Branch/Course: Master of Computer Applications

Semester III (Second Year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours Per Week		Credits
		External	Internal		Theory	Practical	
MCA-19301	Operations Research	75	25	100	4	-	4
MCA-19302	Design and Analysis of Algorithms	75	25	100	4	-	4
MCA-19303	Computer Networks	75	25	100	4	-	4
MCA-19304	Artificial Intelligence and Expert systems	75	25	100	4	-	4
MCA-19305	Database Management Systems	75	25	100	4	-	4
MCA-19306	Computer Networks Lab	50	50	100	-	3	2
MCA-19307	Database Management Systems Lab	50	50	100	-	3	2
	Total Credits						24

Course Code &Title: MCA-19301 OPERATIONS RESEARCH
Semester & Year of study: III & 2020-2021
Course Index: C301

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn about Operations Research and Linear Programming.
To learn about the concept of Dual problems and Transportation Model.
To learn about Network Models, Integer Programming, Dynamic Programming.
To learn about the concept of Deterministic Inventory Models, Game theory.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C301.1	Understand Operations Research and Linear Programming.
C301.2	Understand the concept of Dual problems and Transportation Model.
C301.3	Understand about Network Models, Integer Programming, Dynamic Programming.
C301.4	Understand the concept of Deterministic Inventory Models, Game theory.

MCA-19301 OPERATIONS RESEARCH

Instruction:4 Periods/week	**Time: 3 Hours**	**Credits:4**
Internal:25 Marks	**External: 75 Marks**	**Total: 100 Marks**

UNIT I

Overview of Operations Research: OR models – OR Techniques

Linear Programming: Introduction – Graphical solution; Graphical sensitivity analysis- The standard form of linear programming problems – Basic feasible solutions- unrestricted variables – simplex algorithm – artificial variables – Big M and two phase method – Degeneracy - alternative optima – unbounded solutions – infeasible solutions.

UNIT II

Dual Problems: Relation between primal and dual problems – Dual simplex method

Transportation Model: Starting solutions, North West corner Rule - lowest cost method, Vogels approximation method – Transportation algorithms – Assignment problem – Hungarian Method.

UNIT-III

Network Models: Definitions – CPM and PERT – Their Algorithms

Integer Programming: Branch and Bound Algorithms cutting plan algorithm.

Dynamic Programming: Recursive nature of dynamic programming – Forward and Backward Recursion

UNIT-IV

Deterministic Inventory Models: Static EOQ Models – Dynamic EOQ models.

Game theory: Two person Zero Sum Games – Mixed strategy games and their Algorithms.

Text Books:

1. Operations Research – An Introduction, Handy A Taha – Pearson Education.
2. Operations Research Panneer Selvan Prentice Hall of India.

Reference Books:

1. Operations Research, SD Sharma
2. Operations Research Kanti Swaroop, PK Gupta, Man Mohan – Sultan Chand & Sons Education

Course Code &Title: MCA-19302 DESIGN AND ANALYSIS OF ALGORITHMS
Semester & Year of study: III & 2020-2021
Course Index: C302

Course Objectives:
The learning objectives of this course are:

Course Objectives

To learn about the Asymptotic Notations, Mathematical Analysis of Non-recursive and recursive Algorithms and sorting techniques.
To learn about the Divide-and-Conquer technique, Decrease-and-Conquer and Transform-and-Conquer techniques.
To learn about the Dynamic Programming and Greedy Technique
To learn about the Decision Trees, P, NP and NP- complete problems, Backtracking, Branch-and-Bound, Approximation Algorithms for NP-hard Problems.

Course Outcomes:
By the end of the course, the student will be

C302.1	Understand about the Asymptotic Notations, Mathematical Analysis of Non-recursive and recursive Algorithms and Selection Sort and Bubble sort, Sequential Search and Exhaustive Search.
C302.2	Understand about the Divide-and-Conquer technique, Decrease-and-Conquer and Transform-and-Conquer techniques.
C302.3	Understand the Optimal Binary Search Trees, The Knapsack Problem Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.
C302.4	Understand about the Decision Trees, P, NP and NP- complete problems, Backtracking, Branch-and-Bound, Approximation Algorithms for NP-hard Problems.

MCA-19302 DESIGN AND ANALYSIS OF ALGORITHMS

Instruction:4Periods/week	**Time: 3Hours**	**Credits:4**
Internal:25Marks	**External:75Marks**	**Total: 100Marks**

UNIT I

Introduction: Fundamentals of algorithmic problem solving, important problem types, fundamental data structures.

Fundamentals of analysis of algorithms and efficiency: Analysis framework, Asymptotic Notations and Basic Efficiency classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of recursive Algorithms, Empirical Analysis of Algorithms, Algorithm Visualization.

Brute Force: Selection Sort and Bubble sort, Sequential Search and Exhaustive Search.

UNIT II

Divide-and-Conquer: Merge Sort, Quick sort, Binary Search, Binary Tree Traversals and Related Properties.

Decrease-and-Conquer: Insertion Sort, Depth-First Search and Breadth-First Search-Topological Sorting, Decrease-by-a-Constant-Factor Algorithms, Variable-Size-Decrease Algorithms.

Transform-and-Conquer: Presorting, Balanced Search Trees, Heaps and Heap sort, Problem Reduction.

UNIT III

Space and Time Tradeoffs: Sorting by Counting, Hashing, B-Trees.

Dynamic Programming: Warshall's and Floyd's Algorithm, Optimal Binary Search Trees, The Knapsack Problem and Memory Functions.

Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees

UNIT IV

Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP and NP-complete problems.

Coping with the Limitations of Algorithms Power: Backtracking, Branch-and-Bound, Approximation Algorithms for NP-hard Problems.

Text Book:

1. Introduction to Design & Analysis of Algorithms by Anany Levitin, Pearson Education, New Delhi, 2003

Reference Books:

1. Introduction to Algorithms by Thomas H. Corman, Charles E. Leiserson, Ron ald R. Rivest& Clifford Stein, Prentice Hall of India, NewDelhi.
2. The Design and Analysis of computer Algorithms, Aho, Hopcroft & Ullman, Pearson Education, New Delhi, 2003
3. Fundamentals of algorithmics, Gilles Brassard & Paul Bratley, Prentice Hall of India, NewDelhi

Course Code &Title: MCA-19303 COMPUTER NETWORKS
Semester & Year of study: III & 2020-2021
Course Index: C303

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn about the basics of computer networks and Data Communication.
To learn about Data Link Layer, IEEE Standards, design issues in networks.
To learn about Internet Transport Protocols and different types of protocols.
To learn about various types of Network Devices and different types of Networks

Course Outcomes:
By the end of the course, the student will be

C303.1	Understand the basics of computer networks and Data Communication.
C303.2	Understand about Data Link Layer, IEEE Standards, design issues in networks.
C303.3	Understand Internet Transport Protocols and different types of protocols.
C303.4	Overview of various types of Network Devices and different types of Networks

MCA-19303 COMPUTER NETWORKS

Instruction:4Hrs/week	**Time:3 Hours**	**Credits:4**
Internal:25Marks	**External:75Marks**	**Total: 100Marks**

UNIT I

Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications.

Data Communications: Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN, ATM Networks

UNIT II

Data Link Control, Error Detection & Correction, Sliding Window Protocols, LANs & MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5, 802.6, High Speed LANs.

Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.

UNIT III

Internet Transport Protocols: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.

Over View of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.

UNIT IV

Network Devices: Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Brouters, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies.

Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

Text Books:

1. Computer Networks, Andrews S Tanenbaum, Edition 5, PHI, ISBN: -81-203-1165-5
2. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw-Hill Co Ltd, Second Edition

Reference Books:

1. Computer networks, Mayank Dave,Cengage.
2. Computer Networks, A System Approach, 5th ed, Larry L Peterson and Bruce S Davie,Elsevier.
3. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
4. Understanding Communications and Networks, 3rd Edition, W.A. Shay, Thomson.

Course Code &Title: MCA-19304 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS
Semester & Year of study: III & 2020-2021
Course Index: C304

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn about the basic concept of Artificial Intelligence.
To learn about the algorithms and logics in Artificial Intelligence.
To learn about the theories and functions related to Artificial Intelligence.
To learn about the concept, characteristics and applications of Expert Systems.

Course Outcomes:
By the end of the course, the student will be

C304.1	Understand the basic concept of Artificial Intelligence.
C304.2	Understand the algorithms and logics in Artificial Intelligence.
C304.3	Understand about the theories and functions related to Artificial Intelligence.
C304.4	Understanding the concept, characteristics and applications of Expert Systems.

MCA-19304 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Instruction:4Periods/week **Time:3Hours** **Credits: 4**
Internal:25Marks **External:75Marks** **Total: 100Marks**

UNIT I

What is AI, The Foundations of AI, The History of AI, Agents and Environments, The Concept of Rationality, The Nature of Environments, The Structure of Agents, Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies: Breadth First, Depth First, Depth Limited; Informed Search Strategies: Greedy Best First, A* Algorithms

UNIT II

Heuristic Functions, Local-Search Algorithms and Optimization Problems: Hill Climbing, Simulated Annealing, Genetic Algorithms; Constraint Satisfaction Problems, Backtracking Search For CSPs, Games, Optimal Decisions in Games

Knowledge Based Agents, The Wumpus World, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic, Syntax and Semantics of First Order Logic, Using First Order Logic, Inference in First-Order Logic: Unification, Resolution.

UNIT III

Acting Under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distribution, Independence, Bayes Rule and Its Use, Other Approaches To Uncertain Reasoning: Dempster Shafer Theory, Fuzzy Sets and Fuzzy Logic

Combining Beliefs Under Uncertainty, The Basis of Utility Theory, Utility Functions, Multi Attribute Utility Functions, Decision Theoretic Expert Systems

UNIT IV

Expert System, Concepts and Characteristics, Applications and Domains of Expert System, Elements of an Expert System, Stages in the Development of an Expert System, Semantic Nets, Frames

Speech Recognition, Forms of Learning, Inductive Learning, Learning Decision Trees, Single Layer Feed Forward, Multi-Layer Feed Forward Neural Networks.

Text Books:

1. Artificial Intelligence: A Modern Approach. Stuart Russell, Peter Norvig, Pearson Education 2nd Edition.
2. Expert Systems: Principles and Programming. Joseph C Giarratano, Gary D Riley Thomson Publication, 4thEdition.

Reference Books:

1. Elaine Rich and Kevin Knight: Artificial Intelligence, Tata McGrawHill.
2. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India.
3. David W Rolston: Principles of Artificial Intelligence and Expert System Development, McGraw Hill.

Course Code &Title: MCA-19305 DATABASE MANAGEMENT SYSTEMS
Semester & Year of study: III & 2020-2021
Course Index: C305

Course Objectives:
The learning objectives of this course are:

Course Objectives

To learn about the Introduction of Database System, Data Modeling Using the Entity-Relationship Model
To learn about Relational Data Model and Relational Database Constraints, Relational Algebra and Relational Calculus, Schema Definition, Basic Constraints and Queries
To learn about Relational Database Design, Indexing Structures for files
To learn about Transaction Processing, Concurrency Control Techniques

Course Outcomes:
By the end of the course, the student will be

C305.1	Able to understand the Introduction of Database System, Data Modeling Using the Entity-Relationship Model
C305.2	Able to understand Relational Data Model and Relational Database Constraints, Relational Algebra and Relational Calculus, Schema Definition, Basic Constraints and Queries
C305.3	Able to understand Relational Database Design, Indexing Structures for files
C305.4	Able to understand Transaction Processing, Concurrency Control Techniques

MCA-19305 DATABASE MANAGEMENT SYSTEMS

Instruction:4Periods/week **Time:3 Hours** **Credits:4**
Internal:25Marks **External:75Marks** **Total: 100Marks**

UNIT I

Database and Database Users: Data models, schemas, and instances, three-schemas architecture and data independence, database languages and interfaces, the database system environment, Centralized and client/ server architectures for DBMSs, Classification of database management system.

Data Modeling Using the Entity-Relationship Model: Using High—Level Conceptual data model, Entity types, entity sets Attributes and keys, Relationships types, relationship sets, roles and structural constraints, Weak Entity types, ER diagrams Meaning conventions and design issues, Enhance Entity Relationship model,

Relational data model and relational database constraints: Relational model constraints and relational schemas, update operations.

UNIT II

Relational Algebra and Relational Calculus: Unary Relational operations, Relational Algebra operations, Binary Relational operation, Additional Relational operation, Examples of Queries in Relational Algebra, Domain Relational Calculus.

Relational database design by ER and EER Relational Mapping: Relational database design using ER to Relational Mapping, Mapping EER Model Construct to Relations, **Schema Definition, Basic Constraints and Queries:** SQL Data definition, Specifying basic constraints in SQL, Schema change Statements in SQL, Basic queries in SQL, More complex SQL queries, INSERT DELETE UPDATE queries in SQL, Views in SQL, Data base stored Procedures

UNIT III

Relational Database Design: Informal design Guide lines for Relation Schema, Functional Dependences, Normal forms based on Primary keys, General definitions of Second and Third Normal form, BOYCE-CODE Normal form, Algorithm for Relational database schema design, Multi-valued dependencies and fourth Normal forms,

File Organization and Indexes: Introduction, Secondary Storage Devices, Buffering Blocks, placing file records on disk, Operations on Files, Hashing Techniques, Parallelizing Disk Access using RAID Technology, Indexing Structures for files.

UNIT IV

Algorithm for query processing and Optimization: Translating SQL Queries into Relational Algebra, Algorithms for SELECT and JOIN Operations, Algorithms for PROJECT and SET Operations,

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Process, Transaction and System Concepts, Characterizing Schedules, Concurrency Control Techniques, Database Recovery Concepts, Recovery Techniques.

Text Book:

1. Fundamentals of Database System, Elmasri, Navathe, Pearson Education.

References Books:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw- Hill.
2. Database Concepts, Abraham Silberschatz ,Henry FKorth, SSudarshan, McGraw-Hill

Course Code &Title: MCA-19306 COMPUTER NETWORKS LAB **Semester & Year of study: III & 2020-2021** **Course Index: C306**	
Course Objectives: The learning objectives of this course are:	
Course Objectives	
Learn how to implement data framing methods	
Learn how to implement error detecting techniques	
Learn how to implement routing algorithms	
Learn how to implement security encryption algorithms	
Course Outcomes: By the end of the course, the student will be	
C306.1	Able to implement data framing methods
C306.2	Able to implement error detecting techniques
C306.3	Able to implement routing algorithms
C306.4	Able to implement security encryption algorithms

MCA-19306 COMPUTER NETWORKS LAB

Practical: 3Periods/week **Time:3Hours** **Credits: 2**
Internal:50Marks **External:50Marks** **Total: 100Marks**

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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 through a graph.
4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table for each node using distance vector routing algorithm
5. Take an example subnet of hosts. Obtain broadcast tree for it.
6. Take a 64 bit plain 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.

Text Books:

1. Computer Networks, Andrews S Tanenbaum, Edition 4, PHI.

2. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw-Hill CoLtd, Second Edition.

Course Code &Title: MCA-19307 DATABASE MANAGEMENT SYSTEMS LAB **Semester & Year of study: III & 2020-2021** **Course Index: C307**	
Course Objectives: The learning objectives of this course are:	
Course Objectives	
Learn how to write SQL queries using DDL, DML, DCL commands	
Learn how to write SQL queries on aggregate and conversion functions	
Learn how to write PL/SQL programs on exception handling, control structures	
Learn how to write PL/SQL programs on cursors, procedures, triggers.	
Course Outcomes: By the end of the course, the student will be	
C307.1	Able to write SQL queries using DDL, DML, DCL commands
C307.2	Able to write SQL queries on aggregate and conversion functions
C307.3	Able to write PL/SQL programs on exception handling, control structures
C307.4	Able to write PL/SQL programs on cursors, procedures, triggers.

MCA-19307 DATABASE MANAGEMENT SYSTEMS LAB

Practical: 3Periods/week **Time:3Hours** **Credits: 2**
Internal:50Marks **External:50Marks** **Total: 100Marks**

SQL

1) Simple queries to understand DDL, DML and DCLcommands
2) Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
3) Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints.
4) Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
5) Queries using Conversion functions like (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions like (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char,to_date)

PL/SQL

1) Simple programs to understand PL/SQL
2) Write a PL/SQL program to demonstrate exception–handling
3) Demonstrate the working of COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
4) Develop a program that includes the features NESTED IF, CASE and CASE expression.
5) Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATIONERROR.
6) Programs using CURSORS
7) Programs development using creation of procedures and functions.
8) Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers

Text Books:

1. Oracle Database 11g, Jason Price, Oracle Press
2. Oracle PL/SQL for Dummies, Michael Rosenblum, Paul Dorsey, Wiley Publications.