
17. Implement the following class hierarchy considering appropriate data members and member functions:



18. Implement the following hierarchy considering appropriate data members and member functions (use Virtual functions).



19. WAP to convert meter to centimeter and vice versa, using data conversions and operator overloading
20. WAP to count digits, alphabets and spaces, stored in a text file, using streams.

Note:

1. **In total 10 practicals to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

Theory Paper

Total: 100 Marks
External: 70
Marks
Internal:30
Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The higher of the two scores will be considered for the final assessment.

Lab

Practical: 100 Marks
External: 70 Marks
Internal: 30 Marks

External (Two programs) : 70
Marks Program Writing: 10
+ 10 Marks **Algorithm&**
Flowchart : 5 + 5 Marks
Program Execution: 15 + 15 Marks
Viva: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
Record: 5 Marks
Attendance: 5 Marks
Program Writing: 15
Marks **Program**
Execution: 15 Marks
Viva: 10 Marks

ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250 AIML

Syllabus for BCA-AIML

Semester 4

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**External Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS401	Java Programming	4	0	0	4	70	30	0	100
24CS412	Introduction to Artificial Intelligence	3	1	0	4	70	30	0	100
Skill Enhancement Course (SEC-3) (Choose any one)									
24GN301	Personality Development Skills	2	0	0	2	70	30	0	100
24CS421	Software Verification & Validation	2	0	0	2	70	30	0	100
Discipline Specific Elective (DSE-2) (Choose any one)									
24CS402	Software Engineering	4	0	0	4	70	30	0	100
24CS413	Network Security	4	0	0	4	70	30	0	100
Generic Elective-2 (Choose any one)									
24MG117	Digital Marketing	2	0	0	2	70	30	0	100
24MG118	Project Management	2	0	0	2	70	30	0	100
Practical									
24CS491	Java Lab	0	0	2	2	0	30	70	100
24CS492	Software Engineering Lab	0	0	2	2	0	30	70	100
	Total				**20**	**420**	**240**	**140**	**800**

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

JAVA PROGRAMMING

Code: 24CS401
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Fundamentals of Java Programming, Develop Problem-Solving Skills Using Java, Apply Object-Oriented Programming (OOP) Principles, Work with Arrays, Strings, and Collections, Implement Exception Handling and File I/O, Understand and Use Interfaces and Abstract Classes, Develop GUI Applications Using Java, Work with Multithreading and Applets (optional, if included), Explore Basic Networking in Java and Build Real-World Java Applications.

UNIT I **(10 Hrs)**

Java Basics: Java as Object-oriented Programming Language History of Java, Features of Java, Difference between Java and C++, Java Architecture (JDK, JVM, JRE), Java Tokens: Data types, Literals, Variables, Scope and lifetime of variables, Operators. Control Structures, Arrays.

Introducing Classes: Creating a Class: properties, methods and constructors. Object Access modifiers, Method Overloading, Garbage collection, this keyword, Static (variable, method, block), final keyword, Wrapper Classes, String class and methods.

UNIT II **(10 Hrs)**

Inheritance: Types, Super keyword, method overriding, covariant return type, abstract class.

Interfaces and Packages: Creation and implementing an interface, difference between abstract class and interface, Packages, and importing a package.

Exception Handling: Exception Class, built-in checked and unchecked exceptions, user-defined exceptions, use of try, catch, throw, throws, finally.

UNIT III **(10 Hrs)**

Using I/O: Elementary concepts of Input/Output, using the byte streams, reading and writing using byte streams, automatically closing a file, using the character-based streams, File I/O using character streams (using a File Writer and using a File Reader).

Multi-threaded programming: Multithreading fundamentals, Thread class, and Runnable interface, the life cycle of thread, creation of single and multiple threads, implementation of Thread methods, Synchronization (using Synchronized methods, synchronized statement).

UNIT IV **(10 Hrs)**

Swings Fundamentals: Components (JLabel and ImageIcon, using swing Buttons (JButton, JToggleButton, JCheckBox, JRadioButton), JTextField, JScrollPane, JList, JComboBox) and Containers, Layout managers, event delegation Model, event handling (event sources, event listeners, event classes and interfaces, adapter classes).

JDBC: JDBC Architecture, JDBC Drivers, Connection, Statement, Prepared Statement, Result set, Connecting to the Database using JDBC.

Textbook:

1. Herbert Schildt, “Java 2 -The Complete Reference” – Tata McGraw Hill Education Private Limited, 2010
2. Trilochan Tarai, “Java Core Concepts and Applications”, I.K. International Publishing house pvt. Ltd., 2015

Reference Books:

1. E. Balaguruswamy, “Programming with Java A Primer”, McGraw Hill Education Private Limited, 5th
2. Herbert Schildt, Dale Skrien, “Java Fundamentals A Comprehensive Introduction” – Tata McGraw Hill Education Private Limited, 2013
3. Cay S. Horstmann, “Core Java Volume 1 – Fundamentals”, 10th edition, Pearson, 2017
4. Ken Arnold, Davis Holmes, James Gosling, Prakash Goteti, “The Java Programming Language”, 3rd edition, Pearson, 2008.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Code: 24CS412
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Foundations of Artificial Intelligence (AI), Explore Problem-Solving and Search Techniques, Study Knowledge Representation and Reasoning, Explore Natural Language Processing (NLP), Introduce Current Trends and Future Directions in AI and Encourage Critical Thinking and Problem-Solving Skills.

UNIT I **(10 Hrs)**

Overview of AI: Introduction to AI, Importance of AI, AI and its related field, AI techniques, Criteria for success. Problems, problem space and search: Defining the problem as a state space search, Production Systems and its characteristics, Issues in the design of the search programs.

Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction.

UNIT II **(10 Hrs)**

Knowledge Representation: Definition and importance of knowledge, Knowledge representation, various approaches used in knowledge representation, Issues in knowledge representation.

Logical Reasoning: Logical agents, propositional logic, inferences, Syntax and semantics of First Order Logic, Inference in First Order Logic Knowledge Base, forward chaining, backward chaining, unification, resolution, Expert system: Case study of Expert system in PROLOG.

UNIT III **(10 Hrs)**

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning, Bayes 'Theorem, Certainty factors and Rule-based Systems, Bayesian Networks, Dempster-Shafer Theory, Introduction to Fuzzy logic. Fuzzy set definition & types. Membership functions. Designing a fuzzy set for a given application.

Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

UNIT IV **(10 Hrs)**

Learning: Introduction to Learning, Rote Learning, learning by taking advice, learning in problem solving, learning from examples: Induction, Explanation-based Learning, Discovery, Analogy, Neural Networks, and Genetic Learning.

Textbook:

1. Rich and Knight, "Artificial Intelligence", Tata McGraw Hill, 1992.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Second Edition (Indian Reprint: Pearson Education)

Reference Books:

1. Ivan brakto. "Prolog Programming for AI", Addison Wesley.
2. George F. Luger. "Artificial Intelligence". Pearson Education.
3. Ben Coppin. "Artificial Intelligence Illuminated". Jones and Bartlett Publisher.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

PERSONALITY DEVELOPMENT SKILLS

Code: 24GN301
Max Marks: 70

Course Objectives: The course aims to enable students to Understand the Fundamentals of Personality Development, Enhance Self-Awareness and Confidence, Improve Communication and Interpersonal Skills, Build Positive Attitude and Professional Etiquette, Strengthen Teamwork and Leadership Abilities, Develop Critical Thinking and Problem-Solving Skills, Improve Presentation and Public Speaking Skills, Manage Stress and Emotions Effectively, Prepare for Career and Personal Success and Foster a Holistic and Balanced Personality.

UNIT I **(5 hours)**
Personality Development, Professional Etiquettes, Art of Social Conversation, Basic Body Language, Meeting and Greeting Skills

UNIT II **(5 hours)**
Leadership and Team-Building Skills, Decision Making and Problem Solving through Effective Communication Strategies. Role plays, Team building

UNIT III **(5 hours)**
Confidence Building Skills Self-Introduction, Self-Awareness, Mock Interviews, Extempore, Group Discussion.

UNIT IV **(5 hours)**
Stress and Time Management
Stress management - Meaning, types, Impact /Consequences (Mind, Body and Health), Tips for Busting Stress, Case Studies.
Time management- Importance, Techniques. Case Studies.

Textbook:

1. "Business Communication" by Asha Kaul- PHI.
2. "Personality Development and Communication Skills-I" by Urmila Rai and S.M. Rai - Himalaya Publishing House.
3. "Communication Skills" by Sanjay Kumar and Pushp Lata, Oxford University Press.
4. "Business Communication" by Meenakshi Raman and Prakash Singh, Oxford University Press.

Reference Books:

1. "Life Management and Stress Management" by Shawn Chhabra.
2. "Personality Development and Communication Skills-II" by C.B. Gupta.
3. "Self-Awareness: The Hidden Driver of Success and Satisfaction" Travis Bradberry.
4. "Business Communication" by Hory Sankar Mukherjee, Oxford University Press.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

SOFTWARE VERIFICATION AND VALIDATION

Code: 24CS421
Max Marks: 70

Course Objectives: The course on **Software Verification and Validation** focuses on teaching students the principles, techniques, and tools used to ensure the correctness, reliability, and quality of software systems throughout their development lifecycle.

UNIT I **(5 Hrs)**
Introduction: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Definition of software testing, Test Cases, Test Oracles, Testing Process, Limitations of Testing.

UNIT II **(5 Hrs)**
Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

UNIT III **(5 Hrs)**
Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, and Slice based testing, Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

UNIT IV **(5 Hrs)**
Overview of SQM: Concepts of Software Quality, Quality Attributes, Software Quality Models: McCall, Boehm, ISO-9000, CMM.Miscellaneous topics: Stress Testing, Ad hoc testing: Buddy testing, Exploratory testing, Agile and extreme testing.

Textbook:

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, 2nd Ed., New Age International, 2005.
2. I. Sommerville, “Software Engineering”, 9th Edition, Pearson Edu

Reference Books:

1. Jibitesh Mishra and Ashok Mohanty, “Software Engineering”, Pearson
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, 5th Ed., McGraw Hill Int. Ed., 2001.
3. James Peter, W. Pedrycz, “Software Engineering: An Engineering Approach”, John Wiley & Sons.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

SOFTWARE ENGINEERING

Code: 24CS402
Max Marks: 70

Course Objectives: The objectives of the course is to Understand the Fundamentals of Software Engineering, Familiarize with Software Development Life Cycle (SDLC) Models, Develop Skills in Requirements Engineering, Apply Principles of Software Design, Explore Software Testing and Quality Assurance, Gain Knowledge of Software Project Management, Understand Software Maintenance and Configuration Management, Apply Software Metrics and Quality Standards, Explore Agile and Modern Software Development Practices and Promote Teamwork, Ethics, and Professional Responsibility.

UNIT I **(10 Hrs)**

Introduction of software engineering: Software Crisis, Software life cycle models, Waterfall, Prototype, Spiral Models, Agile model.

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques like FAST, QFD, Requirement analysis using (DFD use-case, sequence and class diagram (with case studies), ER Diagrams, Requirements documentation: SRS, Characteristics & organization of SRS.

UNIT II **(10 Hrs)**

Software Project Planning: Software Metrics-Definition and Need, Types of Metrics-Product, Process and Project Metrics, Size Estimation like lines of Code & Function Count, Halstead Software Science measure, Cost Estimation: Need, Models COCOMO: Basic model, Intermediate model.

Risk Management: Software Risks, Types of risk, risk management activities: risk assessment, risk control.

UNIT III **(10 Hrs)**

Software Design: Cohesion & Coupling, Classification of Cohesiveness & Coupling.

Quality management: Quality concept, software quality assurance, Total Quality Management (TQM), software review, software inspection.

Software Implementation: Structured coding techniques, coding style, Standards and guidelines, documentation guidelines. Reverse Engineering, Software Re-engineering, Configuration Management.

UNIT IV **(10 Hrs)**

Software Testing: Testing Process, Levels of Testing: Unit testing, Integration testing and system testing. Types of Testing: Manual testing, Automation Testing. Methods of Testing- , Black box, White box and Grey Box Testing. Validation, Verification, Alpha-Beta testing, Acceptance testing, Functional Testing and its types, Structural Testing Difference between: Testing and Debugging.

Software Maintenance: Management of Maintenance, The Maintenance Process and Types of maintenance: Preventive, Perceptive, Adaptive and Corrective Maintenance. Maintenance tools and techniques.

Textbook:

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, 2nd Ed., New Age International, 2005.
2. I. Sommerville, “Software Engineering”, 9th Edition, Pearson Edu.

Reference Books:

1. Jibitesh Mishra and Ashok Mohanty, “Software Engineering”, Pearson.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, 5th Ed., McGraw Hill Int. Ed., 2001.
3. James Peter, W. Pedrycz, “Software Engineering: An Engineering Approach”, John Wiley & Sons.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

NETWORK SECURITY

Code: 24CS413
Max Marks: 70

Course Objectives: The course aims to Understand the Fundamentals of Network Security, Explore Cryptographic Techniques and Protocols, Analyze Network Threats and Attack Types, Understand Network Security Protocols and Standards, Study Authentication and Access Control Mechanisms, Understand Firewalls and Intrusion Detection/Prevention Systems, Explore Network Security Tools and Technologies, Develop Security Policies and Risk Management Plans, Address Legal, Ethical, and Privacy Issues and Prepare for Real-World Applications and Certifications.

UNIT I **(10 Hrs)**

Introduction to Network Security and related issues- authentication, confidentiality, integrity, anonymity, etc. Network Security Models, Network Security Threats, Secure socket layer (SSL)/ Transport layer security (TLS), Public Key Infrastructure, Digital Signature Schemes.

UNIT II **(10 Hrs)**

Firewalls: Overview, Types, Features, User Management, Intrusion Detection and Prevention Systems, Intruders, Viruses and Related Threats, Firewall Design Principles, Packet filtering firewall, VPN.

UNIT III **(10 Hrs)**

Authentication applications - Kerberos, X.509, E-Mail security, pretty good privacy (PGP), Secure Multipurpose Internet Mail Extensions (S/MIME), IP security overview, IP security policy, Encapsulating security payload (ESP).

Network Management Security: Overview of SNMP Architecture. Available software platforms/case tools, Configuration Management.

UNIT IV **(10 Hrs)**

Intrusion Detection: Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed Adaptive Intrusion Detection, Intrusion Detection Exchange Format, Honeypots, Virtual Private Network.

Textbook:

1. Kaufman et al., Network Security, Second Edition, Publisher: Prentice Hall, 2002.
2. Stallings and Brown, Computer Security: Principles and Practice, Fourth Edition, Publisher: Pearson, 2018.

Reference Books:

1. Trappe and Washington, Introduction to Cryptography with Coding Theory, Third Edition, Publisher: Pearson, 2020.
2. Principles of Information Security: Michael E. Whitman, Herbert J. Mattord, CENGAGE Learning, 4th Edition.
3. Kaufman et al., Network Security, Second Edition, Publisher: Prentice Hall, 2002.
4. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

DIGITAL MARKETING

Code: 24MG117
Max Marks: 70

Course Objectives: The course aims to Understand the Fundamentals of Digital Marketing, Explore Key Digital Marketing Channels and Strategies, Learn the Basics of Search Engine Optimization (SEO), Gain Proficiency in Social Media Marketing, Understand Pay-Per-Click (PPC) and Online Advertising, Master Web Analytics and Performance Tracking, Develop Content Marketing and Email Campaign Skills, Understand Mobile and E-Commerce Marketing, Address Legal, Ethical, and Privacy Issues in Digital Marketing and Build Practical Skills and Real-World Competence.

UNIT I **(05 Hrs)**

Digital Marketing Basics: Digital Marketing meaning and its importance, Traditional vs Digital Marketing, Benefits of Digital Marketing, Internet Marketing basics, Digital Marketing channels, Types of Business models, Digital Marketing strategies (P.O.E.M framework), Inbound and Outbound marketing, Digital Transformation model, 4Cs of Digital Marketing.

UNIT II **(05 Hrs)**

Social Media Marketing: Introduction, Social Media marketing strategies, Overview of Social media platforms – Instagram, Snapchat, Facebook, Mobile, Twitter, Content Planning and Strategy, Influential marketing, Content marketing, Digital Marketing campaign.

UNIT III **(05 Hrs)**

Search Engine Optimization: Introduction to SEO, On-Page and Off-Page Optimization, Role of Keywords in SEO, Organic vs Non-Organic SEO, Blogging as marketing strategy, Types of Blogs.
Search Engine Marketing: Introduction to Paid marketing, Google Adwords, Types of campaigns and Campaign creation.

UNIT IV **(05 Hrs)**

Tools for SMM and Marketing communication: Overview of Buffer, Hootsuite, Canva, Trello and Hot jar.
Web Analytics: Meaning, Purpose and process, Types, Tools for analytics – Google analytics, Audience analytics, Acquisition analytics, Behavior analytics, Conversion analytics.

Textbook:

1. Rajan Gupta, Supriya Madan, "Digital Marketing", BPB Publication, Ist Edition, 2022
2. Seema Gupta, "Digital Marketing", McGraw Hill, 2nd Edition, 2018.
3. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson, 2nd Edition, 2020.

Reference Books:

1. Ian Dodson, "The Art of Digital Marketing", Wiley, 2017.
2. Nitin Kamat, Chinmay Nitin Kamat, "Digital Marketing", Himalaya Publishing House, 1st Edition, 2017.
3. Vandana Ahuja, "Digital Marketing", Oxford University Press, 8th Edition, 2019.
4. Judy Strauss, Raymond Frost, "E- Marketing", PHI learning, 5th Edition, 2009.
5. Moutusy Maity, "Internet Marketing", Oxford University Press, 2018.
6. Stephanie Diamond, "Digital Marketing", Wiley, 2019.
7. T. N. Swaminathan, Karthik Kumar, "Digital Marketing From Fundamentals to Future", Cengage, 1st Edition, 2019.

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PROJECT MANAGEMENT

Code: 24MG118
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Fundamentals of Project Management, Explore Project Planning and Scheduling Techniques, Understand Resource and Cost Management, Learn Risk Management Strategies, Study Project Quality and Procurement Management, Explore Leadership and Team Management, Gain Knowledge of Project Monitoring and Control, Use Project Management Tools and Software, Understand Project Closure and Post-Implementation Review and Apply Project Management Concepts in Real-World Scenarios.

UNIT I **(08 Hrs)**

Overview of Project Management: Verities of project, Project Features, Project Life Cycle – S-Curve, J-C.

Project Selection: Project Identification and Screening – New ideas, Vision, Long-term objectives, SWOT Analysis (Strength, Weakness, Opportunities, Threats).

Project Appraisal – Market Appraisal, Technical Appraisal, Economic Appraisal, Ecological Appraisal and Financial Appraisal – Payback, Net Present Value (NPV), Internal Rate of Returns (IRR).

Project Selection – Decision Matrix, Technique for Order Preference using Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW).

UNIT II **(07 Hrs)**

Project Presentation: WBS, Project Network – Activity on Arrow (A-O-A), Activity on Node (A-O-N).

Project Scheduling: Gant Chart, Critical Path Method (CPM), Project Evaluation & Review Technique (PERT).

Linear time cost trade-offs in project – Direct cost, indirect cost, Project crashing Resource Consideration – Profiling, Allocation, Levelling.

Introduction to project management software: Primavera/ Microsoft project

UNIT III **(05 Hrs)**

Project Execution: Monitoring control cycle, Earned Value Analysis (EVA), Project Control– Physical control, Human control, financial control.

Organizational and Behavioral Issues: Organizational Structure, Selection-Project Manager, Leadership Motivation, Communication, Risk Management.

Project Termination: Extinction, Addition, Integration, Starvation.

Textbooks:

1. Jack R. Meredith and Samuel J. Mantel, Jr. – 'Project Management- A Managerial Approach' Eighth Edition – John Wiley & Sons Inc – 2012.
2. Arun Kanda – 'Project Management-A Life Cycle Approach' PHI Learning Private Limited – 2011.

References Books:

1. 'A Guide to Project Management Body of Knowledge' PMBOK GUIDE, Sixth edition, Project management Institute – 2017.
2. Ted Klastrorin – 'Project Management, Tools, and Trade-Offs' – John Wiley – 2011

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

JAVA LAB

Code: 24CS491
Max. Marks: 70

(BASED ON 24CS401) Java Programming
Core Practical (Implement minimum 10 out of 15 practicals)

1. Write a program declaring a class Rectangle with data members length and breadth and member functions Input, Output, and CalcArea.
2. Write a program to demonstrate the use of method overloading to calculate area of a square, rectangle and a triangle.
3. Write a program to demonstrate the use of static variables, static methods and static blocks.
4. Write a program to demonstrate the concept of ``this``.
5. Write a program to demonstrate multi-level and hierarchical inheritance.
6. Write a program to use super() to invoke base class constructor.
7. Write a program to demonstrate run-time polymorphism.
8. Write a program to demonstrate the concept of aggregation.
9. Write a program to demonstrate the concept of abstract class with a constructor and a ``final`` method.
10. Write a program to demonstrate the concept of interface when two interfaces have unique methods and the same data members.
11. Write a program to demonstrate a checked exception during file handling.
12. Write a program to demonstrate an unchecked exception.
13. Write a program to demonstrate the creation of multiple child threads.
14. Write a program to use the Byte stream class to read from a text file and display the content on the output screen.
15. Write a program to demonstrate any event handling.

Application Based Practical (Implement minimum 5 out of 10 practicals)

16. Create a class employee which have name, age and address of employee, include functions getdata() and showdata(), getdata() takes the input from the user, showdata() display the data in following format:
    Name:
    Age:
    Address:
17. Write a Java program to perform basic Calculator operations. Make a menu driven program to select operation to perform (+ - * /). Take 2 integers and perform operation as chosen by user.
18. Write a program to make use of Buffered Stream to read lines from the keyboard until 'STOP' is typed.
19. Write a program declaring a Java class called Savings Account with members ``accountNumber`` and ``Balance``. Provide member functions as ``depositAmount ()`` and ``withdrawAmount ()``. If user tries to withdraw an amount greater than their balance then throw a user-defined exception.
20. Write a program creating 2 threads using Runnable interface. Print yourname in ``run ()`` method of first class and "Hello Java" in ``run ()`` method of second thread.
21. Write program that uses swings to display combination of RGB using 3 scrollbars.
22. Write a swing application that uses atleast 5 swing controls
23. Write a program to implement border layout using Swing.
24. Write a java program to insert and update details data in the database.
25. Write a java program to retrieve data from database and display it on GUI.

Note:

1. **In total 15 practical to be implemented. 2 additional practical may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

SOFTWARE ENGINEERING LAB

Code: 24CS492
Max. Marks: 70

(BASED ON 24CS402) Software Engineering
List of Practical:

1. Select and Write down the problem statement for a real time system of relevance.
2. Analyze requirement for a system and develop Software Requirement Specification Sheet (SRS) for suggested system.
3. To create the function-oriented diagram: Data Flow Diagram (DFD).
4. To perform the user's view analysis for the suggested system: Use case diagram.
5. To draw the structural view diagram for the system: Class diagram.
6. To draw the behavioral view diagram: State-chart diagram or Activity diagram.
7. To perform the behavioral view diagram for the suggested system: Sequence diagram.
8. Draw the component diagram.
9. Draw the Deployment diagram.
10. Perform Measurement of complexity with Halstead Metrics for chosen system.

Suggested Applications:

(i) Inventory Management
(ii) Library Management
(iii) Result Management
(iv) Hotel Management System
(v) Any Website
(vi) Any mobile application
(vii)(vii)E-Commerce website
(viii) Any other application

Note:

1. **Students are required to identify an application in the beginning of the semester and conduct all practicals for the same application.**
2. **In total 10 practicals to be implemented.**
3. **Students may use any open source software i.e. argoUML for drawing the above diagrams.**
4. **Students may Use testing tool such as junit.**
5. **Student may Use configuration management tool-libra.**

ARYAVART INTERNATIONAL UNIVERSITY
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Theory Paper

Total: 100 Marks
External: 70 Marks
Internal:30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The higher of the two scores will be considered for the final assessment.

Lab

Practical: 100 Marks
External: 70 Marks
Internal: 30 Marks

External (Two programs): 70
- **Marks Program Writing**: 10 + 10 Marks **Algorithm& Flowchart**: 5 + 5 Marks
- **Program Execution**: 15 + 15 Marks
- **Viva**: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
- **Record**: 5 Marks
- **Attendance**: 5 Marks
- **Program Writing**: 15 Marks **Program Execution**: 15 Marks
- **Viva**: 10 Marks

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ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for BCA AIML

Semester 5

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**External Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS511	Machine Learning with Python	4	0	0	4	70	30	0	100
24CS501	Operating System & Linux Programming	4	0	0	4	70	30	0	100
Skill Enhancement Course (SEC-4) (Choose any one)									
24CS508	Introduction to Big Data	2	0	0	2	70	30	0	100
24CS512	Web Security	2	0	0	2	70	30	0	100
Discipline Specific Elective (DSE-4) (Choose any one)									
24CS502	Cloud Computing	4	0	0	4	70	30	0	100
24CS514	AI in Healthcare	4	0	0	4	70	30	0	100
Project									
24PR401	Minor Project	0	0	4	4	0	100	0	100
24PR502	Seminar/Conference Presentation	0	0	2	2	0	0	100	100
Practical									
24CS591	Linux- OS Lab	0	0	2	2	0	30	70	100
	Total				**22**	**280**	**250**	**170**	**700**

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

MACHINE LEARNING WITH PYTHON

Code: 24CS511
Max Marks: 70

Course Objectives: The course aims to enable students to Understand the Fundamentals of Machine Learning, Gain Proficiency in Python for Machine Learning, Work with Popular Machine Learning Libraries and Frameworks, Preprocess and Explore Data for Machine Learning, Implement Supervised Learning Algorithms, Apply Unsupervised Learning Techniques, Understand Model Evaluation and Validation, Work on Real-World ML Projects, Understand the Ethical and Practical Implications of Machine Learning and Prepare for Further Study or Industry Roles.

UNIT I **(10 Hrs)**

Introduction to Machine Learning, Why Machine learning, Types of Machine Learning Problems, Applications of Machine Learning. Supervised Machine Learning- Regression and Classification. Binary Classifier, Multiclass Classification, Multilabel Classification. Performance Measures- Confusion Matrix, Accuracy, Precision & recall, ROC Curve. Advanced Python- NumPy, Pandas. Python Machine Learning Library Scikit-Learn, Linear Regression with one Variable, Linear Regression with Multiple Variables, Logistic Regression.

UNIT II **(10 Hrs)**

Supervised learning Algorithms: Decision Trees, Tree pruning, Rule-base Classification, Naïve Bayes, Bayesian Network. Support Vector Machines, k-Nearest Neighbour, Ensemble Learning and Random Forest algorithm.

UNIT III **(10 Hrs)**

Artificial Neural Networks, HebbNet, Perceptron, Adaline, Multilayer Neural Network, Architecture, Activation Functions, Loss Function, Hyper parameters, Gradient Descent, Backpropagation, Variants of Backpropagation, Avoiding overfitting through Regularization, Applications of Neural Networks.

UNIT IV **(10 Hrs)**

Unsupervised learning algorithms: Introduction to Clustering, K-means Clustering, Hierarchical Clustering, Kohonen Self-Organizing Maps. Implementation of Unsupervised algorithms. Feature selection and Dimensionality reduction, Principal Component Analysis.

Textbook:

1. Geron Aurelien, “Hands-On Machine Learning with Scikit-Learn & TensorFlow”, O’REILLY, First Edition, 2017.
2. U Dinesh Kumar and Manaranjan Pradhan, “Machine Learning using Python", Wiley, 2019.
3. Fausett Laurence, “Fundamentals of Neural Networks”, Pearson, Ninth Edition, 2012.

Reference Books:

1. Tom Mitchell, “Machine Learning”, First Edition, McGraw- Hill, 1997.
2. Budd T A, "Exploring Python", McGraw-Hill Education, 1st Edition, 2011.
3. Jake VanderPlas,“Python Data Science Handbook”, O’Reilly,1st Edition,2017.

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OPERATING SYSTEM AND LINUX PROGRAMMING

Code: 24CS501
Max Marks: 70

Course Objectives: The objective of the course is to Understand the Fundamental Concepts of Operating Systems, Explore Process and Thread Management, Study Memory and Storage Management, Understand File Systems and I/O Management, Gain Hands-On Experience with Linux OS, Write and Execute Shell Scripts, Implement System-Level Programming in Linux, Learn Inter-Process Communication in Linux, Apply Concepts Through Practical Assignments and Labs and Prepare for Industry and Advanced Study in System Programming.

UNIT I **(10 Hrs)**

Introduction: What is an Operating System, Functions of Operating System, Simple Batch Systems; Multi programmed Batch systems, Time-Sharing Systems, Personal-computer systems, Parallel systems, Distributed Systems, Real-Time Systems.

Introduction to Linux: Architecture of Linux OS, Basic directory structure of Linux, Basic commands of Linux: - man, info, help, what is, apropos, basic directory navigation commands like cat, mkdir, rmdir, cd, mv, cp, rm, file, pwd, date, cal, echo, bc, ls, who, whoami, host name, uname, tty, aliase.

Vi Editor: vi basics, three modes of vi Editor, how to write, save, execute a shell script in vi editor

UNIT II **(10 Hrs)**

Processes: Process Concept, Process Scheduling, Operation on Processes

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms

Process Synchronization: Background, The Critical-Section Problem, Semaphores solution to critical section problem

Process related commands in Linux: ps, top, pstree, nice, renice and system calls

UNIT III **(10 Hrs)**

Memory Management: Background, Logical versus Physical Address space, swapping, Contiguous allocation, Segmentation, Paging

Virtual Memory: Demand Paging, Performance of Demand Paging, Page Replacement, Page-replacement Algorithms, Allocation of Frames, Thrashing

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

UNIT IV **(10 Hrs)**

Information Management: Introduction, File Concept, Access methods, Directory and Disk structure, File Protection

Linux File Security: Permission types, examining permissions, changing permissions (symbolic method numeric method)

Textbook:

1. Silbersachatz and Galvin, “Operating System Concepts”, John Wiley & Sons, 10 th Ed. 2018
2. Sumitabha Das, “Unix Concepts and Application”, TMH

Reference Books:

1. Madnick E., Donovan J., “Operating Systems”, Tata McGraw Hill, 2011
2. Tannenbaum, “Operating Systems”, PHI, 4th Edition, 2015
3. Sivaselvan, Gopalan, “A Beginner’s Guide to UNIX”, PHI Learning

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

INTRODUCTION TO BIG DATA

Code:24CS508
Max Marks:70

Course Objectives: This subject "Introduction to Big Data" helps student to understand the fundamental concepts of Big Data and its ecosystem . Its tools techniques for large datasets like Hadoop and spark in real -world scenarios.

UNIT I **(5 Hrs)**
Introduction to Big Data: Defination, characteristics of Big Data (volume, variety, velocity, veracity, value) Big Data vs Traditional Data, source and types of big data, challenge in Big data management, Applications of big data in various domains

UNIT II **(5 Hrs)**
Hadoop Ecosystem: Introduction to Hadoop and its architecture, HDFS concepts, MapReduce Programming Model, YARN Overview, Hive, Pig, and HBase Introduction.

UNIT III **(5 Hrs)**
Big Data Processing Tools: Introduction to Apache Spark, Spark components: spark core, spark SQL, Spark Streaming, ML lib, Data ingestion tools: sqoop, flume, NoSQL database: Introduction to MongoDB and Cassandra.

UNIT IV **(5 Hrs)**
Big Data Analytical and Applications: Basic of data analytics using big data, real-time processing with spark streaming, case studies: big data in healthcare, E-commerce, and Finance, Data privacy and security in Big Data, future trends in bid data technologies.

Textbooks:

1. Big Data: "Principle and Paradigms" by Rajkumar Buyya
2. Big Data Fundamentals by Thomas Erl , Wajid Khattak, Paul Buhler

References Books:

1. Hadoop: "The definitive Guide" by Tom White
2. "Learning Spark" Lightning fast data analytics by Holden Karau

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WEB SECURITY

Code: 24CS512
Max Marks: 70

Course Objectives: The course aims to Understand the Fundamentals of Web Security, Identify Common Web Vulnerabilities, Learn Techniques for Securing Web Applications, Understand Secure Communication Protocols, Use Web Security Tools and Testing Methods, Understand Security in Client-Side and Server-Side Technologies, Explore Authentication and Identity Management Systems, Study Real-World Case Studies and Attack Scenarios, Understand Legal and Ethical Aspects of Web Security and Design and Build Secure Web Applications.

UNIT I **(08 Hrs)**

Components of Internet, Weak points of Internet, HTTP vs HTTPS, Overview of web authentication technologies, Web application architecture, Recent attack trends, Types of Web Security, Web infrastructure security/Web application firewalls, managing configurations for web apps, Techniques of Web Hacking, Methods of Attacking users, Importance of Web Application Security, Web Application Security vs Network Security. Social Media security - What is Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs Collecting data from Online social media. Trust, credibility, and reputations in social systems.

UNIT II **(04 Hrs)**

Internet and Web Application Security: Email security (PGP and SMIME), Web Security: Web authentication, Injection Flaws, Programming Bugs and Malicious code, XSS and SQL Injection, Memory corruption exploits, Web Browser Security, E-Commerce Security

UNIT III **(04 Hrs)**

Wireless Network Security: Components, Security issues, Securing a Wireless Network, Mobile Security Management: Disaster Recovery, Ethical Hacking, Penetration Testing, Computer Forensics, Cyber laws and crime, Security Audit and Investigation, Cyber Security Solutions

UNIT IV **(04 Hrs)**

Web services overview, Honeytoken, XML security, AJAX attack trends and common attacks, REST security, Content Security Policy Serialization security, Clickjacking, DNS rebinding, HTML5 security, Logging collection and analysis for web apps, Security testing, IPv6 impact on web security.

Textbook:

1. Joel Scam bray, Vincent Liu, Caleb Sima, “Hacking Exposed Web Applications, 3rd Edition”, McGraw-Hill, October 2010
2. Baloch, R., Ethical Hacking and Penetration Testing Guide, CRC Press, 2015.

Reference Books:

1. Dafydd Stuttard, and Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2nd Edition, John Wiley & Sons, 2011.
2. Council, Ec., Computer Forensics: Investigating Network Intrusions and Cybercrime, Cengage Learning, Second Edition, 2010.
3. John W. Ritting house, William M. Hancock, “Cyber Security Operations Handbook”, Elsevier Pub
4. Deborah G Johnson, “Computer Ethics”, 4th Edition, Pearson Education Publication.
5. Earnest A. Kallman, J.P Grillo, “Ethical Decision making and IT: An Introduction with Cases”, McGraw Hill Publication.

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CLOUD COMPUTING

Code: 24CS502
Max Marks: 70

Course Objectives: The course aims to enable students to Understand the Fundamentals of Cloud Computing, Explore Cloud Service Models, Learn About Cloud Deployment Models, Gain Familiarity with Leading Cloud Platforms, Study Virtualization and Resource Management, Implement Cloud Storage and Networking Concepts, Understand Security and Privacy in the Cloud, Explore Cloud Application Development and Deployment, Work on Real-World Cloud Projects and Prepare for Industry and Certification Exams.

UNIT I **(08 Hrs)**

Cloud Computing Overview –Services of Internet, Origins of Cloud computing – Cloud components – Essential characteristics – On-demand self-service, The vision of cloud computing – Characteristics, benefits, and Challenges ahead

UNIT II **(08 Hrs)**

Cloud Computing Architecture-Introduction – Internet as a Platform, The cloud reference model - Types of clouds - Economics of the cloud, Computing platforms and technologies, Cloud computing economics, Cloud infrastructure - Economics of private clouds - Software productivity in the cloud - Economies of scale: public vs. private clouds.

UNIT III **(06 Hrs)**

Principles of Parallel and Distributed Computing: Parallel vs. distributed computing - Elements of parallel computing - Hardware architectures for parallel processing, Approaches to parallel programming - Laws of caution.

UNIT IV **(8 Hrs)**

Virtualization: Introduction - Characteristics of virtualized environments - Taxonomy of virtualization techniques - Virtualization and cloud computing - Pros and cons of virtualization - Technology example: VMware: full virtualization, Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization.

Textbook:

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, “Mastering Cloud Computing” - Foundations and Applications Programming, MK publications, 2013.
2. Gautam Shroff, “Enterprise Cloud Computing: Technology, Architecture, Applications” by Cambridge University Press, 2010.

Reference Books:

1. Michael J.Kavis, “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)”, John Wiley & Sons Inc., Jan 2014.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

AI FOR HEALTHCARE

Code: 24CS514
Max Marks: 70

Course Objectives: The subject "AI for healthcare" help student to understand the fundamental concepts and its application in the healthcare domain. To provide knowledge about different types of healthcare data, understanding of various technique and encourage innovation and critical thinking.

UNIT I **(06 Hrs)**
Introduction to AI in Healthcare: Overview of AI and Machine Learning, Historical background and evolution of AI in medicine. Importance and applications of AI in healthcare, Ethical, legal, and regulatory issues in AI healthcare, Case studies of AI in diagnosis and treatment support.

UNIT II **(08 Hrs)**
Data in Healthcare: Types of medical and healthcare data (structured, unstructured, imaging, sensor data) Data collection, annotation, and pre-processing techniques, Electronic Health Records (EHR): challenges and opportunities, Introduction to healthcare ontologies and standards (HL7, FHIR), Data privacy and security in healthcare.

UNIT III **(08 Hrs)**
AI Techniques in Healthcare: Machine learning algorithms for disease prediction and diagnosis, Deep learning for medical imaging (X-rays, MRI, CT scans), Natural Language Processing for clinical text analysis, AI in personalized medicine and genomics, AI in drug discovery and clinical trial optimization.

UNIT IV **(08 Hrs)**
Emerging Trends and Applications: Wearable devices and remote patient monitoring, AI-enabled robotic surgery and virtual assistants, Chatbots and AI for mental health support, AI in hospital management systems, Future trends: federated learning, explainable AI, digital twins in healthcare**.**

Textbook:

1. 'Artificial Intelligence for Healthcare' by Parashar Shah, Wiley, 2021.

Reference Books:

1. 'Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again' by Eric Topol, Basic Books, 2019
2. 'Machine Learning for Healthcare' by Kevin Franks, Apress, 2020
3. 'Artificial Intelligence in Healthcare: Past, Present and Future' edited by Lei Xing, James K. Min, Academic Press, 2020
4. 'Healthcare Data Analytics' edited by Chandan K. Reddy, Charu C. Aggarwal, CRC Press, 2015

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MINOR PROJECT

Code: 24PR401
Max Marks: 70

PROJECT REPORT
All the students are required to submit a report based on the project work done by them during the sixth semester.

SYNOPSIS (SUMMARY/ABSTRACT):
All students must submit a summary/abstract separately with the project report. Summary, preferably, should be of about 3-4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project that the candidate is going to take up. The write up must adhere to the guidelines and should include the following:

- Name / Title of the Project
- Statement about the Problem
- Why is the particular topic chosen?
- Objective and scope of the Project
- Methodology (including a summary of the project)
- Hardware & Software to be used
- Testing Technologies used
- What contribution would the project make?

TOPIC OF THE PROJECT- This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peep into the project to be taken up, candidate is advised to be prudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

OBJECTIVE AND SCOPE: This should give a clear picture of the project. Objective should be clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

PROCESS DESCRIPTION: The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFDs / Flowcharts to explain the flow of the information.

RESOURCES AND LIMITATIONS: The requirement of the resources for designing and developing the proposed system must be given. The resources might be in form of the hardware/software or the data from the industry. The limitation of the proposed system in respect of a larger and comprehensive system must be given.

CONCLUSION: The write-up must end with the concluding remarks- briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

The following suggested guidelines must be followed in preparing the Minor Project Report:
Good quality white A4 size paper should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

- Left margin - 3.0 cms
- Right margin- 2.0cms
- Top margin 2.54cms
- Bottom margin 2.54cms
- Page numbers - All text pages as well as Program source code listing should be numbered at the bottom centre of the pages.

Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 points above and below para spacing.

Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing.

Chapter Heading Font Size: 20, Times New Roman, Centre Aligned, 30 points above and below spacing.

Coding Font size :10, Courier New, Normal

Submission of Project Report to the University: The student will submit his/her project report in the prescribed format. The Project Report should include:

1. One copy of the summary/abstract.
2. One hard Copy of the Project Report.
3. The Project Report may be about 75 pages (excluding coding).

FORMAT OF THE STUDENT PROJECT REPORT ON COMPLETION OF THE PROJECT

I. Cover Page as per format
II. Acknowledgement
III. Certificate of the project guide
IV. Synopsis of the Project
V. Main Report
    i. Objective & Scope of the Project
    ii. Theoretical Background Definition of Problem
    iii. System Analysis & Design vis-a-vis User Requirements
    iv. System Planning (PERT Chart)
    v. Methodology adopted; System Implementation & Details of Hardware & Software used System Maintenance &Evaluation
    vi. Detailed Life Cycle of the Project
        a. ERD, DFD
        b. Input and Output Screen Design
        c. Process involved
        d. Methodology used testing
        e. Test Report, Printout of the Report & Code Sheet
VI. Coding and Screenshots of the project
VII. Conclusion and Future Scope
VIII. References

Formats of various certificates and formatting styles are as:

1. Certificate from the Guide

CERTIFICATE

This is to certify that this project entitled "xxxxxx xxxxx xxxxx xxxx xxxx xxx" submitted in partial fulfillment of the degree of Bachelor of Computer Applications to the "xxxxxxxxxxxxxxxxxxxxxxxxxxx" through xxxxxx xxxxx done by Mr./Ms. _____

Enrollment No._____is an is an authentic work carried out by him/her at _____

_____

_____

under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree to the best of my knowledge and belief.

Signature of the student Signature of the Guide

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2. Project Report Cover Page Format:

Title of the Project/report

(Times New Roman, Italic, Font size = 24)

Submitted in partial fulfilment of the requirements for the award of the degree of

Bachelor of Computer Applications- AIML (Bookman Old Style, 16-point, centre)

Submitted to: **Submitted by:**

(Guide Name) **(Student's name)**

Enrolment No.:

3. Self-Certificate by the students

SELF CERTIFICATE

This is to certify that the dissertation/project report entitled "……" is done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications- AIML under the guidance of_____. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the student
Name of the Student
Enrollment No.

4. ACKNOWLEDGEMENTS

In the "Acknowledgements" page, the writer recognizes his indebtedness for guidance and assistance of the thesis adviser and other members of the faculty. Courtesy demands that he also recognizes specific contributions by other persons or institutions such as libraries and research foundations. Acknowledgements should be expressed simply, tastefully, and tactfully.

ARYAVART INTERNATIONAL UNIVERSITY
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SEMINAR/ CONFERENCE PRESENTATION

Code: 24PR502
Max. Marks: 100

OBJECTIVE:

Seminars/Conferences and Presentations provide a platform to the students, where they can learn from what others are doing, learn about new things, ideas and important tips related to new technologies. To foster the Innovations happening in upcoming technologies and harnessing the entrepreneurial opportunities, Institutes must provide ample opportunities to the students to learn and yield the advantages of new advancements in the field of technology. It is expected from a student to learn latest in the industry and write an article related to it and present their findings in front of a panel.

The following points need to be considered while planning and evaluating the presentation:

- The seminars must be conducted after every 15 days/ or a month. A minimum of 3-4 seminar sessions can be organized during the semester.
- A minimum of 7-8 slides must be there which would include the title slide. The first slide should be the Introduction slide and the last one reference slide wherein all the links/books references/paper reference to paper must be quoted. The rest of the slides should focus on the technology, application areas etc.
- The title of the seminar must be related to the field of Information technology and must talk about the latest innovation/technology like IOT, Machine learning, Deep learning, AI Cloud computing, Mobility, Hand held devices, Social Computing, NOSQL Database, CRM, Social CRM, Open Source Application Development Frameworks, Zero Trust Security Framework/ Architecture, Big Data/ Data Lake, Emerging and Innovative Technologies, Conversational AI, Sentiments Analysis, DevOps, Real time Analytics, Fraud Detection. Proper approval must be taken before starting the work.
- Student's feedback must be taken after taking the seminar as to what learning they have gathered after studying the topics. For this, a feedback form may be designed using Google form utility.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

LINUX-OS LAB

Code: 24CS591
Max. Marks: 70
(BASED ON 24CS501) Operating System & Linux Programming

Core Practical:

1. Connect to the Linux Server and understand the basic Directory Structure of Linux.
2. To understand help commands like: -man, info, help, what is, apropos
3. To understand basic directory navigation commands like cat, cd, mv, cp, rm, mkdir, rmdir, file, pwd command.
4. To understand basic commands like: - date, cal, echo, bc, ls, who, whoami, hostname, uname, tty, aliase.
5. To understand vi basics, three modes of vi Editor, how to write, save, execute a shell script in vi editor.
6. To understand process related commands like: -ps, top, pstree, nice, renice in Linux.
7. To understand how to examine and change File permissions.
8. Set a file to be read-only with the chmod command. Interpret the file permissions displayed by the ls -l command.
9. Delete one or more directories with the rmdir command. See what happens if the directory is not empty. Experiment (carefully!) with the rm -r command to delete a directory and its content
10. Change your directory to the directory exercises. Create a file in that directory, named the file as example1 using the cat command containing the following text: water, water everywhere and all the boards did shrink; water, water everywhere, no drop to drink.
11. Write basic shell script to display the table of a number.
12. Write basic shell script to input a character from user and then check whether it is uppercase, lowercase or digit.
13. Write basic shell script to calculate factorial of a number.
14. Write basic shell script to input the month number and generate corresponding calendar.
15. Write basic shell script to list all directories.
16. Write basic shell script to display greatest of three numbers.
17. Write basic shell script to check whether the number entered by user is prime or not.

Note:

1. **In total 15 practical to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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Theory Paper

Total: 100 Marks
External: 70 Marks
Internal: 30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The higher of the two scores will be considered for the final assessment.

Lab

Practical: 100 Marks
External: 70 Marks
Internal: 30 Marks

External (Two programs): 70 Marks
Program Writing: 10 + 10 Marks
Algorithm & Flowchart: 5 + 5 Marks
Program Execution: 15 + 15 Marks
Viva: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
Record: 5 Marks
Attendance: 5 Marks
Program Writing: 15 Marks
Program Execution: 15 Marks
Viva: 10 Marks

ARYAVART INTERNATIONAL UNIVERSITY

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Syllabus for BCA AIML

Semester 6th

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**External Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS612	Deep Learning with Python	4	0	0	4	70	30	0	100
24CS603	Internet of Things	4	0	0	4	70	30	0	100
Discipline Specific Elective (DSE-5) (Choose any one)									
24CS601	Data warehousing and Data Mining	4	0	0	4	70	30	0	100
24CS614	Mobile Application Development	4	0	0	4	70	30	0	100
Project									
24PR501	Major Project	0	6	0	6	0	100	0	100
Practical									
24CS693	IoT Lab	0	0	2	2	0	30	70	100
	Total				**20**	**210**	**220**	**70**	**500**

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Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

DEEP LEARNING WITH PYTHON

Code: 24CS612
Max Marks: 70

Course Objectives: The course aims to enable students to understand Deep Learning Foundations, Master Neural Network Architectures, Hands-On Implementation Using Python, Work with Real-World Data, Model Evaluation and Tuning, Understand Practical Challenges, Explore the Ethical and Societal Impact and Develop Capstone or Mini Projects.

UNIT I **(7 Hrs)**

Introduction – Overview of Machine Learning, Introduction to Artificial Neural Network (ANN), Perceptron, training a Neural Network, Activation Functions, Loss Function, Hyperparameters, Gradient Descent, Stochastic Gradient Descent, Backpropagation and regularization, Batch normalization, Building an ANN in Python, Frameworks-TensorFlow, Keras.

UNIT II **(7 Hrs)**

What is Deep Learning? Deep vs Shallow Networks, Convolution Neural Networks (CNN) –Convolution Layers, Pooling Layer, Flattening, Fully Connected Layers, Soft max and Cross-Entropy, building a CNN in Python, Fully Connected CNN, CNN Architectures – LeNet, AlexNet, ZFNet, GoogLeNet, VGGNet, ResNet, DenseNet, Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT III **(7 Hrs)**

Deep Belief Networks, Auto Encoders, Concept of Dimensionality Reduction, Autoencoder, Denoising Autoencoders, Deep Autoencoders, Concept of Reinforcement Learning

UNIT IV **(7 Hrs)**

Recurrent Neural Networks (RNN), LSTM, Sequence Prediction and Time Series Forecasting with LSTM, Overview of Object Detection Techniques using Deep Learning, Overview of Transfer Learning.

Text Book:

1. Adam Gibson and Josh Patterson, Deep Learning: A Practitioner's Approach, (O'Reilly).
2. Mohamed Elgendy, Deep Learning for Vision Systems, Manning Publications, ISBN: 9781617296192
3. Navin Kumar Manaswi, Deep Learning with Applications Using Python, Apress (2018)

Reference Books:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
5. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer, 2018.
6. M. Arif Wani, Farooq Ahmad Bhat, Saduf Afzal, Asif Iqbal Khan, Advances in Deep Learning, Springer, 2020.

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INTERNET OF THINGS

Code: 24CS603
Max Marks: 70

Course Objectives: The objective of the course is to understand IoT Fundamentals, explore IoT Communication Protocols, Design and Build IoT Systems, Integrate IoT with Cloud and Web Services, implement IoT Security and Privacy, Develop Practical Applications, apply Data Analytics in IoT, and Foster Innovation and Problem Solving

UNIT I **(10 Hrs)**

Internet of Things (IoT): Vision, Definition, Conceptual framework, Architectural view, Technology behind IoT, Sources of the IoT, M2M Communication, IoT examples.

Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, Communication technologies, Data enrichment and consolidation, Ease of designing and affordability.

UNIT II **(10 Hrs)**

Hardware for IoT: Sensors, Digital sensors, Actuators, Radio frequency identification (RFID) technology, Wireless sensor networks, Participatory sensing technology.

Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported hardware platforms such as Arduino, Net Arduino, Raspberry Pi, Beagle Bone, Intel Galileo boards and ARM cortex.

UNIT III **(10 Hrs)**

Network & Communication Aspects in IoT: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Programming the Arduino: Arduino platform boards anatomy, Arduino IDE, Coding using emulator, using libraries, Additions in Arduino, Programming the Arduino for IoT.

UNIT IV **(10 Hrs)**

Challenges in IoT Design Challenges: Development challenges, Security challenges, other challenges.

IoT Applications: Smart metering, E-health, City automation, Automotive applications, home automation, Smart cards, communicating data with H/W units, Mobiles, Tablets, Designing of smart street lights in smart city.

Text Book:

1. Rajan Gupta, Supriya Madan, “Fundamentals of IoT”, BPB Publications, Ist Edition, 2023
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things Key Applications and Protocols”, Wiley.
3. Jeeva Jose, “Internet of Things”, Khanna Publishing House.
4. Michael Miller, “The Internet of Things”, Pearson Education.
5. Raj Kamal, “Internet of Things”, McGraw-Hill,1st Edition,2016

Reference Books:

1. Arshdeep Bahgaand Vijay Madisetti,"Internet of Things: A Hands-on Approach", University Press, 2015
2. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017

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DATAWAREHOUSING AND DATA MINING

Code: 24CS601
Max Marks: 70

Course Objectives: The objective of the course is to understand the Fundamentals, Design, and Implementation, Data Warehouse Operations, Data Mining Techniques, Application of Data Mining, Tool Proficiency, Ethical and Privacy Considerations, and Project Development

UNIT I **(7 Hrs)**

Introduction to Data Warehousing: Overview, Difference between Database System and Data Warehouse, The Compelling Need for Data Warehousing, Data Warehouse – The building Blocks: Defining Features, Data Warehouses and data marts, overview of the components, three-tier architecture, Metadata in the data warehouse.
ETL tools: - Defining the business requirements: Dimensional analysis, information packages – a new concept, requirements gathering methods, requirements definition: scope and content

UNIT II **(7 Hrs)**

Principles of Dimensional Modelling: Objectives, From Requirements to Data Design, Multi-Dimensional Data Model, Schemas: the STAR schema, the Snowflake schema, the fact constellation schema.
OLAP in the Data Warehouse: Demand for Online Analytical Processing, limitations of other analysis methods, OLAP definitions and rules, OLAP characteristics, major features and functions, hyper cubes.
OLAP Operations: Drill-down and roll-up, slice-and-dice, pivot or rotation, OLAP models, overview of variations, the MOLAP model, the ROLAP model, the DOLAP model, ROLAP versus MOLAP, OLAP implementation considerations. Query and Reporting, Executive Information Systems (EIS), Data Warehouse, and Business Strategy

UNIT III **(7 Hrs)**

Data mining and data pre-processing:
Data mining: Introduction, What kind of data can be mined, What kind of patterns to be mined, Which technologies are used, What kinds of applications are targeted, Major issues in data mining.
Data pre-processing: Overview of Data pre-processing, data cleaning, data integration, data reduction, data transformation, and data discretization, exploring data using the IRIS datasets. Introduction to apriori algorithm for association mining rules.

UNIT IV **(7 Hrs)**

Data mining applications, and Data mining Tools:
Applications of data mining: Data mining for retail and telecommunication industries, data mining and recommender systems.
Introduction to data mining tools (open source): Weka-Rapid Miner, IBM Watson for classification and clustering algorithms using IRIS Datasets

Text Book:

1. Kamber and Han, “Data Mining Concepts and Techniques”, Third edition, Hartcourt India P.Ltd.,2012.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to data mining”, Pearson education, 2006
3. Paul Raj Poonia, “Fundamentals of Data Warehousing”, John Wiley & Sons, 2004

Reference Books:

1. Ashok N. Srivastava, Mehran Sahami, “Text Mining Classification, Clustering, and Applications”, Published by Chapman and Hall/CRC1st Edition, June 23, 2009
2. Ian H., Eibe Frank, Mark A. Hall, Christopher Pal “Data Mining: Practical Machine Learning Tools and Techniques” Published by Morgan Kaufmann; 4th edition,December 1, 2016.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, PHI, 2006.
4. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill, 1 July 2017 RB.
5. Shmueli, “Data Mining for Business Intelligence: Concepts, Techniques and Applications in Microsoft Excel with XLMiner”, Wiley Publications

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MOBILE APPLICATION DEVELOPMENT

Code: 24CS614
Max Marks: 70

Course Objectives: The objective of the course includes understanding Mobile Development Fundamentals, gaining proficiency in Development Tools and Frameworks, designing user-centric Mobile Interfaces, Implement Core Mobile App Features, Work with Databases and Cloud Services, Ensure App Security and Performance, Test and Debug Mobile Applications, Publish and Maintain Mobile Apps and Develop Real-World Mobile Applications.

UNIT I **(10 Hrs)**

Introduction: Brief history of mobile applications, Different types of mobile applications, Brief history of Android, Introduction to Android Development Environment, Android Application

Design Essentials: Anatomy of an Android application, Creating a First Android Application, Creating an Android project, Project organization, setting up a real Android device, setting up an Android emulator, developing a simple user interface, Running your first application

Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT II **(9 Hrs)**

User Interface in Android: Adaptive and responsive user interfaces, User Input Controls, Menus, Screen Navigation, Recycler View, Drawable, Themes and Styles, Fragments, Fragment Life Cycle, Introduction to Material Design.

Android Application Components: App Widgets, Processes and Threads, User Interface Components, Views and layouts, Input controls, Input Events, Settings, Dialogs, Menus, Notifications, Toasts, Testing the user interface

UNIT III **(8 Hrs)**

Background tasks: Async Task, Async Task Loader, Connecting App to Internet, Broadcast receivers, Services, Notifications, Alarm managers.

Sensor, Location, and Maps: Sensor Basic, Motion and Position Sensors, Location services, Google Maps API, Google Places API

UNIT IV **(10 Hrs)**

Working with data in Android: Shared Preferences, App Settings, SQLite primer, Store data using SQLite database, Content Providers, Content Resolver, Loader

Publishing Your App: Preparing for publishing, signing, and preparing the graphics, publishing to the Android Market

Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Text Books:

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011).
2. Wei-Meng Lee,” Beginning Android 4 Application Development”, Wiley India Pvt. Ltd.
3. J. F. DiMarzio, “Android: A Programmer's Guide”, McGraw-Hill Education (India) Private Limited.

Reference Books:

1. Paul Deitel “Android for Programmers: An App-Driven Approach” 1st Edition, Pearson India.
2. Wei-Meng Lee, “Beginning Android Application Development”, Wiley Publishing.

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MAJOR PROJECT

Code: 24PR501
Max Marks: 70

PROJECT REPORT

All the students are required to submit a report based on the project work done by them during the sixth semester.

SYNOPSIS (SUMMARY/ABSTRACT):
All students must submit a summary/abstract separately with the project report. Summary, preferably, should be about 3-4 pages. The content should be as brief as is sufficient to explain the objective and implementation of the project that the candidate is going to take up. The write-up must adhere to the guidelines and should include the following:

- Name/Title of the Project
- Statement about the Problem
- Why are the particular topic chosen?
- Objective and scope of the Project
- Methodology (including a summary of the project)
- Hardware & Software to be used
- Testing Technologies used
- What contribution would the project make?

TOPIC OF THE PROJECT- This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peek into the project to be taken up, the candidate is advised to be prudent in naming the project. This is the overall impression of the future work; the topic should corroborate the work.

OBJECTIVE AND SCOPE: This should give a clear picture of the project. The objective should be clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

PROCESS DESCRIPTION: The process of the whole software system proposed to be developed should be mentioned in brief. This may be supported by DFDs / Flowcharts to explain the flow of the information.

RESOURCES AND LIMITATIONS: The requirements of resources for designing and developing the proposed system must be given. The resources might be in the form of hardware/software or data from the industry. The limitation of the proposed system with respect to a larger and comprehensive system must be given.

CONCLUSION: The write-up must end with the concluding remarks- briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

The following suggested guidelines must be followed in preparing the Final Project Report:
GoodqualitywhiteA4sizepapershouldbeusedfortypingandduplication.Careshouldbetakentoavoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

- Left margin- 3.0 cms
- Right margin- 2.0 cms
- Top margin- 2.54 cms
- Bottom margin- 2.54 cms
- Page numbers- All text pages as well as Program source code listing should be numbered at the bottom centre of the pages.

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Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, justified 6 points above and below para spacing.
Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 points above & below spacing.
Chapter Heading Font Size: 20, Times New Roman, Centre Aligned, 30 points above and below spacing.
Coding Font size :10, Courier New, Normal
Submission of Project Report to the University: The student will submit his/her project report in the prescribed format. The Project Report should include:

1. One copy of the summary/abstract.
2. One hard Copy of the Project Report.
3. The Project Report may be about 75 pages (excluding coding).

FORMAT OF THE STUDENT PROJECT REPORT ON COMPLETION OF THE PROJECT

I. Cover Page as per format
II. Acknowledgement
III. Certificate of the project guide
IV. Synopsis of the Project
V. Main Report
    i. Objective & Scope of the Project
    ii. Theoretical Background Definition of Problem
    iii. System Analysis & Design vis-à-vis User Requirements
    iv. System Planning (PERT Chart)
    v. Methodology adopted System Implementation & Details of Hardware & Software used System Maintenance & Evaluation
    vi. Detailed Life Cycle of the Project
        a. ERD, DFD
        b. Input and Output Screen Design
        c. Process involved
        d. Methodology used testing
        e. Test Report, Printout of the Report & Code Sheet
VI. Coding and Screenshots of the project
VII. Conclusion and Future Scope
VIII. References

Formats of various certificates and formatting styles are as:

1. Certificate from the Guide

CERTIFICATE

This is to certify that this project entitled "xxxxxxxxxxxxxxxxxxxxxxxx xxx" submitted in partial fulfillment of the degree of Bachelor of Computer Applications - AIML to the "xxxxxxxxxxxxxxxxxxxxxxxxx" through xxxxxxxxxx done by Mr./Ms.

_____Enrollment No. _____is an is an authentic work carried out by him/her at _____ my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree to the best of my knowledge and belief.

Signature of the student Signature of the Guide

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2. Project Report Cover Page Format:

Title of the Project/report
(Times New Roman, Italic, Font size= 24)

Submitted in partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications -AIML (Bookman Old Style, 16points, centre)

Submitted to:
(Guide Name)

Submitted by:
(Student's name)
Enrolment No.:

3. Self-Certificate by the students

SELFCERTIFICATE

This is to certify that the dissertation/project report entitled " ....." is done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications -AIML under the guidance of_____ _____. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the student
Name of the Student
Enrollment No.

4. ACKNOWLEDGEMENTS

In the "Acknowledgements" page, the writer recognizes his indebtedness for guidance and assistance of the thesis adviser and other members of the faculty. Courtesy demands that he also recognizes specific contributions by other persons or institutions such as libraries and research foundations. Acknowledgements should be expressed simply, tastefully, and tactfully.

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IOT LAB

Code: 24CS693

Max. Marks: 70

(BASED ON 24CS603) Internet of Things

List of Practical:

1. Study and Install IDE of Arduino
2. Write the steps to add libraries in Arduino and setup of Arduino IDE for programming.
3. Write a Program using Arduino for Blink LED.
4. Write a Program for monitoring Temperature using Arduino and LM35Temperature Sensors.
5. Write a Program for Controlling Raspberry Pi with WhatsApp.
6. Write a program to shows how to fade an LED on pin 9 using the analogue Write () function.
7. Write the steps to add blynk libraries for Node MCU and account on IFTTT forhome automation.
8. Write a program of Fade LED using Node MCU (ESP8266) and blynk app
9. Write a program for Arduino by using Ultrasonic sensors and servo motor (HC- SR04), and make a smart dustbin.
10. Write a program for controlling bulb on/off by using Blynk app.

Suggested IOT based Applications:

1. Create home automation project for controlling electrical home appliances via Google assistant or any other IOT based project may be undertaken.
2. Setting up Wireless Access Point using Raspberry Pi.
3. Fingerprint Sensor interfacing with Raspberry Pi
4. Raspberry Pi GPS Module Interfacing.
5. Visitor Monitoring with Raspberry Pi and Pi Camera

Note:

1. **In total 10 practical and one application to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

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Theory Paper

Total: 100 Marks
External: 70 Marks
Internal: 30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 3 out of 5 (Long 240-300 Words): 10 marks each (5x3 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

Lab

Practical: 100 Marks
External: 70 Marks
Internal: 30 Marks

External (Two programs) : 70 Marks
Program Writing: 10 + 10 Marks
Algorithm & Flowchart : 5 + 5 Marks
Program Execution: 15 + 15 Marks
Viva: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
Record: 5 Marks
Attendance: 5 Marks
Program Writing: 15 Marks
Program Execution: 15 Marks
Viva: 10 Marks

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Syllabus for BCA-AIML

Semester 7

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS706	Blockchain Technologies	4	0	0	4	70	30	0	100
24CS707	R Programming for Data Science	4	0	0	4	70	30	0	100
24CS708	AI Applications	4	0	0	4	70	30	0	100
24CS709	Computer Vision	4	0	0	4	70	30	0	100
24MO701	MOOC I (from SWAYAM Platform)	3	0	0	3	70	30	0	100
Practical									
24CS793	R Programming Lab	0	0	2	2	0	30	70	100
	Total				**20**	**350**	**180**	**70**	**600**

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Detailed Syllabus

BLOCKCHAIN TECHNOLOGY

Code: 24CS706
Max Marks: 70

Course Objectives: The objective of this course is to develop familiarity with theoretical concepts, underlying technology, tools, implementation strategies, and current practices. The course will offer a strong technical understanding of Blockchain technologies, develop familiarity with current technologies, tools, and implementation strategies, and introduce application areas, current practices, and research activity.

UNIT I **(08 Hrs)**
Introduction to Blockchain Technology – Distributed systems – The history of blockchain – Introduction to blockchain – CAP theorem and blockchain – Benefits and limitations of blockchain – Decentralization using blockchain - Methods of decentralization – Routes to decentralization.

UNIT II **(08 Hrs)**
Cryptography in Blockchain: Introduction – cryptographic primitives – Asymmetric cryptography – public and private keys -line interface – Bitcoin improvement proposals (BIPs) – Consensus Algorithms.

UNIT III **(08 Hrs)**
BitCoin Introduction – Transactions – Structure - Transaction types – The structure of a block– The genesis block – The bitcoin network– Wallets and their types– Bitcoin payments– Bitcoin investment and buying and selling bitcoins – Bitcoin installation – Bitcoin programming and the command-line interface – Bitcoin improvement proposals (BIPs).

UNIT IV **(08 Hrs)**
Ethereum - Ethereum blockchain- Elements of the Ethereum blockchain– Precompiled contracts – Accounts and their types – Block header- Ether – Messages – Mining - Clients and wallets – Trading and investment – The yellow paper - The Ethereum network - Applications developed on Ethereum - Scalability and security issues.

UNIT V **(08 Hrs)**
Smart Contract and Hyperledger – History of Smart Contract – Ricardian contracts - The DAO. Hyperledger projects – Hyperledger as a protocol – Fabric - Hyperledger Fabric - Sawtoothlake – Corda Architecture.

Textbook:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd revised edition. Birmingham: Packt Publishing, 2018.

Reference Books:

1. A. M. Antonopoulos, Mastering Bitcoin, First edition. Sebastopol, CA: O'Reilly, 2015.
2. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, "An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends", in 2017 IEEE International Congress on Big Data (BigData Congress), 2017, pp.557–564.

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R PROGRAMMING FOR DATA SCIENCE

Code: 24CS707
Max Marks: 70

Course Objectives: The objective of the course is to introduce participants to the R programming language and its environment, to equip learners with the skills to manipulate data, perform statistical analyses, and create visualizations using R, to provide insights into advanced data analysis techniques, including machine learning algorithms within the R ecosystem, to foster the ability to tackle real-world data problems and derive actionable insights using R, and to cultivate best practices in coding and data analysis workflows, ensuring reproducibility and efficiency.

UNIT I **(08 Hrs)**

Introduction to R Programming: Overview of R and its IDEs (RStudio), Basics of R syntax and programming concepts, Data types, variables, and operations in R.

UNIT II **(08 Hrs)**

Data Manipulation and Preparation: Importing and exporting data in R, Data cleaning and preparation with dplyr, Data transformation using tidyr.

UNIT III **(08 Hrs)**

Data Analysis and Statistics: Descriptive statistics and exploratory data analysis, Hypothesis testing and inferential statistics, Regression analysis and ANOVA.

UNIT IV **(08 Hrs)**

Data Visualization with R: Principles of effective data visualization, Introduction to ggplot2 and advanced visualization techniques, Creating interactive visualizations with packages like plotly.

UNIT V **(08 Hrs)**

Advanced Analytics and Machine Learning: Overview of machine learning in R, Classification, regression, and clustering techniques, Model evaluation and tuning.

Textbook:

1. N. Metzler, " R Programming for Beginners: An Introduction to Learn R Programming with Tutorials and Hands-On Examples," Independently Published, 2019.
2. 2. Fischetti, Tony, “R: Data Analysis and Visualization,” Packt Publishing, 2016

Reference Books:

1. Lander, Jared. “R for Everyone: Advanced Analytics and Graphics,” Pearson Education, 2017.
2. Singh, Ajit. “R Programming: Simply In Depth,” Amazon Digital Services LLC -KDP, 2020.
3. G. Grolemund, "R Programming: An Approach to Data Analytics," MJP Publisher, 2021.

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AI APPLICATIONS

Code: 24CS708
Max Marks: 70

Course Objectives: The objective of the course is to introduce Artificial Intelligence in detail from its basics to future applications and tools of Industry 4.0, to provide insights on technological advancements and focuses on preparing students and researchers for Industry 5.0, to impart the importance of AI technologies in assistive technology, to discuss the available applications of AI for promoting early diagnosis of diseases, and to understand the various AI technologies.

UNIT I: Artificial Intelligence Insight **(08 Hrs)**

Artificial Intelligence:

a. What and Why
b. History of AI
c. What is AI – The Basics
d. AI Environment
e. Challenges in AI
f. Current work in AI for environment
g. Customer Experience (CX) and the use of AI
h. Future of AI
i. Future challenges in AI.

UNIT II: Influence of AI in Machine Learning **(08 Hrs)**

a. Definition– What is Machine Learning?
b. Importance of Machine Learning
c. Types of Machine Learning
d. Approaches of Machine Learning
e. Machine Learning Algorithm
f. Programming Languages
g. Frameworks
h. Databases
i. Deployment tools
j. Methodology for Model Building
k. Machine learning methods
l. Statistical Measures
m. Application areas of Machine Learning
n. Medical Machine Learning
o. Influence of AI and ML in Clinical and Genomic Diagnostics

UNIT III: Artificial Intelligence in Healthcare Sector & Assistive Technology **(08 Hrs)**

a. AI in diagnosis of Genetic Diseases– Cancer, Diabetes
b. AI in Diagnosis of Syndrome
c. AI in diagnosis of Psychiatric Disorders– Depression, Alzheimer's Disease, Autism Spectrum Disorder, Anxiety, Parkinson's Disease
d. AI in other Diagnosis– Infectious Disease, Lung and Brain Disease
e. Case studies on AI in systems Biology
f. AI technologies in Systems Biology towards Pharmacogenomics
g. AI in Systems Biology for Cancer Cure
h. Applications of AI for COVID-19 Pandemic
i. Transformative impact of AI on AT
j. AI experience and AT for disables people in India
k. AI Powered technology for an inclusive world.

UNIT IV: Artificial Intelligence in Agriculture **(08 Hrs)**

a. Need of AI in Agriculture
b. Emerging Agricultural Technologies
c. Soil and water sensors
d. Weather Tracking
e. Satellite Imaging Agriculture
f. Automation Systems
g. RFID Technology
h. Potential Agricultural Domain for Modernization
i. AI transformation in Agricultural Scenarios

UNIT V: Artificial Intelligence in Radiotherapy **(08 Hrs)**

a. Importance of Artificial Intelligence in Radiotherapy
b. AI tools for automated treatment planning (ATP)
c. Present ATP techniques
d. AI applications, Advancements and Research Guidance in ATP
e. AI challenges in ATP
f. AI in Intensity modulated Radiotherapy (IMRT)
g. AI for IMRT Dose Estimation
h. AI for IMRT Planning Support
i. AI for Modelling IMRT outcome and plan deliverability
j. AI for AUTO Segmentation of OAR in IMRT
k. AI in Brachytherapy
l. AI in Radiotherapy Quality Assurance
m. Challenges associated with AI for Quality Assurance in RT
n. Future directions to improve AI-based Quality Assurance in RT
o. AI in Radiation Biology
p. AI in Radiation Protection/Safety
q. Motivations to develop AI-Based systems for Radiation protection

Textbook:

1. Kaliraj, P., & Devi, T. (Eds.). (2021). Artificial Intelligence Theory, Models, and Applications (1st ed.). CRC Press, Taylor & Francis Group, Boca Raton, ebook ISBN 9781032008097 Auerbach Publications. https://doi.org/10.1201/9781003175865

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

COMPUTER VISION

Code: 24CS709
Max. Marks: 70

Course Objectives:

UNIT I **(10 Hrs)**

Image Formation: Geometric primitives and transformations: Orthogonal, euclidean, affine, projective, etc. photometric image formation. Edges canny, LOG, DOG; line detectors (Hough transform), Corners Harris, Hessian Affine, orientation histogram, SIFT, SURF, HOG, GLOH.

UNIT II **(10 Hrs)**

Camera Geometry: Camera parameters and perspective projection, affine camera, least-squares parameter estimation, linear approach to camera calibration, homography, rectification, auto calibration. Linear color spaces: CIE XYZ, RGB, CMY, non-linear colour spaces: HSV, spatial and temporal effects.

UNIT III **(10 Hrs)**

Motion Analysis: Translational alignment, parametric motion, spline-based motion, optical flow, KLT. Epipolar geometry, sparse correspondence, dense correspondence, multi-view stereo.

UNIT IV **(10 Hrs)**

Object Recognition and Advanced Computer Vision Applications: Basics of object detection, face recognition, instance recognition, category recognition, context and scene understanding, activity recognition, computational photography, shape from X.

Textbooks:

1. Computer Vision: Algorithms and Applications – Richard Szeliski, Springer, 2010.
2. Computer Vision – Shapiro and Stockman, Prentice Hall, 2001.
3. Image Processing, Analysis, and Machine Vision – Sonka, Hlavac, and Boyle, Cengage Learning, 2009.
4. Fundamentals of Machine Vision – Harley R. Myler, PHI Learning, 2003.
5. Computer Vision: A Modern Approach – Forsyth, David A., Ponce, Jean, PHI Learning, 2009.
6. Digital Image Processing – Rafael C. Gonzalez and Richard E. Woods, Pearson Education, 3rd Edition

Reference Books:

1. D. L. Baggio et al., ―Mastering OpenCV with Practical Computer Vision Projects, Packt Publishing, 2012.
2. E. R. Davies, ―Computer & Machine Vision, Fourth Edition, Academic Press, 2012.
3. Jan Erik Solem, ―Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media, 2012.
4. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision, Third

a. Edition, Academic Press, 2012.

5. R. Szeliski, ―Computer Vision: Algorithms and Applications, Springer 2011.
6. Simon J. D. Prince, ―Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

MOOC COURSE I (FROM SWAYAM PLATFORM)

Code: 24MO701
Max Marks: 70

List of MOOCs enrolled by a learner can be found in the "My Courses" page on SWAYAM Portal (link is available at the top of page, click on logged-in user-name), Current Link is:

https://swayam.gov.in/mycourses

The candidate is required to complete a 03-credit Skill Enhancement Course (SEC) from the list of courses available on the SWAYAM online platform.

R PROGRAMMING LAB

Code: 24CS793
Max. Marks: 70

(BASED ON 24CS707) R Programming for Data Science:

List of Experiments:

1. Download and install the R-Programming environment and install basic packages using the install basic packages () command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators, etc.)
3. Write a program to find a list of even numbers from 1 to n using R-Loops.
4. Create a function to print the squares of numbers in sequence.
5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write a program to read a CSV file and analyze the data in the file in R.

Note:

This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.

ARYAVART INTERNATIONAL UNIVERSITY
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Theory Paper

Total: 100 Marks
External: 70 Marks
Internal: 30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

Lab

Practical: 100 Marks
External: 70 Marks
Internal:30 Marks

External (Two programs): 70 Marks
- **Program Writing**: 10 + 10 Marks
- **Algorithm& Flowchart**: 5 + 5 Marks
- **Program Execution**: 15 + 15 Marks
- **Viva**: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
- **Record**: 5 Marks
- **Attendance**: 5 Marks
- **Program Writing**: 15 Marks
- **Program Execution**: 15 Marks
- **Viva**: 10 Marks

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ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for BCA-AIML

Semester 8

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS803	Software Testing Methodologies	4	0	0	4	70	30	0	100
24CS606	Soft Computing	4	0	0	4	70	30	0	100
24GN701	Research Methodology & Research Ethics	4	0	0	4	70	30	0	100
24PR502	Seminar/Conference Presentation	0	0	2	2	0	0	100	100
24PR501	Major Project	0	6	0	6	0	100	0	100
	Total				**20**	**280**	**220**	**100**	**600**

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

SOFTWARE TESTING METHODOLOGIES

Code: 24CS803
Max Marks: 70

Course Objectives: The objective of this course is to study the fundamental concepts of software testing, which include objectives, process, criteria, strategies, and methods, to discuss various software testing types and levels of testing, like black and white box testing, along with levels of unit test, integration, regression, and system testing. It also helps to learn the types of bugs, testing levels with which the student can very well identify a bug and correct it as it happens. It provides knowledge on transaction flow testing and data flow testing techniques so that the flow of the program is tested as well, and to learn the domain testing, path testing, and logic-based testing to make the testing process easier.

UNIT I **(08 Hrs)**

a. Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs
b. Flow graphs and Path testing: Basic concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, and application of path testing.

UNIT II **(08 Hrs)**

a. Transaction Flow Testing: transaction flows, transaction flow testing techniques.
b. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

UNIT III **(08 Hrs)**

a. Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT IV **(08 Hrs)**

a. Paths, Path products, and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.
b. Logic-Based Testing: overview, decision tables, path expressions, KV charts, specifications.

UNIT V **(08 Hrs)**

a. State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.
b. Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools.

Textbook:

1. Software Testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

Reference Books:

1. The craft of software testing – Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective Methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

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SOFT COMPUTING

Code: 24CS606
Max Marks: 70

Course Objectives: This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve various real-life problems will be covered to provide hands-on practice. In summary, this course will provide exposure to both theory and practical systems and software used in soft computing.

UNIT I: Introduction to Soft Computing **(08 Hrs)**

a. Concept of computing systems.
b. "Soft" computing versus "Hard" computing
c. Characteristics of Soft Computing
d. Some applications of Soft computing techniques.

UNIT II: Fuzzy Logic **(08 Hrs)**

a. Introduction to Fuzzy logic.
b. Fuzzy sets and membership functions.
c. Operations on Fuzzy sets.
d. Fuzzy relations, rules, propositions, implications and inferences.
e. Defuzzification techniques.
f. Fuzzy logic controller design.
g. Some applications of Fuzzy logic.

UNIT III: Genetic Algorithms **(08 Hrs)**

a. Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques
b. Basic GA framework and different GA architectures.
c. GA operators: Encoding, Crossover, Selection, Mutation, etc.
d. Solving single-objective optimization problems using GAs.

UNIT IV: Multi-Objective Optimization Problem-Solving **(08 Hrs)**

a. Concept of multi-objective optimization problems (MOOPs) and issues of solving them.
b. Multi-Objective Evolutionary Algorithm (MOEA).
c. Non-Pareto approaches to solve MOOPs
d. Pareto-based approaches to solve MOOPs
e. Some applications with MOEAs.

UNIT V: Artificial Neural Networks **(08 Hrs)**

a. Biological neurons and their working.
b. Simulation of biological neurons for problem-solving.
c. Different ANN architectures.
d. Training techniques for ANNs.
e. Applications of ANNs to solve some real-life problems.

Textbook:

1. Fuzzy Logic: A Practical Approach, F. Martin, McNeill, and Ellen Thro, AP Professional, 2000.
2. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
3. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
4. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
5. Practical Genetic Algorithms, Randy L. Haupt and Sue Ellen Haupt, John Wiley & Sons, 2002.
6. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.

Reference Books:

1. Soft Computing, D. K. Pratihar, Narosa, 2008.
2. Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elsevier Press, 2004.
3. Neuro-Fuzzy and Soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
4. Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011.
5. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

RESEARCH METHODOLOGY & RESEARCH ETHICS

Code: 24GN701
Max Marks: 70

Course Objectives: The objective of the course is to introduce the basic concepts of research methodology to understand methods of selecting a research problem and different tools to be employed in a research project, and to develop skills in qualitative and quantitative data analysis.

UNIT I **(10 Hrs)**

Research process, Problem and Hypothesis: About Research Introduction, Application of research, Definitions of research, Characteristics/Features of a good research, Types of research, Research Methods and Methodology, Research/Scientific Methods/Discovery, Research approaches, Application of research in management (Research applications in marketing management, Production management, Financial management, Human resource management, Current status of research in India), Limitations of research. Research Process - Defining and Formulating the Research Problem, Extensive Literature Survey

UNIT II **(10 Hrs)**

Research Design and Sampling Design: About Research Design - Introduction, Definition, Components of a research designs, Concepts related to research designs, Types of research designs. Sampling Design -Definition of sampling, Features of the sampling technique, Essentials of an ideal sample, Types of sampling, Selecting/Calculating the sample size, Determination of sample size n When estimating the population mean, Some basic technologies of sampling, Common sampling distribution, Sampling theory

UNIT III **(10 Hrs)**

Data Collection, Preparation of Questionnaire and Schedule: About Data Collection Introduction, Primary data, Secondary data, Collection of primary data, Sources of secondary data. Questionnaire and Schedule Merits, Demerits, Formulation of Questionnaire, Various Method/ Technique for getting the Response, Construction of Questionnaire, Schedule, Types of Schedules, Types of Questions, Case Study Method.

UNIT IV **(10 Hrs)**

Analysis of Data, Hypothesis Testing, Role of SPSS and Excel: Analysis of Data -Introduction, Processing of data, Diagrammatic presentation in research. Research Hypothesis - Introduction of Research hypothesis, Steps Involved in Hypothesis Testing, Procedure for Testing Hypothesis, Role of SPSS - Introduction, The Variables view, Statistical Types in SPSS, The SPSS Interface, SPSS output files. Role of MS Excel -Excel and Research, The Excel spreadsheet.

Reference Books:

1. Mukul Gupta, Deepa Gupta, Research Methodology, PHI.
2. Dr. C. R. Kothari, Research Methodology, New Age International (P Ltd) Publishers.
3. Dr. J. Y. Khan, Research Methodology, A. T. H. Publishing Corporation.
4. Dr. Prasant Sarangi, Research Methodology, Taxmanns.
5. Briony J Oates, Researching Information Systems and Computing, SAGE Publications.

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SEMINAR/ CONFERENCE PRESENTATION

Code: 24PR502
Max. Marks: 100

OBJECTIVE:

Seminars/Conferences and Presentations provide a platform to the students, where they can learn from what others are doing, learn about new things, ideas and important tips related to new technologies. To foster the Innovations happening in upcoming technologies and harnessing the entrepreneurial opportunities, Institutes must provide ample opportunities to the students to learn and yield the advantages of new advancements in the field of technology. It is expected from a student to learn latest in the industry and write an article related to it and present their findings in front of a panel.

The following points need to be considered while planning and evaluating the presentation:

- The seminars must be conducted after every 15 days/ or a month. A minimum of 3-4 seminar sessions can be organized during the semester.
- A minimum of 7-8 slides must be there which would include the title slide. The first slide should be the Introduction slide and the last one reference slide wherein all the links/books references/paper reference to paper must be quoted. The rest of the slides should focus on the technology, application areas etc.
- The title of the seminar must be related to the field of Information technology and must talk about the latest innovation/technology like IOT, Machine learning, Deep learning, AI Cloud computing, Mobility, Hand held devices, Social Computing, NOSQL Database, CRM, Social CRM, Open Source Application Development Frameworks, Zero Trust Security Framework/ Architecture, Big Data/ Data Lake, Emerging and Innovative Technologies, Conversational AI, Sentiments Analysis, DevOps, Real time Analytics, Fraud Detection. Proper approval must be taken before starting the work.
- Student's feedback must be taken after taking the seminar as to what learning they have gathered after studying the topics. For this, a feedback form may be designed using Google form utility.

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MAJOR PROJECT

Code: 24PR501
Max Marks: 70

PROJECT REPORT

All the students are required to submit a report based on the project work done by them during the eighth semester.

SYNOPSIS (SUMMARY/ABSTRACT):

All students must submit a summary/abstract separately with the project report. Summary, preferably, should be about 3-4 pages. The content should be as brief as is sufficient to explain the objective and implementation of the project that the candidate is going to take up. The write-up must adhere to the guidelines and should include the following:

- Name/Title of the Project
- Statement about the Problem
- Why are the particular topic chosen?
- Objective and scope of the Project
- Methodology (including a summary of the project)
- Hardware & Software to be used
- Testing Technologies used
- What contribution would the project make?

TOPIC OF THE PROJECT- This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peek into the project to be taken up, the candidate is advised to be prudent in naming the project. This is the overall impression of the future work; the topic should corroborate the work.

OBJECTIVE AND SCOPE: This should give a clear picture of the project. The objective should be clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

PROCESS DESCRIPTION: The process of the whole software system proposed to be developed should be mentioned in brief. This may be supported by DFDs / Flowcharts to explain the flow of the information.

RESOURCES AND LIMITATIONS: The requirements of resources for designing and developing the proposed system must be given. The resources might be in the form of hardware/software or data from the industry. The limitation of the proposed system with respect to a larger and comprehensive system must be given.

CONCLUSION: The write-up must end with the concluding remarks- briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

The following suggested guidelines must be followed in preparing the Final Project Report: Good quality white A4 size paper should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

- Left margin- 3.0 cms
- Right margin- 2.0 cms
- Top margin- 2.54 cms
- Bottom margin- 2.54 cms
- Page numbers- All text pages as well as Program source code listing should be numbered at

the bottom centre of the pages.

Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, justified 6 points above and below para spacing.

Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 points above & below spacing.

Chapter Heading Font Size: 20, Times New Roman, Centre Aligned, 30 points above and below spacing.

Coding Font size :10, Courier New, Normal

Submission of Project Report to the University: The student will submit his/her project report in the prescribed format. The Project Report should include:

1. One copy of the summary/abstract.
2. One hard Copy of the Project Report.
3. The Project Report may be about 75 pages (excluding coding).

FORMAT OF THE STUDENT PROJECT REPORT ON COMPLETION OF THE PROJECT

I. Cover Page as per format
II. Acknowledgement
III. Certificate of the project guide
IV. Synopsis of the Project
V. Main Report
    i. Objective & Scope of the Project
    ii. Theoretical Background Definition of Problem
    iii. System Analysis & Design vis-à-vis User Requirements
    iv. System Planning (PERT Chart)
    v. Methodology adopted System Implementation & Details of Hardware & Software used System Maintenance & Evaluation
    vi. Detailed Life Cycle of the Project
        a. ERD, DFD
        b. Input and Output Screen Design
        c. Process involved
        d. Methodology used testing
        e. Test Report, Printout of the Report & Code Sheet
VI. Coding and Screenshots of the project
VII. Conclusion and Future Scope
VIII. References

Formats of various certificates and formatting styles are as:

1. **Certificate from the Guide**

CERTIFICATE

This is to certify that this project entitled "xxxxxxxxxxxxxxxxxxxxxxxx xxx" submitted in partial fulfillment of the degree of Bachelor of Computer Applications -AIML to the "xxxxxxxxxxxxxxxxxxxxxxxxx" through xxxxxxxxxxx done by Mr./Ms._____Enrollment No._____ is an is an authentic work carried out by him/her at _____my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree to the best of my knowledge and belief.

Signature of the student Signature of the Guide

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2. Project Report Cover Page Format:

Title of the Project/report

(Times New Roman, Italic, Font size= 24)

Submitted in partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications - AIML (Bookman Old Style, 16points, centre)

Submitted to:

(Guide Name)

Submitted by:

(Student's name)

Enrolment No.:

3. Self-Certificate by the students

SELFCERTIFICATE

This is to certify that the dissertation/project report entitled "_____" is done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications -AIML under the guidance of _____.
The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the student

Name of the Student

Enrollment No.

4. ACKNOWLEDGEMENTS

In the "Acknowledgements" page, the writer recognizes his indebtedness for guidance and assistance of the thesis adviser and other members of the faculty. Courtesy demands that he also recognizes specific contributions by other persons or institutions such as libraries and research foundations. Acknowledgements should be expressed simply, tastefully, and tactfully.

ARYAVART INTERNATIONAL UNIVERSITY
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Theory Paper

Total: 100 Marks
External: 70 Marks
Internal: 30 Marks

External: 70 Marks
10 Question (MCQ): 1 mark each (1x10 = 10)
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

Internal: 30 Marks
Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

Lab

Practical: 100 Marks
External: 70 Marks
Internal:30 Marks

External (Two programs): 70 Marks
- **Program Writing**: 10 + 10 Marks
- **Algorithm& Flowchart**: 5 + 5 Marks
- **Program Execution**: 15 + 15 Marks
- **Viva**: 10 Marks

Internal Assessment (30 Marks)
Internal Assessment Examinations will be conducted, carrying 50 marks
- **Record**: 5 Marks
- **Attendance**: 5 Marks
- **Program Writing**: 15 Marks
- **Program Execution**: 15 Marks
- **Viva**: 10 Marks

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