M.Sc. (Computer Science) Syllabus

Session (2016-2017)

KHALSA COLLEGE
AMRITSAR
-An Autonomous College

Note:

2. Subject to change in the syllabi at any time. Please visit the Khalsa College website time to time.

M.Sc. (Computer Science)

Semester I

Sr. No.	Paper no.	Paper	Marks				Page No.
			Theory	Internal Assessment	Practical	Total	
1	MCS-101	Advance Data Structure	80	20	-	100	3
2	MCS-102	Advanced Computer Architecture	80	20	-	100	4
3	MCS-103	Network Design and Performance Analysis	80	20	-	100	5
4	MCS-104	Discrete Structures	80	20	-	100	6
5	MCS-105	Soft Computing	80	20	-	100	7
6	MCS-106P	Programming Laboratory-I(Based on Advanced Data Structures)	-	20	80	100	8
		Total Marks				**600**	

M.Sc. (Computer Science)
SEMESTER-I

MCS-101
Advanced Data Structures

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

Review of algorithm analysis, Binary search trees, balanced binary search trees (red-black trees), Btrees, 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.

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

Strings: Introduction, Operations, Memory representation, Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm.

Amortized analysis, Graph algorithms: DFS, BFS, Shortest path algorithm, Spanning tree, Biconnected components.

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

References:
Alfred V. Aho, Jeffrey D. Uuman, John E. Hopcroft, “Data Structures and Algorithms” Addision Wesley, 1983.
Dinesh P. Mehta, I. Sartaj Sahni, “Handbook of Data Structures and Applications”, Chapman & Hall/CRC, 2004.
Sorenson and Trembley, “An Introduction to Data Structures with Applications, McGraw Hill,\2006 Edition.

M.Sc. (Computer Science)
SEMESTER-I

MCS-102
Advanced Computer Architecture

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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 : Combinational Circuits, Sorting Networks, PRAM models, Interconnection RAMs.

Parallelism in Uniprocessor Systems: Trends in parallel processing, 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

References
Computer Architecture and Parallel Processing, Faye A. Briggs, McGraw-Hill International, 2007
Edition
Computer Systems Organization & Architecture, John d. Carpinelli, Addison Wesley, 2007 Edition.

M.Sc. (Computer Science)
SEMESTER-I

MCS-103
Network Design & Performance Analysis

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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 modelling, designing for peaks, delay or latency

Network performance modelling- 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, 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.

References:
James D. McCabe, Network Analysis, Architecture and Design, 2nd Edition, Morgan Kaufman Series in Networking, 2007 Edition.
Youeu Zheng, Shakil Akhtar, Network for Computer Scientists and Engineers, Indian University, Oxford University Press, 2007 Edition.
A. Forouzan, Data Communications and Networking, Tata McGraw Hill, 2007 Edition.

M.Sc. (Computer Science)
SEMESTER-I

MCS-104
Discrete Structures

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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.
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.

References :

Ehrig, H., Mahr, B. Fundamentals of Algebraic Specification I, EATCS Monographs on Theory. Comp. Sc. Vol. 6 spinger, Berlin 1985.
Gersting J. Mathematical Structures for Computer Science, W.H. Freeman, New York, 1987.
Gibbons, A. Algorithmic Graph theory Cambridge University Press, 1985.
Knuth, D.E. The art of Computer Programming Vol. I: Fundamental Algorithms. 2nd ed. Reading, Mass, Addison Wesley 1973.
Kolman B. Busby R. Discrete Mathematical Structures for Computer Science, Prentice Hall Englewood Cliffs. 1987.
Sahni, S. Concepts in Discrete Mathematics Fridley MN., Camelot Publ. Comp., 1981.
Schmidt G. Strohlein T. Relations Graphs Program, EATS Monograph on Theor. Comp. Sc. Vol. 29 Berlin Spinger 1993.
Wheeler W. Universal Algebra for Computer Scientist EATCS Monographs on Theor.Comp. Sc. Vol. 25 Spinger-Verlag, Berlin 1991

M.Sc. (Computer Science)
SEMESTER-I

MCS-105
Soft Computing

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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.

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.

References:

Elements of artificial neural networks by Kishan Mehrotra, Chilkuri K. Mohan and Sanjay Ranka, 2007 Edition.
Fundamentals of artificial neural networks by Mohammad H. Hassoun, Prentice Hall of India, 2007 edition.
Neural networks and fuzzy systems by Bart Kosko, Prentice Hall of India, 2007 edition.
Fuzzy logic, intelligence, control and information by John Yen and Reza Langari, Pearson Education, 2007 edition.
Probability and statistics by Murray R. Spiegel, John Schiller and R. Alu Srinivasan, Schaum's Outlines, Tata McGraw Hill Publishing Company Limited, 2007 edition.

M.Sc. (Computer Science)
SEMESTER-I

MCS-106 P
Programming Laboratory – I
(Based on Advanced Data Structures)

Time: 3 Hrs. **Total Marks: 100**
Practical Marks: 80
Practical Internal Assessment M: 20

Programs based on Advanced Data Structures using C/C++

M.Sc. (Computer Science)

Semester II

Sr. No.	Paper no.	Paper	Marks				Page No.
			Theory	**Internal Assessment**	**Practical**	**Total**	
1	MCS-201	Theory of Computation	80	20	-	100	10-11
2	MCS-202	Image Processing	80	20	-	100	12
3	MCS-203	Design and Analysis of Algorithms	80	20	-	100	13
4	MCS-204	Formal Specification & Verification	80	20	-	100	14
5	MCS-205	Distributed Database System	80	20	-	100	15
6	MCS-206P	Programming Laboratory-II(Design & Analysis of Algorithm and Distributed Database System)	-	20	80	100	16
					Total	**600**	

M.Sc. (Computer Science)
SEMESTER-II

MCS-201
Theory of Computation

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

Finite Automata Deterministic finite Automata, Non deterministic finite Automata, Transition System, Equivalence of NFA and DFA, Finite Automata with Null-moves. 2-Way Finite Automata, Crossing sequences, Moore and Mealy Machine, Inter Conversion of Moore and Mealy Machine, Application of finite automata i.e. Lexical Analyzers, text editors. Minimization of finite Automata, construction of minimum automation, Formal languages,

Chomsky Hierarchy of Languages, Recursive and recursively-enumerable languages sets, Language and their relation, Languages and automata.

Regular Expression and Languages, Regular expression, Equivalence of finite Automata and Regular expressions, Conversion between regular expressions and finite automata, Application of Regular Expressions.

Regular Languages and Regular sets, Pumping lemma for regular sets, Applications of pumping lemma. Closure properties of regular language, Context free Grammar and Languages, Context free Grammars, Derivation Trees, Leftmost and rightmost derivations, Ambiguity, Properties of Context free Languages- Normal forms for context free grammars(Chomsky Normal Form, Griebach Normal Form, The Kuroda Normal Form)

Pushdown Automata: Deterministic Push down Automata; Equivalence of Push Down Automata and Context free grammar. Linear Bounded Automata (LBA): Power of LBA, Closure Properties.

Turing Machine (TM): One Tape, multi tape, the notions of time and space complexity in terms of T.M. Construction of simple problems. Computational complexity.

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.

References:

1. J.E. Hopcroft, R. Motwani and J.D. Ullamn, “Introduction to Automata Theory, Languages and Computation”, Pearson Education Asia, 2nd Edition.

2. John C. Martin, “Introduction to Languages and the Theory of Computation”, Tata McGraw Hill Publication Company Limited, 3rd Edition.
3. K.L.P Mishra and N. Chandrasekaran,” Theory of Computer Science”,Prenctice-Hall of India
Pvt.Ltd. 3rd Edition”
4. Daniel I.A. Cohen, "Introduction to Computer Theory", Wiley, Second edition.
5. B. M. Moret, “The Theory of Computation”, Pearson Education Asia.
6. H.R. Lewis and C.H. Papa dimitriou, “Elements of the theory of Computation”, Pearson Education Asia 2nd Edition.

M.Sc. (Computer Science)
SEMESTER-II

MCS-202
Image Processing

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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.
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.

References:
1. Pratt, W.K. Digital Image Processing, John Wiley, N.Y./1978.
2. Rosenfield, A and Kak, A.C., Picture processing, Academic PressN.Y., 1982.
3. Jain, A.K., Fundamentals of Digital Image Processing, Englewood Cliffs, Prentice Hall, 1989.
4. Chris Soloman, Stuart Gibson, Fundamentals of Digital Image Processing: A Practical Approach using MatLab, John Wiley and Sons, 2007.
5. Digital Image Processing by Gonzalez & Wood, Addison Wesley, 2000.

M.Sc. (Computer Science)
SEMESTER-II

MCS-203
Design & Analysis of Algorithms

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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.

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).

References:
1. V. Aho, J.E. Hopcroft, J.D. Ullman, Design and Analysis of Algorithms, Addison Wesley, 1976.
2. Horowitz, S. Sahni, Fundamentals of Computer Algorithms, Galgotia Publishers, 1984.
3. K. Mehlhorn, Data Structures and Algorithms, Vols. 1 and 2, Springer Verlag, 1984.
4. Purdom, Jr. and C. A. Brown, The Analysis of Algorithms, Holt Rinechart and Winston, 1985.
5. D. E. Kunth, The Art of Computer Programming, Vols. I and 3, Addison Wesley,1975.
6. AnanyLevitin, Introduction to the Design & Analysis of Algorithms, Addison, Wesley, 2002.

M.Sc. (Computer Science)
SEMESTER-II

MCS-204
Formal Specification & Verification

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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, nondeterminism, concurrency, communication and fairness.

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.

References:
1. Apt and Olderog, Program Verification, Springer Verlag, 1991.
2. S. Alagic and M. Arbib, Design of Well Structured and Correct Programs, Springer Verlag, 1978.
3. A. Pnueli and Z. Manna Temporal Logic of Reactive and Concurrent Systems, Springer Verlag, 1992.
4. D. Gries, Science of Programming, Narosa Pub.1985.
5. J. Loeckx and K. Siber, Found of Prog. Verification, John Wiley, 1984.

M.Sc. (Computer Science)
SEMESTER-II

MCS-205
Distributed Database Systems

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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.

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.

References:

1. Distributed Databases Principles and Systems by Stefano Ceri and GuiseppePelagatti, McGraw-Hill International Editions, 2004.
2. Distributed Database Systems by David Bell, JameGrimson, Addison-Wesley, 1992.
3. M.TamerOzsu, Patrick Valdureiz, 'Principles of Distributed Database Systems' Second Edition, Prentice Hall, 2002.
4. RomezElmasri, ShamkantB.Navathe, 'Fundamentals of Database Systems' Pearson Education, 2005.
5. Silberschatz, Korth, Sudershan"Database System Concepts" 4th Ed. McGraw Hill,2006

M.Sc. (Computer Science)
SEMESTER-II

MCS-206 P
Programming Laboratory – II
(Design & Analysis of Algorithm and Distributed Database System)

Time: 3 Hrs. **Total Marks: 100**
Practical Marks: 80
Practical Internal Assessment M: 20

Implementations based on Design & Analysis of Algorithms and Distributed Database

M.Sc. (Computer Science)

Semester III

Sr. No.	Paper no.	Paper	Marks				Page No.
			Theory	Internal Assessment	Practical	Total	
1	MCS-301	Advanced Software Engineering	80	20	-	100	18
2	MCS-302	System Software	80	20	-	100	19
3	MCS-303	Data Mining and Warehousing	80	20	-	100	20
4	MCS-304	Concept of Core and Advanced Java	80	20	-	100	21-22
5	MCS-305	Network Programming	80	20	-	100	23
6	MCS-306P	Programming Laboratory-III(Based on Advanced Java and Network Programming)	-	20	80	100	24
					Total Marks	**600**	

M.Sc. (Computer Science)
SEMESTER-III

MCS-301
Advanced Software Engineering

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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 Reengineering.

Object-Oriented (OO) Measurements: Introduction, Why metrics ?, Classification of OO metrics, Study of Design Metrics- method size, method internals, class size, 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 Behaviour, Class Relationships, Grouping, Hiding.

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

References:
1. Software project management, Walker Royce, Pearson Education Inc.
2. Software Re-engineering, Robert S. Arnold IEEE Comp. Society.
3. Object Oriented Software Metrics, Lorenz and Kidd.
4. Object-Oriented Analysis and Design, Booch.

M.Sc. (Computer Science)
SEMESTER-III

MCS-302
System Software

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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 pass assemblers.

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

Compilers: Phases of compilation process, lexical 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.

References:
1. Leland L. Beck: System Software, An introduction to system programming, Addison Wesley.
2. D.M. Dhamdhere: Introduction to System Software, Tata McGraw Hill.
3. D.M. Dhamdhere: System Software and Operating System, Tata McGraw Hill, 1992.
4. Madrich, Stuarte: Operating Systems, McGraw Hill, 1974.
5. Stern Nancy Assembler Language Programming for IBM and IBM compatible computers, John Wiley, 1991.

M.Sc. (Computer Science)
SEMESTER-III

MCS-303
Data Mining and Warehousing

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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

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.

References:
1. Han, Kamber *"Data Mining: Concepts and Techniques"* Morgan Kaufmann.
2. Romez Elmasri, Shamkant B.Navathe, *"Fundamentals of Database Systems"* Pearson Education.
3. Silberschatz, Korth, Sudershan *"Database System Concepts"* 4th Ed. McGraw Hill
4. Connolly & Begg *"Database Systems – A Practical Approach to Design, Implementation and Management*", 3rd Ed., Pearson Education.

M.Sc. (Computer Science)
SEMESTER-III

MCS-304
Concept of Core and Advanced Java

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

Classes & Packages

Introduction and Defining Classes, methods, fields, Initializing fields, Static members, Constructors and Finalizers referencing objects, Using packages & Sub packages,, Access specifies

Inheritance, nested and inner class

Extending classes, Abstract class,, Interface, Super keyword, Final keyword, Final classes, Constructors & Inheritance, Dynamic Binding, Overloading and Overriding methods

Exception Handling and Input and Output package

(java.io. package),Introduction to exception, Try and catch block, throw, throws and finally Block, Inbuilt exceptions, User-defined exceptions, Byte streams, Character streams, File IO basics, Object serialization – reader and writer.

AWT, Event Handling and Applet programming

Layout, Manager, AWT Controls, Various Events and Listeners ,Adapter classes ,Applet fundamentals, Applet lifecycle, Creating and running applets, advantages and restrictions

Multithreading

What are Threads, Life cycle of threads, Running Multiple threads, The Runnable interface, Threads priorities Daemon, Thread states, thread groups Synchronization and Inter thread Communication Deadlocks

JDBC

The design of JDBC, Basic JDBC programming concepts, Making the connection, Statement and Result set , Executing SQL commands ,Executing Queries, Scrollable and Updatable Result Sets, Metadata,(Databases : MySQL/ SQL Server/PostgreSQL/Oracle)

Servlets

What are Servlets?, Advantages of Servlet, Lifecycle of servlet, Using Tomcat for servlet development, javax.s ervlet package, The Servlet Interface, The ServletConfig, Interface, The ServletContext, Interface,ServletRequest,ServletResponse,SingleThread Model, GenericServletClass,ServletInputStream,ServletOutputStream,ServletException,javax.servlet. http package, HttpServletRequest,HttpServletResponse, HttpSession, The Cookie

class,HttpServlet class,Handling HTTP Requests and Responses,GET requests,POST requests, Servlet – JDBC,Session Tracking, Security Issues.

Introduction to JSP

Components of JSP – directives, tags and scripting elements. Building a simple application using JSP

Reference:

The Complete Reference java 2 by Herbert Schildt. Tata Mc. Graw Hill 5th Edition

Java Programming Advanced topics by Joe Wigglesworth – Paula Lumby. Thomson Learning

3)Programming in java 2 by R. Raja Ram. SciTech Publications India Pvt. Ltd.

Core Java I - By Cay S. Horstmann and Gary Cornell

Book Complete Reference J2EE by Jim Keogh

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M.Sc. (Computer Science)
SEMESTER-III

MCS-305
Network Programming

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

Introduction to Sockets, 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.

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.

References:
1. Networking Programming, W. Richard Stevens, Pearson Education.
2. Advanced Programming in UNIX Environment, W. Richard Stevens, Pearson Education.

M.Sc. (Computer Science)
SEMESTER-III

MCS-306 P
Programming Laboratory – III
(Based on Advanced Java and Network Programming)

Time: 3 Hrs. **Total Marks: 100**
Practical Marks: 80
Practical Internal Assessment M: 20

Programming Laboratory based on Advanced Java and Network Programming

M.Sc. (Computer Science)

Semester IV

Sr. No.	Paper no.	Paper	Theory	Internal Assessment	Practical	Total	Page No.
1	MCS-401	Advanced Web Technologies using ASP.NET	80	20	-	100	26-27
2	MCS-402	Microprocessor and its Applications	80	20	-	100	28
3	MCS-403	Object Oriented Modelling, Analysis and Design	80	20	-	100	29
4	MCS-404	Programming Laboratory-IV(Based on Advanced Web Technologies using ASP.NET)	80	20	-	100	30
5	MCS-405	Project Work	-	40	160	200	31
			Total Marks			**600**	

M.Sc. (Computer Science)
SEMESTER-IV

MCS-401
Advanced Web Technologies using ASP.NET

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

Introduction to .Net Framework

Developing console applications, C# Type Conversion Methods, boxing and unboxing, compiling & building projects, using command line argument, compiling a C# program using commandLine utility CSC.EXE

Introduction to Web Applications:
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.

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 ApplicationState: 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.

Reference:

ASP.NET 3.5: Stephen Walther, Pearson Education, 2005
ASP.NET 4.0: In Simple Steps by Kogent Learning Solutions Inc.
ASP.NET 4.5: Black Book by Kogent Learning Solution Inc.

M.Sc. (Computer Science)
SEMESTER-IV

MCS-402
Microprocessor and Its Applications

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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, 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).

References:
1. Walter Triebel: The 8086 Microprocessor – Architecture, Software and Interfacing Techniques, PHI, Delhi.
2. Walter Triebel: The 8088 Microprocessor – Architecture, Software and Interfacing Techniques, PHI, Delhi.
3. Douglas V. Hall: Microprocessors and Interfacing – Programming and Hardware, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Peter Abel: IBM PC Assembly Language and Programming, PHI, Delhi.

M.Sc. (Computer Science)
SEMESTER-IV

MCS-403
Object Oriented Modelling, Analysis and Design

Time: 3 Hrs. **Total Marks: 100**
Theory Marks: 80
Theory Internal Assessment M: 20

Note:
(i) The paper setter is required to set eight questions in all and the candidates will be required to attempt any five questions out of these eight questions. All questions will carry equal marks.
(ii) The student can use only Non-programmable & Non-storage type calculator.

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

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

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.

Reference:
Object Oriented Modeling and Design By Michael Blaha, William Premerlani, and Prentice Hall.

M.Sc. (Computer Science)
SEMESTER-IV

MCS-404 P
Programming Laboratory – IV
(Based on Advanced Web Technologies using ASP.NET)

Time: 3 Hrs. **Total Marks: 100**
Practical Marks: 80
Practical Internal Assessment M: 20

Programming Laboratory based on Advanced Web Technologies using ASP.NET

M.Sc. (Computer Science)
SEMESTER-IV

MCS–405P
Project Work

Time: 3 Hrs. **Total Marks: 200**
Project Marks: 160
Project Internal Assessment M: 40

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

Note:
1. The end semester project work evaluation is to be conducted by following panel of examiners:-
   a. Internal Examiner
b. External Examiner
   c. Head/Head's nominee
2. The Project are to be submitted as per the common ordinances for P.G. courses under semester system.