SIR PADAMPAT SINGHANIA UNIVERSITY

Udaipur

SCHOOL OF ENGINEERING

Course Curriculum of 2-Year M.C.A Degree Programme (Batch- 2020-22)

Credit Structure

M.C.A. Core		M.C.A. Elective	
Category	**Credits**	**Category**	**Credits**
Departmental Core Subjects	67	Department Level Optional Courses	8
Ability Enhancement Course	03	University Level Optional Courses	3
Total	70	Total	11
		Grand Total	81

Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/week
1	I	21	23
2	II	26	31
3	III	24	31
4	IV	10	20
	Total	81	--

Course Structure: M.C.A. 2020-22

Semester - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CA-5001	Discrete Mathematics & Graph Theory	3	1	0	4
2	CA-5002	Advanced Database Techniques	3	0	1	4
3	CA-5003	Computer Architecture & Parallel Processing	3	0	0	3
4	CA-5004	Advanced Data Structures	3	0	1	4
5	CA-5005	Advanced Operating Systems	3	0	0	3
6	CA-5006	Principles & Paradigms of Object Oriented Programming	3	0	0	3
					Total Credits	21
7	EP-1999	Endeavour Project(Beyond the Syllabus)				
					Total Contact hours/week	23

Semester - II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CA-5011	Analysis of Algorithms	3	0	1	4
2	CA-5012	Principles of Data Communication	3	0	1	4
3	CA-5013	Artificial Intelligence	3	0	1	4
4	CA-5014	Programming using Python	0	0	1	1
5	CA-5015	Applied Multivariate Data Analysis	3	0	0	3
6	CA-5016	Operation Research	2	1	0	3
7	CA-5XXX	Department Level Optional Course - I	3	0	1	4
8	HU-5003	Professional Communication	2	1	0	3
		Total Contact hours/week				26
9	EP-1999	Endeavour Project(Beyond the Syllabus)				3
		Total Contact hours/week				31

Semester - III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CA-5021	Compiler Design	3	0	1	4
2	CA-5022	Cryptography	3	0	0	3
3	CA-5023	Software Architecture & Project Management	3	0	0	3
4	CA-5024	Introduction to IoT	2	0	1	3
5	CA-5050	Minor Project	0	0	4	4
6	CA-50XX	Department Level Optional Course - II	3	0	1	4
7	XX-XXXX	University Level Optional Course	3	0	0	3
					Total Credits	24
8	EP-2999	Endeavour Project(Beyond the Syllabus)				
					Total Contact hours/week	31

Semester - IV

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CA-5100	Dissertation	0	0	10	10
					Total Credits	10
2	EP-2999	Endeavour Project(Beyond the Syllabus)				3
					Total Contact hours/week	20

List of Department Level Optional Course(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit
1	CA-5101	Fundamentals of Data Science	3	0	1	4
2	CA-5102	Data Mining & Warehousing	3	0	1	4
3	CA-5103	Cloud Computing	3	0	1	4

List of Department Level Optional Course(s) - II

S. No.	Course Code	Course Title	L	T	P	Credit
1	CA-5104	Information Retrieval	3	0	1	4
2	CA-5105	Soft Computing	3	0	1	4
3	CA-5106	Time Series Analysis	3	0	1	4

List of University Level Optional Course(s)

S. No.	Course Code	Course Title	L	T	P	Credit
1	BM-5036	Fundamental of International Business	3	0	0	3
2	BM-5037	Fundamental of Strategic Management	3	0	0	3

Detailed Syllabus for MCA Degree Programme

Semester - I

(Departmental Core Subject)

CA-5001 L-T-P-C
Discrete Mathematics & Graph Theory 3-1-0-4

Objective: *The objective of this course is to make the students understand & use the discrete structures that are backbones of computer science. In particular, this course is meant to introduce logic, proofs, sets, relations, functions, counting, probability and graph theory with an emphasis on applications in computer science.*

Course Outcome: *At the end of this course student will be able to understand the notion of mathematical thinking, reason logically with rule of inference, mathematical proofs and to apply them in problem solving, ability to understand relation, function, counting problem, digraph, understand the use of algebraic structure and apply the learned concept in various domain of Computer Science.*

Course Content

Module 01: Set Theory

Sets, Venn diagrams, Operations on Sets, Laws of set theory, Power set and Products Partitions of sets, The Principle of Inclusion and Exclusion

Module 02: Logic

Propositions and logical operations, Truth tables, Equivalence, Implications, Laws of logic, Normal Forms, Predicates and Quantifiers, Mathematical Induction.

Module 03: Relations and Functions

Relations, Paths and Digraphs, Properties and types of binary relations, Operations on relations, Closures, Warshall‘s algorithm, Equivalence and partial ordered relations, Poset, Hasse diagram and Lattice, Functions: Types of functions - Injective, Surjective

and Bijective, Composition of functions, Identity and Inverse function, Pigeon-hole principle.

Module 04: Counting

Permutations, Combinations, Elements of Probability, Discrete Probability and Conditional Probability, Generating Functions and Recurrence Relations, Recursive Functions, Introduction to Functional Programming

Module 05: Graphs

Definitions, Paths and circuits: Eulerian and Hamiltonian, Types of graphs, Sub Graphs, Isomorphism of graphs.

Text/Reference Books

1. Discrete Mathematics & Applications. Rosen K. H., 5th Ed. Tata McGraw Hill 2003.
2. Discrete Mathematical Structures. Kolman B., Busby R., Ross S. C. & Rehman N., Pearson Education.
3. Elements of Discrete Mathematics. Liu C. L., 2nd Ed., McGraw-Hill, 2000.
4. Computational Category Theory. Rydeheard D. E. & Burstall R. M.
5. Discrete Mathematical Structures. Singh Y. N., Wiley-India.
6. Discrete Mathematics for Computer Scientists and Mathematicians, Mott J. L., Kandel A., Baker T. P., 2nd Ed., Prentice Hall of India,1986.
7. Discrete Mathematical Structures with Applications to Computer Science. Trembley J. P. & Manohar R. Tata McGraw-Hill.
8. Discrete Mathematics. Lipschutz S. & Lipson M. L., Schaum's Outline, McGraw Hill Education.

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Semester - I

(Departmental Core Subject)

CA-5002 L-T-P-C
Advanced Database Techniques 3-0-1-4

Objective: *The objective of this course is to enable the students to review the database concepts and know the advanced features of database management systems, including query processing and evaluation, transaction management and recovery, distributed and object oriented databases.*

Course Outcome: *At the end of this course, student will be able to write complex queries, know about query optimization, transaction management along with advanced database management systems available.*

Course Content

Module 01: Relational Database Design

Features of good database design, Enhanced ER tools, Subclasses, Super class, and Inheritance, Specialization and Generalization, Functional dependency theory and normalization

Module 02: Advanced SQL

Review of basic SQL, Assertion and views, Cursors, triggers and stored procedures, Embedded SQL, dynamic SQL, SQLJ, advanced features of SQL.

Module 03: Query Processing and Evaluation

Measures of Query Cost, Selection Operation, Sorting, Join Operation, other Operations, Evaluation of Expression, Transformation of Relational Expressions, Role of Relational Algebra and Relational Calculus in query optimization, Views and query processing, Storage and query optimization

Module 04: Transaction Management and Recovery

Advanced feature of Transaction, Enhanced Lock Based and timestamp based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Weak Levels of Consistency, Concurrency in Index Structures, Recovery and Atomicity, Recovery with Concurrent Transaction, Buffer Management, Advanced Recovery Techniques, Remote Backup Systems

Module 05: Distributed Databases

Centralized versus non centralized Databases, Homogeneous and Heterogeneous DDBMS and their comparison, Functions and Architecture, Distributed database design, query processing in DDBMS, Distributed concurrency management, deadlock management

Module 06: Object Oriented Database

Limitations of Relational databases, The need of Object oriented databases, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Data types (arrays, multi-set etc.) and structure in Object oriented databases using SQL, Object-Identity and Reference Types in SQL, ODL and OQL

List of Experiments

S. No.	Title of the Experiment	Module
1.	SQL from Relational algebra and Relational Calculus.	03
2.	Demonstration of JOIN operations.	02
3.	Design of E-R Database Schema.	01
4.	Design of Extended E-R Model.	01
5.	Demonstration of Normalization and Normal Forms.	01
6.	Design of Object-Oriented Database Model.	06

7.	Advanced SQL Functions, Structures and Operations.	02
8.	Nested Subqueries.	02
9.	Embedded SQL.	02
10.	Demonstration of Triggers, Cursors and Procedures.	02
11.	Query Optimization.	03

Text/Reference Books

1. Database Management Systems. Gupta G. K. McGraw – Hill.
2. Database System Concepts. Slberchatz K. & Sudarshan. 6th Ed. McGraw Hill.
3. Fundamentals of Database Systems. Elmasri & Navathe. 5th Ed. Pearson education.
4. Database Systems Design, Implementation & Management Thomson Learning. Rob P. & Coronel C. 5th Ed.
5. SQL and PL/SQL for Oracle 10g. Deshpande P. S. Black Book. Dreamtech Press.
6. Introduction to Database Management. Ponniah G. P. Wiley Publication.
7. Oracle for Professionalll. Shah S. SPD.
8. Database Management Systems. Ramkrishnan R. & Gehrke J. TMH.

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Semester - I

(Departmental Core Subject)

CA-5003 L-T-P-C
Computer Architecture & Parallel Processing 3-0-0-3

Objective: *The objective of this course is to impart an understanding of the basic structure and operations of a computer system, concept and need of parallel processing, pipelining, vector and features of a multiprocessor architecture.*

Course Outcome: *At the end of this course, student will be able to describe basic structure and organization of the computer system, demonstrate concepts of parallelism in hardware/software, memory organization and I/O subsystems, principles of pipelining and vector, features of multiprocessors.*

Course Content

Module 01: Overview of Data Representation & Register Transfer Language

Computer data representation, Register transfer and micro-operations, Bus and memory transfers

Module 02: Computer Organization & Design

Instruction codes, Computer registers, Computer instructions, Timing and control, Instruction cycle, Memory-reference instructions, Input-output and interrupt, Design of basic computer and its units

Module 03: Introduction to Parallel Processing

Evolution of computer systems, Parallelism in uniprocessor systems, Parallel computer structures, Architectural classification schemes, Parallel processing applications

Module 04: Memory and Input-Output Subsystems

Hierarchical memory structure, Virtual memory system, Memory allocation and

management, Cache memories and management, Input-Output subsystems

Module 05: Principles of Pipelining and Vector

Introduction to pipelining, Instruction and arithmetic pipelines, Principles of designing pipelined processors, Vector processing requirements

Module 06: Multiprocessor Architecture

Functional structures, Interconnection networks, Parallel memory organization, Multiprocessor operating systems

Text/Reference Books

1. Computer Organization and Architecture: Designing for Performance. Stallings W. 10th Ed. Pearson Publication. 2013.
2. Computer Architecture and Organization. Hayes J. P. McGraw-Hill. 1988.
3. Computer Architecture and Organization: Design Principles and Applications. Govindarajulu B. 2nd Ed. McGraw-Hill (India).
4. Structured Computer Organization. Tanenbaum A. S. 6th Ed. Pearson.
5. Computer System Architecture. Mano M. 3rd Ed., Pearson Publication, 2007.
6. Computer Architecture and Parallel Processing. Hwang K. & Briggs F. A. McGraw-Hill
7. Computer Organization and Design. Chaudhuri P. P. Prentice Hall India, 2004.
8. Computer System Architecture and Organization. Usha M. & Shrikant T. S. Wiley India. 2014.

Detailed Syllabus for MCA Degree Programme

Semester - I

(Departmental Core Subject)

CA-5004 L-T-P-C
Advanced Data Structure 3-0-1-4

Objective: *The objective of this course is to develop an understanding of linear and non-linear data structures and to apply data structures and algorithms in real time applications.*

Course Outcome: *Students will be able to select the data structures that efficiently model the information in a problem and assess efficiency trade-offs among different data structure implementations or combinations*.

Course Content

Module 01: Linear Data Structures

Abstract data types, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations. Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list.

Module 02: Non-Linear Data Structures

Binary search trees, definition, implementation, Operations- searching, insertion and deletion, B-tree, AVL Trees, definition, height of an AVL Tree, Operations – insertion, deletion and searching, Red –Black trees.

Module 03: Graphs

Representation of graph, Graph Traversals - depth-first and breadth-first traversal, Applications of graphs, Topological sort, Minimum spanning tree – Prim's and Kruskal's algorithms.

Module 04: Dictionaries and Hash

Dictionaries- linear list representation, skip list representation, Operations - insertion, deletion and searching. Hash Table Representation- hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing.

Module 05: Pattern Matching

Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm.

List of Experiments

S. No.	Title of the Experiment	Module
1.	Write a program that implements stack (its operations) using Arrays	01
2.	Write a programs that implements Queue (its operations) using Arrays	01
3.	Write a program to perform the following operations on singly linked list: Creation, Insertion, Deletion, Traversal.	01
4.	Write a program to perform the following: Creating a Binary Tree of integers, Traversing the binary tree in preorder, inorder and postorder.	02
5.	Creating an AVL Tree of integers, traversing the tree in preorder, inorder and postorder.	02
6.	Creating a B-Tree of integers, , traversing the tree in preorder, inorder and postorder	02
7.	Creating a Red-Black-Tree and perform the operations	02
8.	Write a program that implements Kruskal's algorithm using a disjoint set data structure. The program takes as input a file (data.txt),	03

	in which each line either represents a vertex or an edge. For the edge lines, the first integer on that line representing the starting vertex, the second the ending vertex, and the third the weigh of the edge. Use this file to construct, line by line, the graph upon which Kruskal's algorithm will be run.	
9.	Write a program to find the minimal spanning tree of a graph using the Prim's algorithm. The program should be able to read in the weight matrix of a graph and produce the minimal spanning tree Generate weight matrices (using a random number generator) with a large number of nodes and estimate the time complexity of the algorithm	03

Text/Reference Books

1. Fundamentals of Data Structures in C, Horowitz E., Sahni S. & Freed S. A. 2nd Ed, Universities Press.
2. Data Structures using C. Tanenbaum A. S., Langsam Y., & Augenstein M. J., PHI/Pearson Education.
3. Data Structures: A Pseudocode Approach with C., Gilberg R. F. & Forouzan B. A., 2nd Ed, Cengage Learning.

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Semester - I

(Departmental Core Subject)

CA-5005 L-T-P-C
Advanced Operating Systems 3-0-0-3

Objective: *The objective of this course is to make the students understand the design issues of advanced operating systems, the architecture, kernel and file management of Unix operating system, basic concepts and need of distributed operating systems, working of different advanced operating systems like Multiprocessor OS, Real time OS, Mobile OS.*

Course Outcome: *On successful completion of the course student will be able to demonstrate understanding of design issues of advanced operating systems and compare different types of operating systems, analyze design aspects and data structures used for file subsystem, memory subsystem and process subsystem of Unix OS, demonstrate understanding of different architectures used in Multiprocessor OS and analyze the design and data structures used in Multiprocessor operating systems, differentiate between threads and processes and compare different processor scheduling algorithms used in Multiprocessor OS and concept, applications area and types of real time systems*

Course Content

Module 01: Introduction

Functions of operating systems, Design approaches: layered, kernel based and virtual machine approach, types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS).

Module 02: Unix Kernel and File Management

System Structure, User Perspective, Architecture of Unix Operating System. Buffer cache: Header, Buffer Pool, Retrieving, Reading and Writing Buffer. File Representation: inodes: Structure of file Directories, Path conversion to inode, superblock.

Module 03: UNIX Process and Memory management

Detailed design of Process Structure: Kernel Data structures for process, Structure of U area and Process table, Process states and Transitions. Context of a Process: Static and Dynamic area of context, Saving the Context Layout of System Memory, Regions, Mapping regions with Process, page table and mapping virtual address to physical address.

Module 04: Distributed Operating system concepts

Goals, Distributed Computing Models, Hardware Concepts, Software Concepts, Architecture of DOS. Design Issues: Transparency, Flexibility, Scalability, Reliability, Performance, fault tolerance.

Module 05: Multiprocessor Operating System and Real Time Operating System

Introduction, Basic multiprocessor system architectures, design issues, Threads, Process synchronization: the test and set instruction, the swap instruction, implementation of the process wait. Processor scheduling: Issues, Co-scheduling, Smart scheduling, Affinity Based scheduling. Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems,

Text/Reference Books

1. The Design of the UNIX Operating System. Bach M. J. PHI.
2. Distributed Computing. Mahajan & Shah S. 2nd Ed. Oxford.
3. Advanced Concepts in Operating Systems. Singhal M. & Shivaratri N. G.
4. Mobile Computing. Raj Kamal. 1st Ed. Oxford.
5. Distributed Systems: Principles and Paradigms. Tanenbaum A. S. & Steen M. V. 2nd Ed. Pearson Education.
6. Real-Time Systems: Theory and Practice. Mall R. Pearson Education India. 2006.

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Semester - I

(Departmental Core Subject)

CA-5006 L-T-P-C
Principles & Paradigms of Object Oriented Programming 3-0-0-3

Objective: *The objective of this course is to teach various concepts and principles of object-oriented programming along with its associated terminologies.*

Course Outcome: *At the end of the course student will be able to understand basic concepts and principles of Object oriented programming and implement these concepts using object oriented programming languages like C++ or Java.*

Course Content

Module 01: Object Oriented Paradigm and Modeling concepts

Introduction, Object-Oriented Analysis, Object-Oriented Design, Object-Oriented Programming, Objects and Classes. Encapsulation and Data Hiding, Message Passing, Inheritance, Polymorphism, Generalization and Specialization, Aggregation or Composition

Module 02: Object Oriented System and its Principles

Phases in Object-Oriented Software Development: Object–Oriented Analysis, Object Oriented Design- System Design and Object Design, Object Oriented Implementation and Testing. Major Elements- Abstraction, Encapsulation, Modularity and Hierarchy. Minor Elements –Typing, Concurrency and Persistence.

Module 03: object Oriented Analysis and its Techniques

Object Modelling, Dynamic Modelling- States and State Transitions, Events, Actions. Functional Modelling- Data Flow Diagrams, Notations and different levels. Structured Analysis vs. Object Oriented Analysis, Advantages/Disadvantages of Object Oriented Analysis, Advantages/Disadvantages of Structured Analysis

Module 04: UML Analysis Model and Object Oriented Design

Conceptual Model of UML- Basic Building Blocks, Rules, Common mechanisms, UML Basic Notations, UML Structural Diagram - Class diagram, UML behavioral diagrams, Stages for Object Oriented Design

Module 05: Implementation Strategies

Implementation of Classes, attributes and behaviors, Object, Inheritance, abstraction, Polymorphism and Encapsulation.

Text/Reference Books

1. Object-Oriented Modeling and Design with UML. Blaha M. R., Missouri C. & Rumbaugh J. R. 2nd Ed., Pearson, 2005.
2. Object-Oriented Systems Analysis and Design. George J. F., Batra D., Valacich J. S. & Hoffer J. A. 2nd Ed. Pearson College Div., 2006.
3. Object-Oriented Analysis and Design with Applications. Booch G., Maksimchuk R. A., Engle M. W, Young B. J., Conallen J. & Houston K. A. 3rd Ed., Addison-Wesley Professional, 2007.

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Semester - II

(Departmental Core Subject)

CA-5011 L-T-P-C
Analysis of Algorithms 3-0-1-4

Objective: *The objective of this course is to make the students understand the mathematical approach for analysis of algorithms, to solve problems using various strategies and to analyze strategies for solving problems not solvable in polynomial time.*

Course Outcomes: *At the end of the course student will be able to analyze the running time and space complexity of algorithms, the complexity of divide and conquer strategy, greedy strategy and dynamic programming strategy. They will also be able to apply backtracking, branch and bound and string matching techniques to deal with some hard problems.*

Course Content

Module 01: Introduction to analysis of algorithm

Performance analysis, space and time complexity, Growth of function- Big-Oh, Omega Theta notation. Mathematical background for algorithm analysis, Analysis of selection sort, insertion sort. Recurrences: The substitution method, Recursion tree method, Master method. Divide and Conquer Approach: General method Analysis of Merge sort, Analysis of Quick sort, Analysis of Binary search, Finding minimum and maximum algorithm and analysis, Strassen"s matrix multiplication.

Module 02: Dynamic Programming Approach

General Method, Multistage graphs, single source shortest path all pair shortest path, Assembly-line scheduling, 0/1 knapsack, Travelling salesman problem, Longest common subsequence

Module 03: Greedy Method Approach

General Method, Single source shortest path, Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees- Kruskal's and prim"s algorithm, Optimal storage on tapes

Module 04: Backtracking and Branch-and-bound

General Method, 8 queen problem (N-queen problem), Sum of subsets, Graph coloring, 15 puzzle problem, Travelling salesman problem.

Module 05: String Matching Algorithms

The naïve string matching Algorithms, The Rabin Karp algorithm, String matching with finite automata, the knuth-Morris-Pratt algorithm

List of Experiments

S. No.	Title of the Experiment	Module
1.	Selection sort, insertion sort. Merge sort, Quick sort, and Binary search.	01
2.	Multistage graphs, single source shortest path, all pair shortest path, 0/1 knapsack, Travelling salesman problem, Longest common subsequence.	02
3.	Single source shortest path, Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees- Kruskal's and prim's algorithm, Optimal storage on tapes.	03
4.	8 queen problem (N-queen problem), Sum of subsets, Graph coloring, 15 puzzle problem, Travelling salesman problem.	04
5.	The naïve string matching Algorithms, The	05

	Rabin Karp algorithm, String matching with finite automata, The knuth-Morris-Pratt algorithm.

Text/Reference Books

1. Computer Algorithms. Horowitz E., Galgotia Publication, New Delhi -2000.
2. The Design and Analysis of Computer Algorithm. Aho A. V., Hopcrofd J. E. & Ullman J. D. Addison Wesley, 1998.
3. Introduction to Algorithms. Coreman T. H., Leiserson C. E., Rivest R. L. & Stein C. 2nd Ed. PHI publication. 2005.
4. Fundamentals of Computer Algorithms. Horowitz E., Sahni S. & Rajsekaran S. University Press.

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Semester - II

(Departmental Core Subject)

CA-5012 L-T-P-C
Principles of Data Communication 3-0-1-4

Objective: *This objective of this course is to provide students with a clear understanding of the state of the art in computer network systems & protocols in some depth, including both abstract & concrete aspects of high speed networks & wireless standards, familiarize them with the basics of data communication & various types of computer networks, to make them understand the challenges of network communication & the operation of the protocols that are used inside the internet and design of communication protocols, the OSI model & TCP/IP protocol suite model, different types of network topologies.*

Course Outcome: *On successful completion of this course learner will be able to demonstrate the concepts of data communication at physical layer and compare ISO - OSI model with TCP/IP model, demonstrate the knowledge of networking protocols at data link layer, design the network using IP addressing and subnetting / supernetting schemes, analyze various routing algorithms and protocols at network layer, transport layer protocols and congestion control algorithms and explore protocols at application layer.*

Course Content

Module 01: Introduction to Data Communication and Networking

Uses of Computer Networks, Network Hardware, Network Software Internet Reference Models (OSI and TCP/IP), Analog and Digital data transmission, transmission media- Guided and Unguided.

Module 02: Data Link Layer

Multi Access Protocols-ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, Data link layer switching and Multiplexing, Error Detection and Correction methods, Encoding Schemes, Repeaters, hubs, bridges, switches, routers & gateways.

Module 03: Network Layer

Connection less & Connection oriented, Networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms.

Module 04: Internetworking and Transport Layer

Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses, Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release, Connection Release, Crash Recovery.

Module 05: The Internet Transport and Application Layer Protocols

UDP and TCP, The TCP Sliding Window, The TCP Congestion Control, The future of TCP, Network application services & protocols including email ,www, electronic mail, DNS, Network security & management.

List of Experiments (Minimum Six)

S. No.	Title of the Experiment	Module
1.	Identification of various networks components: Connections, BNC, RJ-45, I/O box, Cables, Co-axial, twisted pair, UTP, NIC (network interface card), Switch, Hub	01
2.	Implementation of character stuffing and destuffing	02
3.	Implementation of CRC and checksum	02
4.	Configuration of network devices in CISCO packet tracer	02

5.	Implement communication between various network devices using CISCO packet tracer	02
6.	Study and execution of Network commands	03
7.	To find out details of network from IP addressing scheme using ‘C’ code	04

Text/Reference Books

1. Computer Networks. Tanenbaum A. S., 3rd Ed.
2. Data Communication and Networking. Forouzan, 4th Ed.
3. Data and Computer Communication. Stailings W., 3rd Ed.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Departmental Core Subject)

CA-5013 L-T-P-C
Artificial Intelligence 3-0-1-4

Objective: *The objective of this course is to present an overview of artificial intelligence principles and approaches, develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning. Students will implement a small AI system in a team environment.*

Course Outcomes: *After Completing the course student will be able to compare artificial intelligence with human intelligence and improving traditional information processing by designing state space for real world problems, understand the working of various searching algorithms for artificial intelligence area and implementing efficient ones, learn to represent knowledge through different representation techniques and application of reasoning on knowledge base to derive inferences.*

Course Contents

Module 01: Artificial Intelligence

Introduction, Definition and Terminologies, Silicon Model, Biomodel, Cognitive Model, Foundation of Artificial intelligence, History of Artificial intelligence, Intelligent agent: Concept of Rationality, Structure of Agents

Module 02: Problem Solving

Introduction to logic, Problems, Problem Spaces, and Search, Production Systems, Problem Characteristics, Breadth first, Depth-first, Generate and Test, Heuristic

Functions, Hill Climbing, Best first Search, Problem Reduction, AND/OR graphs, Constraints Satisfaction.

Module 03: Knowledge Representation

Knowledge Representation and Mappings, Knowledge Representation issues. Predicate Logic, Resolution, Representing Knowledge using Rules, Reasoning under Uncertainty

Module 04: Symbolic Reasoning

Introduction to Non monotonic Reasoning, Statistical Reasoning, Probability, Bayesian logic, Certainty factors, Dempster Shafer reasoning

Module 05: Game Playing & Planning

Introduction, Minimax Search, Alpha-beta Cutoffs, Planning system, Goal Stack, Nonlinear, Hierarchical Planning

List of Experiments

S. No.	Title of the Experiment	Module
1.	Arithmetic and Logical computation, Heuristic search, Different AI problems Like Tic-Tac-Toe, Water Jug Problem, Missionaries and Cannibal, Crypto-arithmetic problems, Blocks World Problem, 8 Queens, 8 puzzle problems, Sorting, Monkey Banana Problem, List Manipulation etc.	01
2.	Path finding algorithms: DFS, BFS,A*, An optimal maze solver using A*	02
3.	Path finding problem: Traveling salesman problem	02
4.	Symbolic- AI: Rule based system Expert systems in the field of Medical, Agriculture and Education.	03
5.	Self-learning of simple rule to maximize some reward. How a simple organism can survive in an unknown environment.	03
6.	Genetic algorithm problem	
7.	Probabilistic graph methods for text generation	04

8.	A simple web – filtering agent is constructed that automatically collects new items of interest based on pre-defined search criteria	05

Text/Reference Books

1. Artificial Intelligence. Knight R. E. 3rd Ed., McGraw-Hill International, 2008.
2. Artificial Intelligence. A Modern Approach. Russell S. J. & Norvig P., 3rd Ed., Prentice-Hall, 2010.
3. AI through Prolog. Neil C. R., Prentice Hall International Ed., 1998.
4. Introduction to Artificial Intelligence. Charniak E. & McDermott D., Addison Wesley, 1985.
5. Artificial Intelligence: An Engineers Approach. Schalkoff, McGraw-Hill, 1992.
6. Artificial Intelligence Programming with Turbo Prolog. Keith W. & Terry H., John W. & Sons, 1998.
7. Prolog Programming. Ivan B., PHI, 2002.
8. Artificial Intelligence Application Programming. M. Tim Jones, 2nd Ed., Dreamtech, 2006.
9. Artificial Intelligence Programming. Charniak E., Riesbeck C. McDermott K., D. V., Meehan J. R., 2nd Ed., 2014.
10 Artificial Intelligence: A Modern Approach. Russell S. J. & Norvig P. 3rd Ed., Prentice-Hall, 2010.
11 Artificial Intelligence with Python. Joshi P., Packt, 2017.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Departmental Core Subject)

CA-5014 L-T-P-C
Programming using Python 0-0-1-1

Laboratory Outcome: *At the end of this Lab, the students will be able to write, test and debug Python programs, implement conditionals and loops, use functions and represent Compound data using Lists, Tuples and Dictionaries, read and write data from & to files and use object-oriented programming concept to design programs.*

List of Experiments

S. No.	Title of the Experiment
1.	Program on input output operation
2.	Program on using different data types
3.	Program on various operators.
4.	Program on loops and iterations.
5.	Program on using a list and its operations.
6.	Program on using a dictionary and its related operations.
7.	Program on using tuple and its related operations.
8.	Program on using a function and its supportive operations.
9.	Program on using Class and Objects.
10.	Program on using concept of Object Oriented Programming.
11.	Program on using Files.

Text/Reference Books

1. Python Programming: A Modern Approach. Kurama V., Pearson.
2. Learning Python. Lutz M., 4th Ed., Orielly, 2010.
3. Introduction to Computer Science using Python: A Computation Problem-

Solving Approach. Dierbach C., Wiley Publication.
4. Python Programming. Urban M. & Murach J., Shroff/Murach, 2016.
5. Think Python. Downey A., Green Tea Press.
6. Core Python Programming. Chun W., Pearson.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Departmental Core Subject)

CA-5015 L-T-P-C
Applied Multivariate Data Analysis 3-0-0-3

Objective: *The objective of this course is to provide students with a working knowledge of the basic concepts underlying the most important multivariate techniques, with an overview of actual applications in various fields, and with experience in actually using such techniques on a problem of their own choosing.*

Course Outcome: *After the completion of this course, students shall be able to distinguish between dependence and interdependence methods in multivariate data analysis, identify the most appropriate statistical techniques for a multivariate dataset, carry out and apply commonly used multivariate data analysis techniques, and interpret results.*

Course Content

Module 01: Introduction to Multivariate Analysis

Introduction to Multivariate Analysis, Multivariate Distributions, Multivariate Normal Distribution and Related, Multivariate Normal Distribution and Related Results, Multivariate Normal Distribution and Related Results, Multivariate Normal Distribution and Related Results

Module 02: Cluster Analysis

The Problem, the Proximity between Object, Classification of Individuals, Cluster Analysis

Module 03: Principal Component Analysis and Factor Analysis

Standardized Linear Combination, Principal Components in Practice, Interpretation of the PCs, Asymptotic Properties of the PCs, Normalized Principal Components Analysis, Principal Components as a Factorial Method, Common Principal Components, Factor Analysis: The Orthogonal Factor Model, Estimation of the Factor Model, Factor Scores and Strategies

Module 04: Discriminant Analysis and Correspondence Analysis

Discriminant Analysis and Classification, Boston Housing, Allocation Rules for Known Distributions, Discrimination Rules in Practice, Correspondence Analysis, Chi-square Decomposition

Module 05: Canonical Correlation Analysis

Canonical Correlation Analysis, Multidimensional Scaling, Correspondence Analysis, Multivariate Linear Models

Text/Reference Books

1. Practical Multivariate Analysis. Afifi A., May S. & Clark V. A., CRC Press, Taylor &Francis, Boca Raton, 2012.
2. Applied Multivariate Statistical Analysis. Johnson R. A. & Wichern D. W. Prentice Hall of India Pvt Ltd., New Delhi, 2002.
3. Applied Multivariate Techniques. Sharma S., John Wiley and Sons, New York, 1996.
4. Exploring Hyperspace A Non-mathematical Explanation of Multivariate Analysis. Alt M., McGraw-Hill Book Company, New York, 1990.
5. Applied Multivariate Data Analysis. Everitt B. S. & Dunn G., Arnold, London, 2001.
6. Statistical Methods in Hydrology. Haan C.T., The Iowa State University Press/Ames, 1977.
7. A Primer in Multivariate Statistics. Harris R. J., Academic Press, New York, 1985.
8. Multivariate Statistical Methods A Primer. Manly B. F. J., Chapman and Hall, London, 1994.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Departmental Core Subject)

CA-5016 L-T-P-C
Operation Research 2-1-0-3

Objective: *The objective of this course is to make the students aware of the operation research based mathematical techniques for providing the optimal solution to the industrial problems.*

Course Outcome: *After completion of this course the students will be able to describe characteristics and scope of OR, define and formulate mathematical problems, select optimal problems solving techniques for a given problem using LP, formulate and solve transportation, travelling sales man and transshipment problems and job/ work assignments.*

Course Content

Module 01: Introduction

Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.

Module 02: Linear Programming Problem

Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Sensitivity Analysis, Primal and Dual Problems, Economic Interpretation.

Module 03: Transportation and Assignment

Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in

transportation, Modified Distribution method, unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problems and Travelling sales man Problem.

Module 04: Queuing Theory

Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:8/FCFA

Module 05: Inventory Control

Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.

Module 06: Project Management

Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.

Text/Reference Books

1. Operations Research: An Introduction, Taha H., Pearson.
2. Operations Research. Natarajan A. M., Balasubramani P. & Tamilarasi A., Pearson Education Inc.
3. Operations Research, Mariappan P., Pearson.
4. Operations Research, Wagner H. N., Prentice Hall.
5. Optimization in Operations Research, Rardin R., Pearson Education Inc.
6. Operations Research, Paneerselvam R., Prentice Hall of India Pvt. Ltd.
7. Quantitative Techniques in Management, Vohra N. D., Tata McGraw-Hill.

Detailed Syllabus for MCA Degree Programme

Semester – II

(Ability Enhancement Course)

HU-5003 L-T-P-C
Professional Communication 2-1-0-3

Objective: *To develop persuasive & effective communication skills*

Course Outcomes: *The student will be able to communicate with clarity, precision & confidence in a variety of public & interpersonal settings*

Course Content

Module 01: Communication

Importance of effective communication skills, Objectives & Process of communication; Types of communication: Verbal & non-verbal; Channels of communication, Barriers to communication (Physical, Psychological, Mechanical, Linguistic & Cultural); Language skills (listening, speaking, reading, writing).

Module 02: Technical Report Writing

Characteristics & structure of a formal report; Classification & types of reports; Organization, Analysis & Interpretation of data; Revising, Editing & Proofreading in accordance with universally accepted standard practices, especially in areas like abstracting/summarizing as well as in citations, references & bibliographies.

Module 03: Presentation Skills

Effective strategies for oral presentations - Audience analysis; Organizing contents; use of media; Awareness of body language, time & space; Tone, variety of pitch, rate, volume & Articulation; Manuscript reading, Memorized, Extemporaneous and Impromptu Presentation.

Module 04: Group Discussion

Classification of GD topics; GD as a part of the selection process; GD phases; Non-verbal communication in GD, Do's & don'ts of GD.

Module 05: Business Meetings

Notice, Agenda, Minutes of Meeting

Text/ Reference Books

1. Essentials of Business Communication. Pal R. & Korlahalli J. Sultan Chand & Sons. 2011.
2. Technical Communication. Raman M. & Sharma S. Oxford University Press. 2004.
3. Effective Technical Communication. Rizvi A. 11th Ed. Tata McGraw-Hill Publishing Company Ltd. 2005.
4. Business Correspondence & Report-writing. Sharma R. C. & Mohan K. 5th Ed. Tata McGraw-Hill Education. 2017.
5. How to Write Reports and Proposals. Forsyth P. Kogan Page. 2010.

Detailed Syllabus for M.C.A. Degree Programme

EP-1999/2999 L-T-P-C
Endeavour Project (Beyond the Syllabus) 0-0-0-3

Our University is continuously looking at innovative ways to deliver knowledge to our students, making learning & delivery mechanism innovative, interesting & easy with truly 'out of the box' teaching-learning process. This beyond the syllabus initiative uses all working second Saturdays as class days.

Endeavour is a compulsory interdisciplinary project for all students of the University. Respective Heads of the Department shall select students & form groups. Each project shall be supervised by a faculty member.

The faculty of SPSU will select a contemporary topic, which is preferably industry relevant & associate a company or professional who can provide application-oriented perspective. The topic chosen may be from wide range of subjects. For example: - Biodiversity, Social subjects, Media & advertisement, Environment, Scientific, Technical, Management, Architecture, Tourism or any other subject or their combination.

The project is evaluated in two phases: Internal Evaluation & External Evaluation. This ensures descriptive assessment of the projects performance & challenges faced during the implementation of the project. The project will be spread over two semesters beginning from the odd semester (July to November) & ending in the even semester (December to May) every year. The grade obtained in this course may be used to improve the student's semester grade point average.

The final report should include the reasons for the choice of the title, the concept, the structure, the results with working models/drawings etc. & its practicality. The role & responsibility of every individual of the group should be indicated clearly. The report should be written in the prescribed format/guidelines, certified by the faculty member & presented as a seminar.

The project is evaluated as per the approved procedure & marks obtained are computed in the even semester.

Detailed Syllabus for M. C. A. Degree Programme

Semester - III

(Departmental Core Subject)

CA-5021 L-T-P-C
Compiler Design 3-0-1-4

Objective: *The objective of this course is to make the students understand the principles & techniques involved in the designing of analysis & synthesis phases of compilation, design & Implementation of a lexical analyzer, syntax analyzer, semantic analyzer, code generation schemes, type checking for the optimization of codes & run-time environment.*

Course Outcome: *After the successful completion of this course, students will be able to analyze the grammar, design parser using different approach and perform syntax-directed translation schemes for optimize compiler*.

Course Content

Module 01: Introduction

Compilers, Interpreter, Analysis of source program, Evolution of programming languages, Single and Multi-pass compiler, Structure of a compiler, Compilation and interpretation, Types of compiler, Compiler Construction Tools, functions of loaders, Relocation and Linking concept, Different loading schemes-Relocating loader, Direct Linking Loader, Dynamic linking and loading.

Module 02: Lexical Analysis

The role of Lexical Analyzer, Input Buffering, Specification of Tokens using Regular Expressions, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Structure of LEX programs, Finite Automata, DFA, NFA, Conversion of an NFA to a DFA , Construction of an NFA from a Regular Expression, Optimization of DFA-Based

Pattern Matchers,. Converting regular expressions to deterministic finite automata(DFA), minimizing of DFA.

Module 03: Syntax Analysis

The need of syntax analysis and its scope, Context-Free Grammars, Derivation trees and Parse Trees, Ambiguity, Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL(1) Grammars.

Bottom-Up Parsing: Shift Reduce parsing, Operator precedence parsing, LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables. Parser Generators, Introduction to YACC, Lexical Analyzers with LEX, Detection of syntactic errors in LL and LR parsers. Error Recovery strategies for different parsing Techniques.

Module 04: Syntax-Directed Translation

Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L- attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

Type Checking: Type systems, Specification of a simple type checker

Module 05: Run-Time Environments

Intermediate Code Generation (ICG): Intermediate languages – Graphical representations, Three-Address code, Quadruples, Triples. Assignment statements, Boolean expressions, Flow of control statements, case statements, Backpatching.

Run-Time Environments: Source Language issues, Storage organization, Storage, allocation strategies, handling different parameter passing mechanism, Memory allocation for dynamic data structure, symbol tables.

Module 06: Code Generation and Code Optimization

Principal sources of optimization, Basic Blocks and Flow Graphs, Optimization of Basic blocks, Peephole Optimization, fundamental optimizing transformation, local and global optimization, loops in flow graph, Code generation: Issues in the design of a code generator. The target machine, a simple code generator.

List of Experiments

S. No.	Title of the Experiment	Module

1.	Programs to recognize various types of regular expressions	02
2.	Implementation pattern matching operation, String operation for various expressions	02
3.	Implementation to check parenthesis from a file.	02
4.	Implementation for the identification various types of tokens from a file	02
5.	Implementation to lexical analyzer	02
6.	Implementation of a calculator.	03
7.	Implementation for the conversion an infix expression to prefix expression, evaluate prefix and postfix expression.	03
8.	Implementation of parser for the grammar in arithmetic expression	03
9.	Implementation of predictive parsing	03
10.	Implementation of LR parsing	03
11.	Implementation for the Computation of FIRST and FOLLOW function	03
12.	Implementation of intermediate code generation.	05
13.	Program to implement symbol table.	05
14.	Program to perform code optimization	06
15.	Program to perform code generation	06

Text/Reference Books

1. Compilers Principles Techniques and Tools. Aho A. V., Lam M. S., Ravi S., Jeffrey D. Ullman. 2nd Ed. Pearson.
2. Principles of Compiler Design. Aho A. V., Jeffrey D. Ullman. Narosa Publishing House.
3. Principles of Compiler Design. Raghvan V. McGraw-Hill. 2010.

4. Crafting a Compiler with C. Fischer C. N. P. & Le. Blanc R. J. Pearson Education. 2009.
5. Engineering a Compiler. Cooper K. D. & Torczon. Morgan Kaufmann Publishers.2004.

Detailed Syllabus for MCA Degree Programme

Semester - III

(Departmental Core Subject)

CA-5022 L-T-P-C
Cryptography 3-0-0-3

Objective: *The objective of this course is to make the students understand the techniques & methods needed for the proper functioning of the ciphers, one way functions & trap-door functions, cryptanalysis of public key ciphers, namely RSA, key exchange problem & solutions using the Diffie-Hellman algorithm, Message Authentication Codes (MAC) & signature schemes, elliptic & hyper-elliptic curve cryptography.*

Course Outcomes: *At the end of this course learner will able to understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory, understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication, apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes, apply different digital signature algorithms to achieve authentication and design secure applications, understand network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP, analyze and apply system security concept to recognize malicious code.*

Course Content

Module 01: Introduction

Security Goals, Services, Mechanisms and attacks, Security model, Classical Encryption techniques, Symmetric cipher model, mono-alphabetic and poly- alphabetic substitution techniques: Vigenere cipher, playfair cipher, Hill cipher, transposition techniques: keyed and keyless transposition ciphers, steganography.

Module 02: Block Cipher and Stream Cipher

Congruence & residue class rings, Euclid's algorithm, Modes of operation, DES & its variants, RCS, IDEA, Blowfish, AES, linear & differential cryptanalysis. Linear feedback shift registers, SEAL, unconditional security.

Module 03: Public Key Parameter

Modular arithmetic, Gcd, Finite Fields, Mathematics of Asymmetric key cryptography, Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm, RSA Cryptosystem, Rabin Cryptosystem, Elliptic Curve Cryptosystems

Module 04: Hash Function and Digital Signature

Properties of hash functions, MD5 & SHA-1, keyed hash functions, Attacks on hash functions, Diffie-Hellman algorithms, Digital Signature: RSA, DAS & NR signature schemes, Blind & undeniable signatures, Entity Authentication: Passwords, challenge-response algorithms, zero-knowledge protocols.

Module 05: Network Issue

Certification, public-key infrastructure (PKI), secured socket layer (SSL), Kerberos. Elliptic & hyper-elliptic curve cryptography, number field sieve, lattices & their applications in cryptography, hidden monomial cryptosystems, cryptographically secure random number generators.

Text/Reference Books

1. Cryptography and Network Security. Forouzan B. A. 2nd Ed. Tata McGraw-Hill. 2010.
2. Cryptography and Network Security. Stallings W. 4th Ed. Pearson.2006.
3. Cryptography and Network Security. Kahate A. 3rd Ed. Tata McGraw-Hill. 2003.

Detailed Syllabus for MCA Degree Programme

Semester - III

(Departmental Core Subject)

CA-5023 L-T-P-
Software Architecture & Project Management 3-0-0-3

Objective: *The objective of this course is to impart student with the knowledge of various architectural styles and design levels of software, steps for planning and managing a project, evaluation of a project, software effort estimation and resource allocation.*

Course Outcome: *After the completion of this course student will be able to describe the status of software architecture and its styles, know the importance of project management and how a project must be planned, estimated and scheduled.*

Course Content

Module 01: Introduction to Software Architecture

Software architecture and design levels, an engineering discipline for software, Software engineering, Routine and innovative design, Model for the evolution of an engineering discipline, the current state of software technology, The status of software architecture

Module 02: Architectural Styles

Overview of architectural styles, Pipes and filters, Data abstraction and object oriented organization, Event based, implicit innovation, Layered systems, Repositories, Interpreters, Process control, Other familiar architectures, Heterogeneous architectures

Module 03: Introduction to Software Project Management

Importance of software project management, Software projects versus other types of projects, Activities covered by software project management, Plans, Methods and methodologies, Problems with software projects, Setting objectives, Stakeholders, Requirement specification, Management control

Module 04: Project Planning

Identify project scope and objectives, Identify project infrastructure, Analyze project characteristics, Identify project products and activities, Estimate effort for each activity, Identify activity risks, and Allocate resources, Review/publicize plan, Execute plan/lower levels of planning

Module 05: Programme Management and Project Evaluation

Introduction to Programme Management, Managing the allocation of resources within programmes, Strategic Programme Management, Creating a programme, Aids to Programme Management, Benefits management, Evaluation of individual projects, Technical assessment, Cost-benefit analysis, Cash flow forecasting, Cost-benefit evaluation techniques, Risk evaluation

Module 06: Software Effort Estimation

Introduction to estimates, Problems with over and under estimates, The basis of software estimating, Software effort estimation techniques, Expert judgment, Estimating by analogy, Albrecht function point analysis, Function points Mark II, COSMIC full function points, A procedural code-oriented approach, COCOMO-A parametric model

Module 07: Activity Planning

Objectives of Activity Planning, Project schedules, Projects and activities, Sequencing and scheduling activities, Network planning models, Formulating a network model, Adding the time dimension, The forward and backward pass, Identifying the critical path, Activity float, Shortening the project duration, Identifying critical activities, Activity on arrow networks

Module 08: Risk Management

Risk and its categories, A framework for dealing with risk, Risk identification, Risk identification, Risk assessment, Evaluating risks to the schedule, Applying PERT technique, Monte Carlo simulation, Critical chain concepts

Module 09: Resource Allocation

Nature of resources, Identifying resource requirements, Scheduling resources, creating critical paths, counting the cost, being specific, publishing the resource schedule, Cost schedules, Scheduling sequences

Text/Reference Books

1. Software Architecture. Perspectives on an Emerging Discipline. Mary S. & David G., PHI Learning. 1996.
2. Software Project Management. Bob H. & Mike C. 4th Ed. Tata McGraw-Hill. 2006.
3. Software Project Management in Practice. Pankaj J., Pearson Education. 2002.
4. Software Project Management. A Unified Framework. Walker R., Pearson Education. 1998.

Detailed Syllabus for MCA Degree Programme

Semester - III

(Departmental Core Subject)

CA-5024	L-T-P-C
Introduction to IoT	2-0-1-3
Pre-requisite	Computer Networks, C-Programming

Objective: *The objective of this course is to make the students understand the concepts and protocols of IoT ecosystem and to build IoT applications using various sensors and actuators.*

Course Outcome: *After the successful completion of this course, students will be able to understand various components of IoT ecosystem, different sensors, actuators, wireless sensor network and different protocols related to IoT and integrate different sensors and actuators to design small applications.*

Course Content

Module 01: Introduction to IoT Ecosystem

IoT ecosystem, Sensors, Actuators, Basics of Networking, Introduction Arduino, Raspberry Pi and Node MCU, Sensor Networks, UAV Networks, Machine to Machine Communication, Interoperability in Internet of Things.

Module 02: IOT Data Link Layer & Network Layer Protocols

IOT Data Link Layer & Network Layer Protocols, PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

Module 03: Transport & Session Layer Protocols

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-CoAP, XMPP, AMQP, MQTT.

Module 04: Integration of Sensors and Actuators with Arduino/NodeMCU

Integration of sensors like temperature, LDR, IR and ultrasonic sensor with Arduino. Integration of various actuators with Arduino.

Module 05: Case Studies

Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial Internet of Things, Data Handling and Analytics, Agriculture, Healthcare, Activity Monitoring.

List of Experiments

S. No.	Title of the Experiment	Module
1.	Write an application to interface multiple LED's with Arduino/NodeMCU.	01,04
2.	Write an application to interface motors with Arduino/NodeMCU.	01,04
3.	Write an application to interface Bluetooth.	01,02
4.	Write an application to interface LDR sensor.	01,04
5.	Write an application to interface MH sensor (IR Sensor).	01,04
6.	Write an application to interface ultrasonic sensor.	01,04
7.	Write an application to implement Line following robot.	01,04
8.	Write an application to implement smart dustbin.	01,04
9.	Write an application to demonstrate MQTT protocol using NodeMCU.	01,03
10.	Write an application to demonstrate CoAP protocol using NodeMCU.	01,03

Text/Reference Books

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases. Raj P. & Raman A. C. CRC Press.
2. Internet of Things: A Hands-on Approach. Bahga A. & Madisetti V. Universities Press.

3. Fundamentals of Wireless Sensor Networks: Theory and Practice. Dargie W. & Poellabauer C., Wiley.
4. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. David H., Gonzalo S., Patrick G., Rob B. & Jerome H., Pearson.

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Semester - III

(Departmental Core Subject)

CA-5050 L-T-P-C
Minor Project 0-0-4-4

Students will choose an area of their interest in consultation with a faculty member of the department, who will act as the Supervisor. The area of interest could be confined to his/her discipline or may be interdisciplinary.

In the Minor project the student shall define a computer application problem, which may be in the existing application/tool or propose to develop a new application to offer some service/product. The student should provide a complete description of the methodologies to be applied for modification in the existing tool/service/product etc. The student will compile the work plan and result/ outcome in the form of a report and present the same in the form of a seminar for evaluation at the end of the semester. The evaluation will be done as per the approved procedure.

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Semester - IV

(Departmental Core Subject)

CA-5100	L-T-P-C
Dissertation	0-0-10-10

Dissertation provides an opportunity to the students to demonstrate independence and originality in thought and application. Students will select topics from the field of computer application and based on a thorough review of literature on that topic, they will identify the problems and decide on plans of research for dissertation. Under the supervision of faculty members, they will execute their plans involving theoretical and/or experimental work. The results obtained will be analysed to arrive at a conclusion which should have some novelty in the field of computer application.

Dissertation will be prepared as per the prescribed format/ guidelines and will be presented in the form a seminar.

The Dissertation work will be evaluated continuously over the span of the semester as per the approved procedure.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Department Level Optional Course - I)

CA-5101 L-T-P-C
Fundamentals of Data Science 3-0-1-4

Objective: *The objective of this course is to provide students with an overview of the entire data analysis process, while providing them with basic tools (programming languages and toolkits) to navigate through the program. Students will also be exposed to many different applications of the data science approach.*

Course Outcome: *After Completing the course student will be able to: comprehend the IT-interestingness of data and understand the attributes of data, pre-process the given data and visualize it for a given application or data exploration/ mining task, apply techniques of supervised and unsupervised machine learning for various data applications, implement web search methods by page ranking and can implement models of information retrieval by applying different techniques of text mining.*

Course Content

Module 01: Understanding Data

Data Wrangling and Exploratory Analysis, Data Transformation & Cleaning, Feature Extraction, Data Visualization. Introduction to contemporary tools and programming languages like R, Python for data analysis.

Module 02: Statistical & Probabilistic analysis of Data

Multiple hypothesis testing, Parameter Estimation methods, Confidence intervals, Bayesian statistics and Data Distributions.

Module 03: Introduction to machine learning

Supervised & unsupervised learning: Classification & Clustering Algorithms like

Decision Tree based classification and K-Means clustering, Dimensionality reduction: PCA & SVD, Correlation & Regression analysis, Training & Testing data: Over-fitting & Under-fitting.

Module 04: Introduction to Information Retrieval

Boolean Model, Vector model, Probabilistic Model, Text based search: Tokenization, Tf-IDF, stop words and n-grams, synonyms and parts of speech tagging

Module 05: Introduction to Web Search & Big Data

Crawling and Indexes, Search Engine architectures, Link Analysis and ranking algorithms such as HITS and PageRank Hadoop File system & MapReduce Paradigm.

List of Experiments (Minimum Six)

S.No.	Title of the Experiment	Module
1.	Learning the basic programming paradigms of modern languages like R and Python.	01
2.	Learning to collect, preprocess and visualize the data using various r Packages like dplyr or Matplotlib in python	01
3.	Attempting problems related to Exploratory data analysis using R or Python	01
4.	Statistics and probability-based data handling Problem handling problems with R and Python tools. Hypothesis testing problems with R. Parameter estimation methods. Handling Bayesian Statistics and data distribution problems.	02
5.	Problems related to Classification of any data set Problems related to Clustering of any data set Problem related to Decision trees and their visualization Dimensionality reduction problems using PCA and	03

	SVD and their analysis Drawing Correlation graphs and their analysis	
6.	Handling various text analytics steps and their successful implementation in R or Python Understanding the various information retrieval models and their impetration	04
7.	Implementing the concept of web scraping Implementing the concept of extraction of data from different data formats like json, XML, CSV, pdf and word etc. A Working project on any topic	05

Text/Reference Books

1. The Data Science Handbook. Field C., 1st Ed., Publisher. Wiley. 2018.
2. Principles of Data Science. Ozdemir S., 1st Ed, Packt Publishing Limited. 2016.
3. Practical Statistics for Data Scientists: 50 Essential Concepts. Peter B., Shroff /O'Reilly, First Ed. 2017.
4. Introduction to Data Mining. Pang N. T., Pearson Educatioin, 2007.
5. Modern Information Retrieval. Ricardo B. Y. & Berthier R. N., Pearson Education, 2004.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Departmental Level Optional Course - I)

CA-5102 L-T-P-C
Data Mining & Warehousing 3-0-1-4
Pre-requisite: Database concepts, Algorithm design and analysis

Objective: *The objective of this course is to identify the scope and essentiality of Data Warehousing and Mining, analyze data, choose relevant models and algorithms for respective applications, study spatial and web data mining, develop research interest towards advances in data mining.*

Course Outcome: *On successful completion of course learner will be able to understand Data Warehouse fundamentals, Data Mining Principles, design data warehouse with dimensional modelling and apply OLAP operations, identify appropriate data mining algorithms to solve real world problems, compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining, describe complex data types with respect to spatial and web mining, benefit the user experiences towards research and innovation.*

Course Content

Module 01: Introduction to Data Warehouse and Dimensional modelling

Introduction to Strategic Information, Need for Strategic Information, Features of Data Warehouse, Data warehouses versus Data Marts, Top-down versus Bottom-up approach. Data warehouse architecture, metadata, E-R modelling versus Dimensional Modelling, Information Package Diagram, STAR schema, STAR schema keys, Snowflake Schema, Fact Constellation Schema, Fact less Fact tables, Update to the dimension tables, Aggregate fact tables.

Module 02: ETL Process and OLAP

Major steps in ETL process, Data extraction: Techniques, Data transformation: Basic tasks, Major transformation types, Data Loading: Applying Data, OLTP Vs OLAP, OLAP definition, Dimensional Analysis, Hypercubes, OLAP operations: Drill down, Roll up, Slice, Dice and Rotation, OLAP models: MOLAP, ROLAP.

Module 03: Introduction to Data Mining, Data Exploration and Preprocessing

Data Mining Task Primitives, Architecture, Techniques, KDD process, Issues in Data Mining, Applications of Data Mining, Data Exploration :Types of Attributes, Statistical Description of Data, Data Visualization, Data Preprocessing: Cleaning, Integration, Reduction: Attribute subset selection, Histograms, Clustering and Sampling, Data Transformation & Data Discretization: Normalization, Binning, Concept hierarchy generation, Concept Description: Attribute oriented Induction for Data Characterization.

Module 04: Classification, Prediction and Clustering

Basic Concepts, Decision Tree using Information Gain, Induction: Attribute Selection Measures, Tree pruning, Classification: Naive Bayes, Classifier Rule - Based Classification: Using IF- THEN Rules for classification, Prediction: Simple linear regression, Multiple linear regression Model Evaluation & Selection: Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap, Clustering: Distance Measures, Partitioning Methods (k-Means, k-Medoids), Hierarchical Methods(Agglomerative, Divisive).

Module 05: Mining Frequent Patterns and Association Rules

Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rule, Frequent Pattern Mining, Efficient and Scalable Frequent Item set Mining Methods: Apriori Algorithm, Association Rule Generation, Improving the Efficiency of Apriori, FP growth, Mining frequent Itemsets using Vertical Data Format, Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules.

List of Experiments

S. No.	Title of the Experiment	Module
1.	Build Data Warehouse/Data Mart for a given problem statement	01

	i) Identifying the source tables and populating sample data ii) Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable) .	
2.	To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot	02
3.	Implementation of Classification algorithm(Decision Tree/ Bayesian)	04
4.	Implementation of Linear Regression.	04
5.	Implementation of Clustering algorithm(K-means/ Agglomerative).	04
6.	Implementation of Association Rule Mining algorithm (Apriori).	05
7.	Perform data Pre-processing task and Demonstrate performing Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA,R tool, XL Miner, etc.)	05
8.	Implementation of page rank algorithm.	05
9.	Implementation of HITS algorithm.	05

Text/Reference Books

1. Data Warehousing: Fundamentals for IT Professionals, Ponniah P., 2nd Ed., Wiley India.
2. Data Mining Concepts and Techniques, Han J. & Kamber M., 3rd Ed., Morgan.
3. Data warehousing, Theraja R., 2nd Ed. Oxford University Press.
4. Data Mining Introductory and Advanced Topics, Dunham M. H., Pearson Education.
5. Data Mining, Witten I. H., Frank E. & Hall M. A., 3rd Ed. Morgan Kaufmann publisher.
6. Introduction to Data Mining, Tan P., Steinbach M. & Kumar V., Person Publisher.
7. Data Mining Methods, Chattamvelli R., 2nd Ed. Narosa Publishing House.

Detailed Syllabus for MCA Degree Programme

Semester - II

(Departmental Level Optional Course - I)

CA-5103	L-T-P-C
Cloud Computing	3-0-1-4

Objective: *The objective of this course is to provide students with the fundamentals and essentials of Cloud Computing as well as a sound foundation of Cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios. To enable students exploring some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.*

Course Outcome: *Students will be able to explain the characteristics of cloud and cloud deployment models, illustrate the cloud service models with examples, carryout the seven-step model of migration into a cloud, predict challenges and risk while migrating to cloud, categorizes the legal issues and cloud compliance standards.*

Course Content

Module 01: Foundation of Cloud Computing

Introduction to cloud computing, History of Cloud Computing, Cloud computing characteristics, Advantages and disadvantages of cloud computing, computing paradigms, Evaluating the cloud's business impact and economics, Cloud infrastructure mechanisms, Cloud service management.

Module 02: Cloud Services and Deployment Models

Cloud deployment models, Cloud Service Models, Cloud infrastructure mechanisms, Logical network perimeter (LNP), Virtual server, Cloud storage devices (CSD), Cloud usage monitor, Resource replication, Ready-made environment, Cloud service management.

Module 03: Cloud Computing Architecture

Cloud computing architecture design principles, Cloud computing life cycle (CCLC), Cloud computing reference architecture, Load balancing approach, Mobile cloud computing (MCC), Case study – Oracle cloud management.

Module 04: Managing the Cloud

Virtualization Technology: Understanding virtualization, adopting virtualization, Techniques of virtualization, How virtualization works, Types of Virtualization, Virtualization in Cloud, Service oriented Architecture: SOA foundation, Web Services and SOA, SOA communication, SOA components, SOA Infrastructure, Need of SOA, Business Process Management (BPM).

Module 05: Cloud Security and Privacy

Cloud security, Cloud CIA security model, Cloud computing security architecture, Cloud legal issues, Performance monitoring and management of cloud services, Data security, Cloud risk management framework, Risk management process for cloud consumers, Data privacy risks in the cloud, Business continuity and disaster recovery, Threats in cloud, Cloud service level agreements (SLA) practices, Issues of Quality of Cloud Services, Techniques for providing QoS to the cloud applications, Migration of a local server into cloud, Trust management.

Module 06: Cloud Computing Applications

Introducing cloud computing applications, Google App Engine, Google Cloud Data store, Microsoft Windows Azure Cloud, Amazon Web Services (AWS), High-performance computing, Message Passing Interface, MapReduce programming model, Eucalyptus cloud platform, Open Nebula cloud platform, OpenStack cloud platform, Nimbus Cloud Computing Platform, The Apache Hadoop ecosystem.

Module 07: Adoption of Cloud Computing

Adoption of cloud computing in the current era, Factors affecting cloud computing adoption, Cloud computing existing areas of application, Case studies.

List of Experiments

S. No.	Title of the Experiment	Module

1.	Study the basic cloud architecture and represent it using a case study.	01,03
2.	Enlist major differences between SaaS, PaaS & IaaS. Also submit a research done on various companies in cloud business and the corresponding services provided by them, tag them under SaaS, PaaS & IaaS.	02
3.	Present a report on obstacles and vulnerabilities in cloud computing on generic level.	05
4.	Present a report on Amazon cloud services.	06
5.	Present a report on cost management in cloud..	07
6.	Enlist and explain legal issues involved in the cloud with the help of a case study.	05
7.	Explain the process of migrating to cloud with a case study.	05
8.	Present a report on Google cloud and cloud services.	06

Text/Reference Books

1. Cloud computing: Principles and paradigms. Buyya, Rajkumar, James B., & Andrzej M. Goscinski, eds. Vol. 87. John W. & Sons, 2010.
2. Cloud Computing: Master the Concepts, Architecture & Applications with Real-world examples & Case studies. Hiran, K. K., et al. Bpb Publications, 2019.
3. Cloud Essentials Comp TIA® Authorized Courseware for Exam CLO-001. Kirk H., Cook S. L., TelmoSampaio, John W. & Sons Inc., 2013.
4. Cloud Computing: A Practical Approach for Learning & Implementation. Srinivasan, Pearson Education, 2014.

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Semester - III

(Department Level Optional Course - II)

CA-5104 L-T-P-C
Information Retrieval 3-0-1-4

Objective: *The objective of this course is to provide knowledge about the basic information retrieval approaches to perform the various types of searching, indexing & retrieval from structured or unstructured data & their applications.*

Course Outcome: *After successful completion of this course, students will be able to understand the basics of Information retrieval like corpus, precision, recall of an IR system, the data structures like Inverted Indices used in Information retrieval systems, the basics of web search, the different techniques for compression of an index including the dictionary and its posting list, the different components of an Information retrieval system and develop the ability of develop a complete IR system from scratch*

Course Content

Module 01: Introduction

Introduction: concepts & terminology of information retrieval systems, Information Retrieval vs. Information Extraction; Indexing: inverted files, encoding, Zipf's Law, compression, Boolean queries.

Module 02: Fundamental of IR Models

Fundamental IR models: Boolean, Vector Space, probabilistic, latent semantic indexing, query processing & refinement techniques. Performance Evaluation: precision, recall, F-measure.

Module 03: Classification & Clustering

Classification: Rocchio, Naive Bayes, k-nearest neighbors, support vector machine;

Clustering: partitioning methods, k-means clustering, hierarchical.

Module 04: Overview of Advanced Topics

Introduction to advanced topics: search, relevance feedback, ranking, query expansion.

List of Experiments

S.No.	Title of the Experiment	Module
1.	Programs related to Extraction of Data from PDFs, Word files, JSON, HTML.	01
2.	Programs related to Parsing Text Using Regular Expression	01
3.	Programs related to Exploring and Processing of Text Data.	02
4.	Programs related to Conversion of Text to Features.	02
5.	Programs related to extraction of Noun Phrases, Similarity between texts, tagging parts of speech, Classifying text.	03
6.	Programs related to summarizing text and clustering of documents.	04
7.	Extraction of XML based data using Python script	04
8.	Application of Singular Value Decomposition(SVD) for text analytics	04
9.	Sentiment Analysis using Tweeter based data	04

Text/Reference Books

1. An Introduction to Information Retrieval. Manning C. D., Raghavan P. & Schtze H. Cambridge University Press. 2009.
2. Modern Information Retrieval. Ricardo B. Y. & Berthier R. N. 1st Ed. Addison-Wesley Publishing Co. 1999.
3. Information Retrieval: Algorithms and Heuristics. Grossman D. A. & Frieder O. Springer the Information Retrieval Series. 2004.

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Semester - III

(Department Level Optional Course - II)

CA-5105	L-T-P-C
Soft Computing	3-0-1-4
Pre-requisite:	Mathematics

Objective: *The objective of this course is to teach various concepts and algorithms given in the field of soft computing. The students will also be able to implement various soft computing algorithms.*

Course Outcome: *At the end of the course students will be able to understand various concepts of fuzzy logic, fuzzy system and neuro fuzzy system. The students will also be able to understand and implement various genetic based machine learning algorithms.*

Course Content

Module 01: Overview of Crisp Sets, Fuzzy Sets, Fuzzy Relations and Fuzzy Logic

Basic concepts of crisp sets and fuzzy sets, Basic types of fuzzy sets, Fuzzy sets verses crisp sets, Representation and extension principle for fuzzy sets, Operations on Fuzzy sets. Crisp versus Fuzzy relations, Binary relations on fuzzy sets, Equivalence, compatibility and ordering relations, Morphisms and compositions of relations, Fuzzy relations equations, Fuzzy measures and possibility theory, Classical logic and multivalued logics, Fuzzy propositions and approximate reasoning.

Module 02: Fuzzy Systems and Neuro Fuzzy Systems

Relevance of integration between fuzzy sets and neural networks – pros and cons, Fuzzy neurons, Fuzzy neural networks, Neuro fuzzy systems, Fuzzy associative memories.

Module 03: Introduction to Genetic Algorithms

Genetic algorithms, Robustness of traditional optimization and search methods, The Goals of optimizations, Differentiate genetic algorithms vs traditional methods, A simple genetic algorithm, Genetic algorithms at work – a Simulation by hand, Grist for the Search Mill – Important Similarities, Similarity Templates (Schemata), Learning the Lingo.

Module 04: Genetic Algorithms Revisited

Mathematical foundations, The fundamental theorem, Schema processing at work: An example by hand revisited. The two-armed and k-armed bandit problem, The building block hypothesis, Another perspective: The minimal deceptive problem, Schemata revisited: similarity templates as hyper planes. Computer Implementation of A Genetic Algorithm : Data Structures, Reproduction, Crossover, and mutation, A time to reproduce, a time to cross, Get with the main program, Mapping objective functions to fitness form, Fitness scaling, Coding's, A multi parameter, Mapped, Fixed-Point coding, Discretization, Constraints.

Module 05: Introduction to Genetic-Based Machine Learning

Genetics-Based machine learning inception, classifier system, Rule and message system, Apportionment of credit: The bucket brigade, Genetic algorithm, A simple classifier system in Pascal, Results using the simple classifier system.

List of Experiments

S. No.	Title of the Experiment	Module
1.	Implementation of Fuzzy Operations.	01
2.	Implementation of Fuzzy Relations (Max-min Composition)	01
3.	Implementation of Fuzzy Controller.	02
4.	Implementation of Simple Neural Network	02
5.	Implementation of A Genetic Algorithm: Data Structures, Reproduction, Crossover, and mutation.	03,04

6.	Implementation of Perceptron Learning Algorithm	04,05
7.	Implementation of a simple classifier system in Pascal.	05
8.	Implementation of Simple Genetic Application.	04,05
9.	Study of ANFIS Architecture	03,04,05
10.	Study of Derivative-free Optimization.	03

Text/Reference Books

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications. Klir G. & Yuan B. Prentice Hall of India, 1997.
2. Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence. Kosko B. Prentice Hall of India, 1997.
3. Genetic Algorithms in Search, Optimization and Machine Learning Goldberg D.E. Addison-Wesley an imprint of Pearson Education Asia.
4. Fuzzy Logic with Engineering Applications. Ross T. J. Wiley India.

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Semester - III

(Department Level Optional Course - II)

CA-5106 L-T-P-C
Time Series Analysis 3-0-1-4

Objective: *The objective of this course is to enable the students to apply the concepts and methods underlying the analysis of univariate time series, and the context for interpretation of results, decompose a time series into trend, seasonal and irregular components, understand the theoretical bases of different methods of time series analysis including decomposition, determine how and when to apply different methods of time series analysis and how to test for goodness of fit.*

Course Outcome: *Upon completion of the course, students will be able to understand the fundamental advantage and necessity of forecasting in various situations, know how to choose an appropriate forecasting method in a particular environment and how to apply various forecasting methods, which includes obtaining the relevant data and carrying out the necessary computation (running suitable statistical software, if necessary) and to improve forecast with better statistical models based on statistical analysis.*

Course Content

Module 01: Introduction to Time Series

Different types of data: Cross-sectional data, Time series data, Panel data, Internal structures of time series: General trend, Seasonality, Run sequence plot, Seasonal sub series plot, Multiple ,ox, lots, Cyclical changes, Unexpected variations, Models for time series analysis: Zero mean models, Random walk, Trend models, Seasonality models, Autocorrelation and Partial autocorrelation.

Module 02: Understanding Time Series Data

Advanced processing and visualization of time series data, Resampling time series data, Group wise aggregation, Moving statistics, Stationary processes, Differencing, First-order differencing, Second-order differencing, Seasonal differencing, Augmented Dickey-Fuller test, Time series decomposition, Moving averages, Moving averages and their smoothing effect, Seasonal adjustment using moving average, Weighted moving average, Time series decomposition using moving averages, Time series decomposition.

Module 03: Exponential Smoothing based Methods

Introduction to time series smoothing, First order exponential smoothing, Second order exponential smoothing, Modeling higher-order exponential smoothing

Module 04: Auto-Regressive Models

Auto-regressive models, Moving average models, Building datasets with ARMA, Confidence interval

Module 05: Deep Learning for Time Series Forecasting

Multi-layer perceptrons, Training MLPs, MLPs for time series forecasting, Recurrent neural networks, Bi-directional recurrent neural networks, Deep recurrent neural networks, Training recurrent neural networks, Solving the long-range dependency problem, Long Short Term Memory, Gated Recurrent Units, LSTM or GRU ,Recurrent neural networks for time series forecasting, Convolutional neural networks,2D convolutions,1D convolution,1D convolution for time series forecasting

List of Experiments

S. No.	Title of the Experiment	Module
1.	Creating, plotting and smoothing time series in Python	01
2.	Smoothing using polynomials, removing trend, acf	01
3.	Interpreting the period gram and cumulative period gram; simulating AR, MA and ARMA	02,03

	processes	
4.	Simulating ARIMA processes, recognizing stationarity and non-stationarity	03,04,05

Text/Reference Books

1. Forecasting and Time Series. Bowerman & O'Connell, 4th Ed.
2. Time Series: A Biostatistical Introduction. Diggle D. P., Oxford Science Publications, 1990.
3. The Analysis of Time Series. Chatfield C., 7th Ed., CRC Press, 2016.
4. Time Series: Theory and Methods. Brockwell P. J. & Davis R. A., 2nd Ed., Springer Series in Statistics, 1991.
5. Time Series Analysis and Its Applications with R Examples. Shumway R. H. & Stoffer D. S., 3rd Ed., Springer, 2016.
6. Introduction to Statistical Time Series. Fuller W. A., John Wiley, New York, 1996.
7. Time Series Analysis. Hamilton, Princeton University Press, 1994.

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Semester - III

(University Level Optional Course)

BM-5036 L-T-P-C
Fundamentals of International Business 3-0-0-3

Objective: *Students should understand international business management and cultural differences that impact business operation. Further to develop the analytical ability of the student to attain an insight into regional trade agreement, Forex management and country risk analysis.*

Learning Outcomes: *Leaner will be able to understand the scope of international business and optimal way to enter the market, evaluate country attractiveness, impact on business models and cultural differences, know international trade & international finance decisions and its impact on operations, basics of WTO from the perspective of a business manager and acquaint about multinational and subsidiary development and management.*

Course Content

Module 01: Introduction

Objectives, scope, perlmutter's EPRG Model.

Module 02: Country Analysis

PESTEL analysis, The Atlas of Economic complexity, Porters diamond, country risk analysis.

Module 03: Cross Cultural Management

Hofstede's Cultural Dimension, CAGE framework Pankaj Ghemawat, culture and leader SPSU/SOM/Management/MBA/2020 Ver. 1.0 76 effectiveness: the globe study.

Module 04: Mode of Entry

Market/country entry strategic alliances/-JV/ M & A.

Module 05: Investment decisions

Drivers of FDI- Special emphasis on emerging market.

Offshore banking, Forex management, ADR-GDR’ s-EU bonds.

Module 06: WTO regional trade agreement

Building blocks of WTO, Major agreements of WTO.

Module 07: Managing of Multinationals

- Organization Structure -

Matrix

-Geographic

-Product

- International HRM -

Expatriate Management

-Staffing of Subsidiaries

- Integration Response Models -

Types of subsidiaries

-Control of subsidiaries

- Global manufacturing and supply chain -

Optimizing of Supply chain

- Off shoring V/S Outsourcing

Text/Reference Books

1. International Business. Mike W. P., Klaus E. M., Cengage Learning.
2. International Business Environment the: Text and Cases J. Black S., Anant K. S. Prentice Hall India.
3. International Business. Charles W. L. Hill - McGraw Hill.
4. International Management. Arvind V. P. TMH.
5. The Cultural Dimension of International Business. Gary P. F. Pearson.
6. Multinational Management. John B. Cullen Th.
7. International Business: Challenges and Choices. Alan Sitkin, Nick B., Oxford Press.

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Semester - III

(University Level Optional Course)

BM-5037 L-T-P-C
Fundamentals of Strategic Management 3-0-0-3

Objective: *Leaner should know about the role of strategic thinking in changing business environment and to understand the process of strategy formulation, implementation & evaluation. Further to focus on application & decision making.*

Learning Outcomes*: Leaner will be able to familiarize with terminologies and processes of strategic management, understand of strategic management so as to enable the students about SBU, portfolio management and strategic coherence, acquaintance with tools of strategic fit, industry analysis and sustainable competitive Advantage, understand organizational growth options, strategizing and implementing them and know non- financial perspective and strategic parameters in the globalized world.*

Course Content

Module 01: Introduction

Introduction to strategic management, schools of strategic formulation and implementation & evaluation.

Module 02: Globalization and Strategy

Globalization, addressing a VUCA environment with a bottom – up approach (Volatile, Uncertain Complex and Ambiguous time)

Module 03: Strategy Analysis and formation

PESTEL & SWOT as tools for strategic formulation, BCG matrix /GE matrix, 7S McKinsey models as tools for strategic formulation, VRIO analysis, Ansoff

matrix, grand strategy as tools for strategic formulation, Porter's Generic strategies and value chain, Red – Blue - Purple Ocean strategy

Module 04: Competencies

Internal Competences & Resources Core, Distinctive, Strategic & Threshold Competence, Competence v/s Capability, Resource Analysis, Value Chain, Analysis, Strategic Outsourcing Core competence and synergy, Distinctive competencies.

Module 05: Competing in Global Markets

Competing in Global Markets: Differences in Cultural, Demographic and Markets, Multi Country and Global competition concepts, Strategy options, competing in Emerging Markets., Mergers and Acquisitions, Strategic alliance & Joint Ventures, Vertical Integration, Offensive, Defensive, and Strategies

Text/Reference Books

1. Strategic Management: Formulation Implementation & Control. Pierce & Robinson, 9th Ed., Tata McGraw – Hill, N. Delhi.
2. Strategic Management: Concepts & Cases. David F. R., 10th Ed., Pearson Prentice Hall, N. Delhi.
3. Crafting & Executing Strategy. Thomson, Strickland, Gamble & Jain, 14th Ed., Tata McGraw –Hill, N. Delhi.
4. Strategic Management: A South Asian Perspective. Hit, Ireland, Hoskisson & Manikutty, 9th Ed., Cengage Learning, Delhi.
5. Strategic Management: Formulation Implementation & Control. Pierce & Robinson, 9th Ed., Tata McGraw – Hill, N. Delhi.
6. Strategic Management: Concepts & Cases. David F. R., 10th Ed, Pearson – Prentice Hall, N. Delhi.
7. Strategic Management: A Book on Business Policy & Corporate Planning. Francis C., Himalaya Publishing House, Mumbai, 2008.
8. Explaining Corporate Strategy. Johnson & Scholes, 6th Ed., Pearson Education, Delhi.