# M.Sc. (Computer Science)

# MSc(CS)

# Session 2014-2015

## Semester-I

| Paper | Subject | Marks |
|---|---|---|
| MCS-101 | Advanced Data Structures | 100 |
| MCS –102 | Advanced Computer Architecture | 100 |
| MCS -103 | Network Design & Performance Analysis | 100 |
| MCS -104 | Discrete Structures | 100 |
| MCS –105 | Soft Computing | 100 |
| MCS –106P | Programming Laboratory - I (Based on Advanced Data Structures) | 100 |
| | **Total Marks** | **600** |

# M.Sc. (Computer Science)

# M.Sc. (Computer Science) (Semester-I)

**MCS-101: Advanced Data Structures**

**Max. Marks: 100**

## TERM –I (Before September)

Review of algorithm analysis, Binary search trees, balanced binary search trees (red-black trees), B-trees, AVL Trees, 2-3 trees, 2-3-4 trees.

Binary heaps, heap operations, specifications, implementation and applications. Advanced heap structures, priority queue operations, and double-ended priority queues.

## TERM –II (From September)

Dictionaries, binomial heaps, Fibonacci heaps. Data structures for disjoint sets, tables and table operations.

Amortized analysis, string matching, and graph algorithms.

External data structures - external storage, external files, external sorting searching indexing files, external hashing.

# M.Sc. (Computer Science) (Semester-I)

**MCS-102: Advanced Computer Architecture**

**Max. Marks: 100**

## TERM –I (Before September)

Paradigms of Computing: Synchronous – Vector/Array, SIMD, Systolic

Asynchronous – MIMD, reduction Paradigm, Hardware taxanomy: Flynn's classification, Software taxanomy: Kung's taxanomy, SPMD.

Parallel Computing Models, Parallelism in Uniprocessor Systems: Trends in parallel processing,

## TERM –II (From September)

Basic Uniprocessor Architecture, Parallel Processing Mechanism.

Parallel Computer Structures: Pipeline Computers, Array Computers, Multiprocessor Systems Architectural Classification Schemes: Multiplicity of Instruction-Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining

Pipelining : An overlapped Parallelism, Principles of Linear Pipelining, Classification of Pipeline Processors, General Pipelines and Reservation Tables

# M.Sc. (Computer Science) (Semester-I)

**MCS-103**
**Network Design & Performance Analysis**

**Max. Marks: 100**

## TERM –I (Before September)

Requirements, planning, & choosing technology: System requirements, traffic sizing characteristics time & delay consideration.

Traffic engineering and capacity planning: Throughput calculation traffic characteristics &source models, traditional traffic engineering, queued data & packet switched traffic modeling, designing for peaks, delay or latency

Network performance modeling- Creating traffic matrix, design tools, components of design tools, types of design projects.

Technology Comparisons- Generic packet switching networks characteristics, private vs. public networking, Business aspects of packet, frame and cell switching services

## TERM –II (From September)

High speed LAN protocols comparison, Application performance needs, Throughput, burstiness, response time and delay tolerance, selecting service provider, vendor, service levels etc.

Access Network Design- N/W design layers, Access N/W design, access n/w capacity, Backbone n/w design, Backbone segments, backbone capacity, topologies, Tuning the network, securing the network, Design for network security.

Documentation and network management- Documentation, network management, SNMP, RMON
Network Optimization- Network optimization theory: Goals of network optimization, measurements for network optimization, optimization tools, optimization techniques.

# M.Sc. (Computer Science) (Semester-I)

**MCS-104**
**Discrete Structures**
**Max. Marks: 100**

## TERM –I (Before September)

Graph Theory: Graph - Directed and undirected Eulerian chains and cycles. Hamiltonian chains and cycles Trees, Chromatic number Connectivity and other graphical parameter. Application.

Combinatorial Mathematics: Basic counting principles Permutations and combinations Inclusion and Exclusion Principle Recurrence relations, generating Function, Application.

Sets and Functions : Sets relations functions operations equivalence relations, relation of partial order partitions binary relations.

## TERM –II (From September)

Monoids and Groups: Groups Semigroups and monoids Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations in semigroups. Morphisms. Normal subgroups. Structure of Cyclic groups permutation groups, dihedral groups Elementary applications in coding theory.

Rings and Boolean algebra : Rings Subrings morphism of rings ideals and quotient rings. Euclidean domains Integral domains and fields Boolean Algebra direct product morphisms Boolean sub-algebra Boolean Rings Application of Boolean algebra in logic circuits and switching functions.

# M.Sc. (Computer Science) (Semester-I)

**MCS-105**
**Soft Computing**
**Max. Marks: 100**

## TERM –I (Before September)

Neural Networks

Introduction to neural networks, working of an artificial neuron, linear seperability, perceptron, perceptron training algorithm, back propagation algorithm, adalines and madalines.

Supervised and unsupervised learning, counter-propagation networks, adoptive resonance theory, neocognitron and bidirectional associative memory.

Fuzzy Logic

Introduction to fuzzy logic and fuzzy sets, fuzzy relations, fuzzy graphs, fuzzy arithmetic and fuzzy if-then rules.

## TERM –II (From September)

Applications of fuzzy logic, neuro-fuzzy systems and genetic algorithm.

Probabilistic Reasoning

Introduction to probability theory, conditional probability, Baye's theorem, random variables and expectations.

Probability distributions, various types of probability distributions like joint distributions, normal distributions etc., fuzzy logic and its relationship with probability theory.

# M.Sc. (Computer Science) (Semester-I)

**MCS-106 P**
**Programming Laboratory - I**

**Max. Marks: 100**

Programs based on Advanced Data Structures using C/C++ division as per theory.

# M.Sc. (Computer Science)

## Semester-II

| Paper | Subject | Marks |
|---|---|---|
| MCS-201 | Theory of Computation | 100 |
| MCS - 202 | Image Processing | 100 |
| MCS -203 | Design & Analysis of Algorithms | 100 |
| MCS -204 | Formal Specification & Verification | 100 |
| MCS –205 | Distributed Database Systems | 100 |
| MCS –206P | Programming Laboratory – II (Design & Analysis of Algorithm and Distributed Database Systems) | 100 |
| | **Total Marks** | **600** |

# M.Sc. (Computer Science) (Semester-II)

**MCS-201**
**Theory of Computation**
**Max. Marks: 100**

## TERM –I (Before March)

**Operations on Languages:** Closure properties of Language Classes. Context Free Languages: The Chomsky Griebach Normal Forms. Linear Grammars and regular Languages. Regular Expressions Context Sensitive Languages; The Kuroda Normal Form, One sided Context Sensitive Grammars.

**Unrestricted Languages:** Normal form and Derivation Graph, Automata and their Languages: Finite Automata, Push down Automata and Turing Machines, The Equivalence of the Automata and the appropriate grammars.

## TERM –II (From March)

**Syntax Analysis:** Ambiguity and the formal power Series, Formal Properties of LL(k) and L.R.(k) Grammars.

**Derivation Languages:** Rewriting Systems, Algebraic properties, Canonical Derivations, Context Sensitivity.

**Cellular Automata:** Formal Language aspects, Algebraic Properties Universality & Complexity Variants.

# M.Sc. (Computer Science) (Semester-II)

**MCS-202: Image Processing**

**Max. Marks: 100**

## TERM –I (Before March)

**Background:** Introduction to electronic systems for image transmission and storage, computer processing and recognition of pictorial data, overview of practical applications.

**Fundamentals:** Mathematical and perceptual preliminaries, human visual system model, image signal representation, imaging system specification building image quality, role of computers, image data formats.

**Image Processing Techniques:** Image enhancement, image restoration, image feature extraction, image data compression and statistical pattern recognition.

## TERM –II (From March)

Hardware architecture for image processing: Distributed processing of image data, role of array processing, standard image processor chips (as example).

**Techniques of Colour Image Processing:** Colour image signal representation, colour system transformations, extension of processing techniques to colour domain.

**Applications of Image Processing:** Picture data archival, machine vision, medical image processing.

# M.Sc. (Computer Science) (Semester-II)

**MCS-203**
**Design & Analysis of Algorithms**

**Max. Marks: 100**

## TERM –I (Before March)

**Introduction:** Concept of Algorithm, Algorithm Specification, Performance Analysis (Time and space complexities), Asymptotic Notations.

**Divide and Conquer:** General Method, Binary Search, Finding the Maximum and Minimum, Quick Sort, Selection.
**Greedy Method:** General Method, Knapsack Problem,, Minimum Cost Spanning Trees (Prim's Algorithm, Kruskal's Algorithm) and Sibnngle-Source Shortest Path.

**Dynamic Programming:** General Single Method, Multistage Graphs, All Pairs Shortest Paths, Single-Source Shortest Paths, Optimal Binary Search Tress, 0/1 Knapsack and Travelling Saleman Problem.

## TERM –II (From March)

**Backtracking:** General Method, 8-Queens Problem, Graph Coloring and Hamiltonian Cycles.

**Search and Traversal Technique:** Techniques for Binary Trees, Techniques for Graphs.
**Alegebric Algorithms:** General Method, Evaluation and Interpolation, Fast Fourier Transformation, Modular Arithmatic.

**NP- Hard Problems:** Basic Concepts, Nondeterministic Algorithms, Classes *NP*-Hard and *NP*- Complete, *NP*-Hard Graph Problems (CNDP, DHC, TSP and AOG).

# M.Sc. (Computer Science) (Semester-II)

**MCS-204**

**Formal Specification & Verification**
**Max. Marks: 100**

## TERM –I (Before March)

**Specification of Sequential Programs:** Pre-post conditions Partial and total correctness, First Order Logic, Abstract data types and data type refinement. Case study of specification languages.

Axiomatic System for first order logic. Proofs by mathematical induction. Hoare Logic, Techniques for proving non deterministic programs.

Dijkstra's weakest pre-condition semantics. Extension of Hoare Logic to deal with Languages involving advanced constructs like procedures with parameters, non-determinism, concurrency, communication and fairness.

## TERM –II (From March)

**Advanced Topics:** Specification and verifications of reactive programs. Safety and Liveness Properties, Temporal Logic for specifying safety and liveness properties. Techniques for proving safety and liveness properties.

Computer-aided Verification: Deductive and model-theoretic approach. Automatic verification of finite state systems.

# M.Sc. (Computer Science) (Semester-II)

**MCS-205**
**Distributed Database Systems**

**Max. Marks: 100**

## TERM –I (Before March)

Introduction to distributed databases, comparison of distributed and centralized systems, DDBMS, global relations, fragment and physical image, types of schemas, methods of fragmentation of a relation, levels of transparency in a distributed system, integrity constraints.

Representation of database operation in form of a query, operation in form of a query, operations on a query, unary and binary tree in a query, converting a global query into fragment query, join and union operations involving a query, aggregate functions, and parametric queries.

Introduction to query optimization, estimation of profiles of algebraic operations, optimization graphs, reduction of relation using semi-join and join operation.

## TERM –II (From March)

Properties and goals of transaction management, distributed transactions, recovery mechanism in case of transaction failures, log based recovery, check pointing, and communication and site failures in case of a transaction and methods to handle them, serializability and timestamp in distributed databases.

Introduction to distributed deadlocks, local and global wait for graphs, deadlock detection using centralized and hierarchical controllers, prevention of deadlocks, 2 and 3 phase locking and commitment protocols, reliability in commitment and locking protocols, reliability and concurrency control, reliability and removal of inconsistency.

Distributed database administration, authorization and protection in distributed databases, distributed database design, heterogeneous database system.

# M.Sc. (Computer Science) (Semester-II)

**MCS-206 P**
**Programming Laboratory – II**

**Max. Marks: 100**

Implementations based on Design & Analysis of Algorithms and Distributed Database Systems division as per theory.

# M.Sc. (Computer Science)

## Semester-III

| Paper | Subject | Marks |
|---|---|---|
| MCS-301 | Advanced Software Engineering | 100 |
| MCS –302 | System Software | 100 |
| MCS -303 | Data Mining and Warehousing | 100 |
| MCS -304 | Concept of Core and Advanced Java | 100 |
| MCS –305 | Network Programming | 100 |
| MCS –306P | Programming Laboratory - III<br>(Based on Advanced Java and Network Programming) | 100 |
| | **Total Marks** | **600** |

# M.Sc. (Computer Science) (Semester-III)

**MCS-301**
**Advanced Software Engineering**

**Max. Marks: 100**

## TERM –I (Before September)

**Software Project Management:** Fundamentals of Software project planning , Conventional Software Management, Evolution of Software Economics, Improvement of Software Economics, Comparison of old and modern ways of Software Management.

**Software Re-engineering:** Introduction Re-engineering, Restructuring and Reverse Engineering, Re-engineering existing systems, Data Re-engineering and migration, Software Reuse and Re-engineering.

**Object-Oriented (OO) Measurements:** Introduction, Why metrics ?, Classification of OO metrics, Study of Design Metrics- method size, method internals, class size

## TERM –II (From September)

Class inheritance, Method inheritance, class intervals and class externals.

**Object-Oriented Analysis and Design:** What is Object-Oriented Design ?, Object, Abstraction, Collaboration among Objects, Polymorphism, Classes, specifying State, Specifying Behavior, Class Relationships, Grouping, Hiding.

**Software Agents:** Definition, Applications, Types and Classes, Multi-Agent systems, characteristics & Properties Agents.

# M.Sc. (Computer Science) (Semester-III)

**MCS-302**
**System Software**

**Max. Marks: 100**

## TERM –I (Before September)

**Introduction to System Software:** Evolution of System Software, components of system software, Translators, loaders, interpreters, compiler, assemblers.

**Assemblers:** Overview of assembly process, design of one pass and two assemblers.

**Macroprocessors:** Macro definition and expansion, concatenation of macro parameters, generations of unique labels, conditional macro expansion, Recursive macro expansion.

## TERM –II (From September)

**Compilers:** Phases of compilation process, logical analysis, parsing, storage management optimisation. Incremental compilers, cross compilers, P code compilers.

**Loaders and Linkage Editors:** Basic loader functions. Relocation, program linking, linkage, editors, dynamic linking bootstrap loaders.

**Other System Software:** Operating system, DBMS, text editors, Interactive debugging systems.

# M.Sc. (Computer Science) (Semester-III)

**MCS-303**
**Data Mining and Warehousing**

**Max. Marks: 100**

## TERM –I (Before September)

**Data Warehousing:**
Concepts of Data Warehousing, Difference between operational database systems and Data warehousing, Need of a separate Data Warehouse. Multidimensional Data Model.

**Data Warehousing Architecture:**
Steps for Design and Construction of Data-Warehouses, Three-Tier Data Warehouse Architecture, Characteristics of Data Warehousing Data, Data Marts, Types of OLAP Servers: ROLAP, MOLAP, HOLAP; Difference between Online Transaction Processing and Online Analytical Processing

## TERM –II (From September)

**Data Warehouse Implementation:**
Efficient Computation of Data Cubes, Indexing OLAP Data, Efficient Processing of OLAP Queries, Metadata Repository, Data Warehouse Back-End Tools and Utilities

**Data Mining**
Basic Concepts; Data Mining Techniques: Predictive Modeling, Database Segmentation, Link Analysis, Deviation Detection in details. Data Mining Query Languages, Applications and Trends in Data Mining.

# M.Sc. (Computer Science) (Semester-III)

**MCS-304**
**Concept of Core and Advanced Java**

**Max. Marks: 100**

## TERM –I (Before September)

**Java Fundamentals:** Features, Objects Oriented Basis, Java Virtual Machine

Character Set, Operators, Data Types, Control Structures

Classes, Inheritance, Polymorphism, Packages & Interfaces, Stream IO Classes, Exception Handling,

## TERM –II (From September)

**Multithreading:** Java Thread model, Thread Priorities, Synchronization, Interthread communication, Suspending, resuming & stopping thread.

**Applet:** Applet basics, Applet architecture, Applet: Display, Repaint, Parameter Passing.

Telnet, FTP, Web Server and their implementation in Java.

# M.Sc. (Computer Science) (Semester-III)

**MCS-305**
**Network Programming**

**Max. Marks: 100**

## TERM –I (Before September)

Sockets and Socket Address structures, Concept of Zombies, Daemon Processes, Super servers, Concurrent versus Iterative servers, Protocol Independence, Error Handling : Wrapper functions, OSI Model, Unix standards.

TCP Connection establishment & Termination, Port Numbers and Concurrent Servers, Protocol Usage by common Internet Applications.

## TERM –II (From September)

UDP Communication Semantics, UDP Echo Server, Echo Client working, Protocol Usage by Common Internet Applications.

Sockets Address Structures, Byte ordering & Manipulation Functions, TCP Socket System Calls, TCP Client-Server E.g., I/O Multiplexing, Signal Handling in Concurrent Servers.

Socket Options, Elementary Names Address Conversions, Ipv4 and Ipv6 Interoperability.

# M.Sc. (Computer Science) (Semester-III)

**MCS-306 P**
**Programming Laboratory – III**

**Max. Marks: 100**

Programming Laboratory based on Advanced Java and Network Programming

# Semester-IV

| Paper | Subject | Marks |
|---|---|---|
| MCS-401 | Advanced Web Technologies using ASP.NET | 100 |
| MCS - 402 | Microprocessor and Its Applications | 100 |
| MCS -403 | Object Oriented Modeling, Analysis and Design | 100 |
| MCS -404P | Programming Laboratory – IV<br>(Based on Advanced Web Technologies using ASP.NET ) | 100 |
| MCS –405P | Project Work | 200 |
| | **Total Marks** | **600** |

# M.Sc. (Computer Science)

# M.Sc. (Computer Science) (Semester-IV)

**MCS-401**
**Advanced Web Technologies using ASP.NET**

**Max. Marks: 100**

## TERM –I (Before March)

**Standard Controls:** Display information, Accepting user input, Submitting form data, Displaying images, Using the panel control, Using the hyperlink control.

**Validation Controls:** Using the required field validator control, Using the range validator control using the compare validator control, Using the regular expression validator control, Using the custom validator control, Using the validation summary controls.

**Rich Controls:** Accepting file uploads, Displaying a calendar, Displaying advertisement, Displaying different page views, Displaying a wizard.

**Designing Website with Master Pages:** Creating master pages, Modifying master page content, Loading master page dynamically.

**SQL Data Source Control:** Creating database connections, Executing database commands, Using ASP.NET parameters with the SQL data source controls, Programmatically executing SQL data source commands, Cashing database data with the SQL data Source controls.

## TERM –II (From March)

**List Controls:** Dropdown list control, Radio button list controls, list box controls, bulleted list controls, custom list controls.

**Grid View Controls:** Grid view control fundamentals, Using field with the grid view control, Working with grid view control events extending the grid view control.

**Building Data Access Components with ADO.NET:** Connected the data access, Disconnected data access, Executing a synchronous database commands, Building data base objects with the .NET framework.

**Maintaining Application State:** Using browser cookies, Using session state, Using profiles.

**Caching Application Pages and Data:** page output caching, partial page caching, data source caching, data caching, SQL cache dependences.

# M.Sc. (Computer Science) (Semester-IV)

**MCS-402**
**Microprocessor and Its Applications**

**Max. Marks: 100**

## TERM –I (Before March)

**Introduction:** Introduction to Microprocessor, General Architecture of Microcomputer System. Microprocessor Units, Input unit, Output unit, Memory unit and auxiliary storage unit.

**Architecture of 8086/8088 Microprocessor:** Description of various pins, configuring the 8086/8088 microprocessor for minimum and maximum mode systems, Internal architecture of the 8086/8088 microprocessor, system clock, Bus cycle, Instruction execution sequence.

**Memory Interface of 8086/8088 Microprocessor:** Address space and data organization, generating memory addresses hardware organization of memory address space

## TERM –II (From March)

Memory bus status code, memory control signals, read/write bus cycles, program and data storage memory, dynamic RAM system.

**Input/Output Interface of the 8086/8088 Microprocessor:** I/O interface, I/O address space and data transfer, I/O instructions, I/O bus cycles, Output ports, 8255A Programmable Peripheral Interface (PPI), Serial communication interface (USART and UART) – the RS- 232 C interface.

Interrupt Interface of 8086/8088 Microprocessor, Types of Interrupt, Interrupt Vector Table (IVT).

# M.Sc. (Computer Science) (Semester-IV)

**MCS-403**
**Object Oriented Modeling, Analysis and Design**

**Max. Marks: 100**

## TERM –I (Before March)

Object Orientation, OMT Methodology, Object and Class, Link and Association Generalization, Aggregation Multiple Inheritance, Packages,

Object Meta Modeling, Metadata and Metamodels, Functional Modeling Pseudocode with the Object navigation Notation, ONN Constructs, Combining ONN Constructs.

## TERM –II (From March)

**Analysis:** Object Model, Data Dictionary, Dynamic Model, Functional Model.

System Design:- Devising an Architecture, Database Management Paradigm, Object Model, Elaborating the functional Model, Evaluating the Quality of Design Model.

# M.Sc. (Computer Science) (Semester-IV)

**MCS-404 P**
**Programming Laboratory – IV**
**Max. Marks: 100**

Programming Laboratory based on Advanced Web Technologies using ASP.NET

# M.Sc. (Computer Science) (Semester-IV)

**MCS–405P**

**Project Work**

**Max. Marks: 200**

The Project is to be prepared based on sum current problems from industry / business / academic domain using some currently available technology / platform.