ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for MCA

Semester 1

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS101	Fundamentals of IT	4	0	0	4	70	30	0	100
24CS102	C Programming	4	0	0	4	70	30	0	100
24MT101	Discrete Mathematical Structure	4	0	0	4	70	30	0	100
24CS302	Computer Organization and Architecture	4	0	0	4	70	30	0	100
24CM101	Accounting and Financial Management	4	0	0	4	70	30	0	100
24EN102	Business Communication	3	1	0	4	70	30	0	100
Practical									
24CS192	C Programming Lab	0	0	2	2	0	30	70	100
24CS193	Office Management Lab	0	0	2	2	0	30	70	100
	Total				**24**	**350**	**210**	**140**	**700**

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

FUNDAMENTALS OF IT

Code: 24CS101

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.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

Text Book:

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.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

C PROGRAMMING

Code: 24CS102

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.

Text Book:

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)

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

DISCRETE MATHEMATICAL STRUCTURE

Code: 24MT101

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).

Text Book:

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

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

COMPUTER ORGANIZATION AND ARCHITECTURE

Code: 24CS302
Max Marks: 70

Course Objectives: The objective of the course is to learn the structure and functioning of computer hardware, understand instruction sets, memory hierarchy, and CPU organization and analyze performance and system-level operations.

UNIT I **(8 Hrs)**
Boolean Algebra and Logic: Basics Laws of Boolean Algebra, Logic Gates, Simplifications of Boolean equations using K-maps SOP and POS, Don't Care condition.
Arithmetic Circuits: Adder, Subtractor, Parallel binary adder/Subtractor.

UNIT II **(8 Hrs)**
Combinational Circuits: Multiplexers, De-Multiplexers, Decoders, Encoders.
Flip-flops: S-R, D, J-K, T, Clocked Flip-flop, Race around condition, Master slave Flip-Flop, Realisation of one flip-flop using other flip-flop, Applications of flip flop: Latch, Registers, Counters (elementary treatment to be given).

UNIT III **(8 Hrs)**
Data Transfer Operations: Register Transfer, Bus and Memory Transfer, Registers and micro-operations.
Basic Computer Organizations and Design: Instruction Codes, Computer Registers, Instruction Cycle, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

UNIT IV **(8 Hrs)**
Input-Output Organization: Peripheral Devices, Input-Output Interfaces, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).
Memory Organization: Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Textbook:

1. Morris Mano, Computer System Architecture, 3rd Edition, Prentice-Hall of India Private Limited, 1999.
2. Morris Mano, "Digital Logic and Computer Design", PHI Publications, 2002

Reference Books:

1. R. P. Jain, "Modern Digital Electronics", TMH, 3rd Edition, 2003.
2. William Stallings, Computer Organization and Architecture, 4th Edition, Prentice Hall of India Private Limited, 2001
3. Subrata Ghosal," Computer Architecture and Organization", Pearson, 2011
4. Malvino, "Digital Computer Electronics: An Introduction to Microcomputers", McGraw-Hill.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

ACCOUNTING AND FINANCIAL MANAGEMENT

Code: 24CM101

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.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

BUSINESS COMMUNICATION

Code: 24EN102
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.

Text Book:

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.

C PROGRAMMING LAB

(BASED ON 24CS102) 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.**

OFFICE MANAGEMENT LAB

MS word Basics: Introduction to MSWord; Features & area of use. Working with MS Word. Menus & Commands, Toolbars & Buttons, Shortcut Menus, Wizards & Templates. Creating a New Document; Different Page Views and layouts; Applying various Text enhancements. Working with - Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features; Bullets, Numbering, Auto formatting, Printing & various print options. Advanced Features of MS-Word: Spell Check, Thesaurus, Find & Replace; Headers & Footers Inserting - Page Numbers, Pictures, Files, Auto texts, Symbols etc., Working with Columns, Tabs &indents; Creation & Working with Tables including conversion to and from text; Margins & Space management in Document; Adding References and Graphics; Mail Merge, Envelops & Mailing Labels.

ARYAVART INTERNATIONAL UNIVERSITY

MS Excel: Introduction and area of use; Working with MS Excel., concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Different Views of Worksheets; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook & Worksheets with various options

MS PowerPoint: Introduction & area of use; Working with MS PowerPoint; Creating a New Presentation; Working with Presentation; Using Wizards; Slides & its different views; Inserting, Deleting and Copying of Slides; Working with Notes, Handouts, Columns & Lists; Adding Graphics, Sounds and Movies to a Slide; Working with PowerPoint Objects; Designing & Presentation of a Slide Show; Printing Presentations

विद्याधनं सर्वधनप्रधानं

MS Access: Define data needs and types ,define and print table relationships, Add, set, change or remove primary keys Split databases Create databases Create tables Modify tables Enter records using datasheet view, Delete records from a table Change records in a table Create fields and modify field properties Create reports Modify the design of reports and forms.

Computerized Accounting: Use of Accounting Software Tally, Creation Company, Voucher Entry, Types of accounts, Mode of accounting (Day cash book, ledger book, bank reconciliation, Ledgers, Trial balance, Balance Sheet) Analysis of Trial Balance and Final Accounts

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Theory Paper

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

External : 70 Marks
10 Question (MCQ): 1 marks 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

.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for MCA

Semester 2

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS503	Operating Systems	4	0	0	4	70	30	0	100
24CS202	Database Management System	4	0	0	4	70	30	0	100
24CS304	Design and Analysis of Algorithms	4	0	0	4	70	30	0	100
24CS511	Machine Learning with Python	4	0	0	4	70	30	0	100
24MT304	Operations Research	4	0	0	4	70	30	0	100
Practical									
24CS591	Linux Lab	0	0	2	2	0	30	70	100
24CS296	Machine Learning with Python Lab	0	0	2	2	0	30	70	100
24CS292	Database Management System Lab	0	0	2	2	0	30	70	100
	Total				**26**	**350**	**240**	**210**	**800**

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

OPERATING SYSTEMS

Code: 24CS503
Max Marks: 70

Course Objectives: The operating systems course is an essential part of any Computer-Science education. The purpose of this course is to understand the mechanisms of the Operating Systems like Process Management, Process Synchronization, Memory Management, File System Implementation, Storage Structures used in OS and Protection Principles. How effectively the OS is utilizing the CPU resources with the help of these mechanisms.

UNIT I **(8 Hrs)**
Introduction to OS: Functionality of OS - OS design issues - Structuring methods (monolithic, layered, modular, micro-kernel models) - Abstractions, processes.
OS Principles: System calls, System/Application Call Interface – Protection: User/Kernel modes – Interrupts.

UNIT II **(10 Hrs)**
Scheduling: Processes Scheduling - CPU Scheduling: Pre-emptive, non-pre-emptive – Multiprocessor scheduling – Deadlocks - Resource allocation and management - Deadlock handling mechanisms: prevention, avoidance, detection, recovery.
Concurrency: Inter-process communication, Synchronization - Implementing synchronization primitives (Peterson's solution, Bakery algorithm, synchronization hardware) - Semaphores – Classical synchronization problems, Monitors: Solution to Dining Philosophers problem.

UNIT III **(8 Hrs)**
Memory Management: Main memory management, Memory allocation strategies, Virtual memory: Hardware support for virtual memory (caching, TLB) – Paging - Segmentation - Demand Paging - Page Faults – Page Replacement –Thrashing.

UNIT IV **(8 Hrs)**
Storage Management, Protection and Security : Disk structure and attachment – Disk scheduling algorithms (seek time, rotational latency based)-System threats and security – Policy vs mechanism - Access vs authentication.

UNIT V **(6 Hrs)**
System protection: Access matrix – Capability based systems - OS: performance, scaling, future directions in mobile OS, Recent Trends.

Textbook:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne. "Operating System Concepts", Wiley (2018).
2. Stallings (2006), "Operating Systems, Internals and Design Principles", 5th edition, Pearson Education, India.

Reference Books:

1. Ramez Elmasri, A. Gil Carrick, David Levine. "Operating Systems: A Spiral Approach". McGraw Hill Higher Education (2010).
2. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau. "Operating Systems: Three Easy Pieces". Arpaci-Dusseau Books, Inc (2015).
3. Andrew S. Tanenbaum, "Modern Operating Systems". Pearson, 4th Edition (2016).
4. William Stallings. "Operating Systems: Internals and Design Principles". Pearson, 9th Edition (2018).

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

DATABASE MANAGEMENT SYSTEM

Code: 24CS202
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.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

DESIGN AND ANALYSIS OF ALGORITHMS

Code: 24CS304
Max Marks: 70

Course Objectives: The objective of the course is to design efficient algorithms, analyze their time and space complexity, and understand algorithmic strategies such as divide and conquer, greedy, dynamic programming, and backtracking.

UNIT I: Introduction **(8 Hrs)**
Algorithm - Pseudo Code for Expressing Algorithms - Performance Analysis- Space Complexity - Time Complexity- Asymptotic Notation - Big Oh Notation - Omega Notation - Theta Notation and Little Oh Notation. - Recurrences - Substitution method, Recursion-tree method, Master method.

UNIT II: Disjoint Sets, Divide and Conquer **(8 Hrs)**
Disjoint Sets: Disjoint Set Operations - Union and Find Algorithms.
Divide and Conquer: General Method - Applications-Binary Search – Quick Sort - Merge Sort-Strassen's Matrix Multiplication.

UNIT III: Dynamic Programming **(8 Hrs)**
General Method –Applications-Matrix Chain Multiplication - Optimal Binary Search Trees - 0/1 Knapsack Problem - All Pairs Shortest Path Problem - Travelling Sales Person Problem – Reliability Design Problem.

UNIT IV: Greedy Method and Backtracking **(8 Hrs)**
Greedy Method: General Method –Applications- Job Sequencing with Deadlines - Knapsack Problem - Minimum Cost Spanning Trees - Single Source Shortest Path Problem - Backtracking: General Method – Applications-N-Queens Problem - Sum of Subsets Problem - Graph Colouring - Hamiltonian Cycles.

UNIT V: Branch and Bound, Np-Hard and Np-Complete Problems **(8 Hrs)**
Branch and Bound: General Method - Applications - Travelling Sales Person Problem - 0/1 Knapsack Problem- LC Branch and Bound Solution - FIFO Branch and Bound Solution.
NP Hard and NP-Complete Problems: Basic Concepts - Non-deterministic algorithms - NP – Hard and NP Complete Classes - Cook's Theorem.

Textbook:

1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, "Fundamentals of Computer Algorithms", Universities Press, 2nd Edition, 2015.
2. 2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, "The Design And Analysis Of Computer Algorithms", Pearson India, 1st Edition, 2013.

Reference Books:

1. Knuth Donald E, "Art of Computer Programming: Fundamental Algorithms Volume 1 - Fundamental Algorithms", Third Edition, Pearson Publishers, 2011.
2. Levitin A, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, 2012.
3. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.
   Jon Kleinberg, Éva Tardos , Algorithm Design, Pearson education, 2014.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

MACHINE LEARNING WITH PYTHON

Code: 24CS511
Max Marks: 70

Course Objectives: The objective of the course is to learn core ML algorithms and their applications, use Python libraries (e.g., scikit-learn, pandas) for model building and apply ML techniques to real-world data problems.

UNIT I **(12 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 **(8 Hrs)**

Supervised learning Algorithms: Decision Trees, Tree pruning, Rule-based 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, Hyperparameters, 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.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

OPERATIONS RESEARCH

Code: 24MT304
Max. Marks: 70

Course Objectives: This course typically focus on introducing the fundamentals of operations research, including its definition, historical evolution, and scientific approach to problem-solving. Students learn to identify applications in areas like linear programming, simulation, and queueing theory for improved efficiency. Emphasis is placed on phases of OR studies, such as judgment, research, and action, to formulate models and evaluate alternatives.

UNIT I **(10 Hrs)**

The origin of OR, Definition and scope of Operation Research, Types, methodology and typical applications of OR, Phases of an O.R. study, Formulation of Linear-programming model, graphical solution, converting the linear programming problem to standard form, Simplex method. Big-M method, two-phase method, degeneracy, alternate optima, unbounded and infeasible solution, definition of the dual problem, prima-dual relationship, Dual Simplex method.

UNIT II **(10 Hrs)**

Assignment problem and its mathematical formulation, solution of assignment problem (Hyngarian method), Transportation problem and its mathematical formulation. Initial basic feasible solution of transportation problem by North-West corner rule. Lowest-Cost Entry method and Vogel's Approximation method, Optimal solution of transportation problem (Modi method).

UNIT III **(10 Hrs)**

Game theory: Two person zero games, Minimax and maximum principle, Game with saddle point, Rule of dominance, Algebraic and graphical method, Sequencing problem – processing through 2 machines, 3 machine – s jobs and k machines.

UNIT IV **(10 Hrs)**

Queuing Models: Introduction of Basic Concepts in Stochastic Processes. Markov Chain and Markov Processes. Queuing Systems. Probability Distribution of Arrival and Service Times. Markovian Queuing Systems: M/M/1, M/M/C, M/M/1/N, M/M/C/N

Textbooks:

1. Sharma, S.D., Operation Research, Kedar Nath Ram Nath Publications.
2. Sharma, J.K., Mathematical Model in Operation Research, Tata McGraw Hill.

Reference Books:

1. Taha, H.A., Operation Research-An introduction, Tata McGraw Hill, New Delhi.
2. Gupta, P.K. and Hira, D.S., Operations Research, S. Chand & Co.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

LINUX LAB

Code: 24CS591
Max. Marks: 70
(BASED ON 24CS503) Operating System

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.**

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

MACHINE LEARNING WITH PYTHON LAB

Code: 24CS296
Max. Marks: 70
(BASED ON 24CS511) Machine Learning with Python

Core Practical:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

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

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

DATABASE MANAGEMENT SYSTEM LAB

Code: 24CS292
Max. Marks: 70
(BASED ON 24CS202) 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.**

Theory Paper

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

External : 70 Marks
10 Question (MCQ): 1 marks 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

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for MCA

Semester 3

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS402	Software Engineering	4	0	0	4	70	30	0	100
24CS303	Computer Networks	4	0	0	4	70	30	0	100
24CS601	Data warehousing and Data Mining	4	0	0	4	70	30	0	100
Discipline Specific Elective (DSE-1) (Choose any one)									
24CS316	Image Processing	4	0	0	4	70	30	0	100
24CS603	Internet of Things	4	0	0	4	70	30	0	100
24CS413	Network Security	4	0	0	4	70	30	0	100
24CS602	E-Commerce	4	0	0	4	70	30	0	100
Practical									
24CS492	Software Engineering Lab	0	0	2	2	0	30	70	100
24CS393	Computer Networks Lab	0	0	2	2	0	30	70	100
	Total				**20**	**280**	**180**	**140**	**600**

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

SOFTWARE ENGINEERING

Code: 24CS402
Max Marks: 70

Course Objectives: The objective of the course is to enable students to learn the software development life cycle and methodologies, apply principles of requirement analysis, design, testing, and maintenance, and understand project management and quality assurance.

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
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

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

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

DATAWAREHOUSING AND DATA MINING

Code: 24CS601
Max Marks: 70

Course Objectives: The objective of the course is to understand data warehousing architecture and ETL processes, learn data mining techniques for pattern discovery and apply tools to analyze large datasets for decision-making.

UNIT I **(10 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 **(10 Hrs)**

Principles of Dimensional Modelling: Objectives, From Requirements to data design, Multi-Dimensional Data Model, Schemas: the STAR schema, the Snowflake schema, 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 **(10 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 IRIS datasets. Introduction to apriori algorithm for association mining rule.

UNIT IV **(10 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

Textbook:

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 RB5. Shmueli, “Data Mining for Business Intelligence: Concepts, Techniques and Applications in Microsoft Excel with XLMiner”, Wiley Publications.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

IMAGE PROCESSING

Code: 24CS503
Max Marks: 70

Course Objectives: This course introduces digital image fundamentals like digitization, sampling, quantization, and 2D transforms in spatial and frequency domains. Students learn enhancement methods such as smoothing, sharpening, and filtering to improve image quality. They explore degradation models and restoration techniques to recover original images from noise or blur.

UNIT I **(10 Hrs)**

Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship between pixels, distance measures, connectivity, Image Geometry, Photographic film. Histogram: Definition, decision of contrast basing on histogram, operatio ns basing on histograms like image stretching, image sliding, Image classification. Definition and Algorithm of Histogram equalization.
Image Transforms: A detail discussion on Fourier Transform, DFT, FFT, properties, WALSH Transform, WFT, HADAMARD Transform, DCT.

UNIT II **(12 Hrs)**

Image Enhancement: (by SPATIAL Domain Methods) Arithmetic and logical operations, pixel or point operations, size operations, Smoothing Filters-Mean, Median, Mode filters – Comparative study, Edge enhancement filters – Directorial filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF Filters, Prewitt filter, Contrast Based edge enhancement techniques. – Comparative study, Low Pass filters, High Pass filters, sharpening filters. – Comparative Study, Comparative study of all filters, Colour image processing.
Image enhancement: (By FREQUENCY Domain Methods) -design of Low pass, High pass, EDGE Enhancement, smoothening filters in Frequency Domain. Butter worth filters, Homomorphic filters in Frequency Domain Advantages of filters in frequency domain, comparative study of filters in frequency domain and spatial domain.

UNIT III **(10 Hrs)**

Image compression: Definition: A brief discussion on – Run length encoding, contour coding, Huffman code, compression due to change in domain, compression due to quantization Compression at the time of image transmission. Brief discussion on: - Image Compression standards.
Image Segmentation: Definition, characteristics of segmentation
Detection of Discontinuities, Thresholding Pixel based segmentation method. Region based segmentation methods – segmentation by pixel aggregation, segmentation by sub region aggregation, histogram-based segmentation, spilt and merge technique. Use of motion in segmentation (spatial domain technique only)

UNIT IV **(08 Hrs)**

Morphology: Dilation, Erosion, Opening, closing, Hit-and-Miss transform, Boundary extraction, Region filling, connected components, thinning, Thickening, skeletons, Pruning Extensions to Gray – Scale Images Application of Morphology in I.P.

Textbook:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods Addison Wesley

Reference Books:

1. Fundamentals of Electronic Image Processing by Arthyr –R – Weeks, Jr. (PHI)
2. Image processing, Analysis, and Machine vision by Milan Sonka vaclan Halavac Roger Boyle, Vikas Publishing House.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

INTERNET OF THINGS

Code: 24CS603
Max Marks: 70

Course Objectives: The objective of the course is to learn IoT architecture, sensors, and communication protocols, develop basic IoT applications using hardware and software tools and understand data collection and cloud integration for IoT systems.

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: Development challenges, Security challenges, and 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 a smart city.

Textbook:

1. Rajan Gupta, Supriya Madan, “Fundamentals of IoT”, BPB Publications, 1st 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 Bahga and 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.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

NETWORK SECURITY

Code: 24CS413
Max Marks: 70

Course Objectives: The objective of the course is to learn fundamental concepts of cybersecurity and threats, understand encryption, firewalls, and authentication methods and apply basic techniques to secure networks and systems.

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.

Text Book:

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
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

E-COMMERCE

Code: 24CS602
Max Marks: 70

Course Objectives: The objective of the course is to understand the fundamentals of electronic commerce and digital markets, learn about online payment systems, security, and e-business models and explore legal, ethical, and technological aspects of e-commerce.

UNIT I **(10 Hrs)**

Introduction: Definition of Electronic Commerce, Evolution of e-commerce, E-Commerce& E Business, Unique features of e-commerce, applications of E-Commerce, advantages and disadvantages of E-commerce, Types of e-commerce: B2B, B2C, C2C, M-commerce, Social Commerce

E-commerce infrastructure: Technological building blocks: Internet, web and mobile applications

UNIT II **(10 Hrs)**

Building an e-commerce presence: Planning, System Analysis, Design, Choosing Software, Hardware, Other E-commerce site tools: Tools For website design, Tools for SEO, Interactivity and active contents (Server-side scripting)

Important Components of E-commerce website: Product Cataloguing, Product Listing Page, Product description Page, Cart building and Checkout, third party integrations: Payment systems, Data Layer Integrations for analytics, Customer support integration, Order tracking, Shipping, return and cancellation

New Technologies for E-commerce: Chatbots, Recommendation systems (Personalisation), Smart Search, Product Comparison, Augmented reality, big data, Cloud computing

UNIT III **(10 Hrs)**

Electronic Payment Systems-

Overview of Electronics payments, electronic Fund Transfer, Digital Token based Electronics payment System, Smart Cards, Credit Cards, Debit Cards, Emerging financial Instruments Smartphone wallet, Social / Mobile Peer to Peer Payment systems, Digital Cash and Virtual Currencies, Online Banking, Payment Gateway, Electronic Billing Presentment and Payment.

UNIT IV **(10 Hrs)**

Security Threats and Issues: Cybercrimes, Credit card frauds/theft, Identity fraud, spoofing, sniffing, DOS and DDOS attacks, social network security Issues, Mobile Platform Security issues, Cloud security issues

Technology Solutions: Encryption: Secret Key Encryption, Public Key Encryption, Digital Certificates and public key infrastructure

Securing channels: Secured Socket Layer (SSL), Transport Layer Security (TLS), Virtual Private Network (VPN), Protecting Networks: Firewalls, Proxy Servers, Intrusion detection and protection systems, Anti-Virus software

Text Book:

1. Kenneth C. Laudon, "E-Commerce: Business, Technology and Society", 15th Edition, Pearson education
2. KK Bajaj & Debjani Nag," E-Commerce: The Cutting Edge of Business "McGraw Hill, II edition, 2015
3. Efraim Turban, Jae Lee, David King, H. Michael Chung, "Electronic Commerce – A Managerial Perspective", Addison-Wesley.

Reference Books:

1. The Complete Reference: Internet, Margaret Levine Young, Tata McGraw Hill.
2. E-Commerce: Concepts, Models, Strategies, CSV Murthy, Himalayas Publishing House.
3. Frontiers of Electronic Commerce, Ravi Kalakota & Andrew B. Wilson, Addison-Wesley (An Imprint of Pearson Education).
4. Network Security Essentials: Applications & Standards, William Stallings, Pearson Education.

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

SOFTWARE ENGINEERING LAB

Code: 24CS492
Max. Marks: 70

(BASED ON 24CS402) Software Engineering

List of Experiments:

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 behavioural view diagram: State-chart diagram or Activity diagram.
7. To perform the behavioural 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) 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 a testing tool such as JUnit.**
5. **Students may use the configuration management tool-libra.**

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

COMPUTER NETWORKS LAB

Code: 24CS393
Max Marks: 70

(BASED ON 24CS303) Computer Networks:

List of Experiments:

1. Implement the data link layer framing methods such as character, character stuffing and bit stuffing.
2. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
3. Implement Dijkstra's algorithm to compute the shortest path thru a graph.
4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm.
5. Take an example subnet of hosts. Obtain broadcast tree for it.
6. Take a 64-bit playing text and encrypt the same using DES algorithm.
7. Write a program to break the above DES coding.
8. Using RSA algorithm encrypt a text data and decrypt the same.

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

ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for MCA

Semester 4

Theory									
Course Code	**Topic**	**L**	**T**	**P**	**Credit**	**Theory Marks**	**Internal Marks**	**Practical Marks**	**Total Marks**
24CS615	Software Project Management	4	0	0	4	70	30	0	100
24CS502	Cloud Computing	4	0	0	4	70	30	0	100
24MO701	MOOC Course I (from SWAYAM Platform) (choose any one) • Affective Computing • Blockchain and its Applications • GPU Architectures and Programming	3	0	0	3	70	30	0	100
24MO702	MOOC Course II (from SWAYAM Platform) (choose any one) • AI:Constraint Satisfaction • Edge Computing • Introduction To Soft Computing	3	0	0	3	70	30	0	100
24PR502	Seminar/Conference Presentation	0	0	2	2	70	30	0	100
24IN401	Internship	0	0	6	6	0	30	70	100
	Total				**22**	**350**	**180**	**70**	**600**

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

Detailed Syllabus

SOFTWARE PROJECT MANAGEMENT

Code: 24CS615
Max. Marks: 70

Course Objectives: The course provides an in-depth examination of project management principles and modern software project management practices. The five process groups and nine knowledge areas are examined in the context of the systems development lifecycle. Methods for managing and optimizing the software development process are discussed along with techniques for performing each phase of the systems development lifecycle. Portfolio management and the use and application of software project management tools are also discussed.

UNIT I: SYSTEM ANALYSIS & DESIGN (08 Hrs)
Overview of System Analysis & Design: Introduction to different methodologies & structured system analysis –Details of SDLC approach – mini cases – E.R. diagrams – DFD concepts – Data dictionary concepts. Structure charts – modular programming – I/O & file design consideration – Entity Life Histories (ELH).

UNIT II: SYSTEM IMPLEMENTATION (08 Hrs)
System implementation & maintenance: Implementation Strategies – SW / HW selection & procurement – Control & security – issues of designing & implementing online systems – data communication requirements – system conservation approaches & selection issues.

UNIT III: PROJECT DEVELOPMENT & DATABASE DESIGN (08 Hrs)
Introduction to Database technologies & CASE tools with specific packages – overview of relational model – Database creation – SQL command – Normalization – designing forms & reports – using CASE tools for system analysis & design-case studies – Cost/benefit analysis – project & resource planning – design & development testing & documentation.

UNIT IV: SOFTWARE PROJECT MANAGEMENT (08 Hrs)
Software project management: challenges & opportunities – changing technologies & approaches – choice development of methodologies & technical platforms, project management techniques – monitoring 7 measurement of progress.

UNIT V: SOFTWARE PROJECT MANAGEMENT (08 Hrs)
Software project management – elements, cost estimation, manpower planning, Software & Product Metrics – Quality assurance & control – standards & documentation – testing – implementation – training – technology management – quality standards – certificate – handling multiple projects, issues of shared development.

Textbooks:

1. Software Engineering Principles and Practice by Waman S. Jawadekar, Tata McGraw-Hill Co., Chennai.
2. For Unit I Database Management Systems Alexis Leon & Mathews Leon, Vikas Publishing House PVT Ltd.
3. Software Project Management by S.A. Kelkar, PHI learning India PVT. Ltd.
4. Software project management (2-volume set) by Prof. SN. Singh and SL. Gupta – Global India Publications PVT Ltd., New Delhi.

ARYAVART INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

CLOUD COMPUTING

Code: 24CS502
Max Marks: 70

Course Objectives: The objective of the course is to understand cloud models (IaaS, PaaS, SaaS) and architectures, learn virtualization, storage, and deployment in the cloud and explore platforms like AWS, Azure, or Google Cloud.

UNIT I **(10 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 **(10 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 **(10 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 **(10 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 - paravirtualization

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
विद्याधनं सर्वधनप्रधानं

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.

MOOC COURSE II (FROM SWAYAM PLATFORM)

Code: 24MO702
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 Value Added Course (VAC) from the list of courses available on the SWAYAM online platform.

ARYAVART
INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

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
विद्याधनं सर्वधनप्रधानं

ARYAVART INTERNATIONAL UNIVERSITY
Tilthai, Dharmanagar, North Tripura

INTERNSHIP

Course Code: 24IN401
Max Marks: 70

Course Objective: This internship capstone course aims to provide students with an integrative learning experience that combines professional work in a real-world organization with rigorous academic research. Students will develop and apply theoretical knowledge to practical challenges through an action research project, enhancing their problem-solving, critical thinking, and communication skills. This course aims to bridge the gap between academic study and professional practice, preparing students for successful careers in their chosen fields

Internship Student Engagement Process: An internship is a structured, hands-on learning experience integrating academic knowledge with pre-professional work activities. It mutually benefits both the student-intern and the host organization. Interns apply foundational skills from their studies to real-world tasks, enhancing their practical experience. Placement sites outline clear expectations, duties, and performance goals for the interns. They also offer regular supervision and feedback to guide the interns' development. This experiential learning helps students build valuable industry-specific skills, gain insights into their chosen field, and improve their employability upon graduation.

Step 1. Orientation Session: The orientation session for the internship/capstone project is designed to provide students with a comprehensive overview of what to expect and how to succeed in their upcoming professional experience. The session aims to bridge the gap between academic learning and practical application in a real-world setting.

Step 2. Identify an internship: Students research opportunities that align with their career goals and academic background. They explore various platforms, such as online job boards, networking events, and professional associations, to find positions that offer relevant hands-on experience and skills in their chosen field.

Step 3. Internship agreement Form: The Student, Mentor, and internship Coordinator in the Industry will complete the internship agreement form.

Step 4. Start of Internship: The internship lasts eight weeks. Interns are expected to commit to 20 hours per week, allowing for a balanced integration of work and learning. The internship mentor will arrange specific schedules. This structure ensures that interns gain substantial experience while accommodating any academic commitments. Regular check-ins and progress reviews will be conducted to support intern development and address any challenges, providing a productive and enriching internship experience.

Step 5. Submission of Report:
Front Page: Student Name, Course, Internship Company, Duration, Mentor
Internship Agreement Form
Internship Certificate
Introduction & background of the Company
Roles & responsibilities as an Intern
Weekly work allotment & completion report
Challenges & Solutions
Learning from the internship
Conclusion etc

Step 6. Internship Evaluation: The PPT presentation and Viva Voce for internship evaluation is an oral exam where interns present their experiences, learning, and contributions. It involves summarising their role, key projects, and applied skills. Interns discuss the knowledge gained, application of academic theories, and challenges faced, including how they were addressed. Feedback from supervisors and industry insights are also shared. Examiners ask questions to delve deeper into the intern's understanding and experiences. This evaluation assesses the intern's ability to articulate their growth and readiness for professional work. The review of the work done by students will be carried out after two weeks of report submission. The internal examiner will evaluate the student's submission.

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.

ARYAVART
INTERNATIONAL UNIVERSITY
विद्याधनं सर्वधनप्रधानं