M.Sc. (Computer Science) Syllabus

Session (2018-2019)

KHALSA COLLEGE AMRITSAR
-An Autonomous College

Note:

M.Sc. (Computer Science)

Semester I

Sr. No.	Paper Code	Paper Name	Marks				Page No.
			Theory	**Internal Assessment**	**Practical**	**Total**	
1	MCS-101	Advance Data Structure	75	25	-	100	3
2	MCS-102	Advanced Computer Architecture	75	25	-	100	4
3	MCS-103	Network Design and Performance Analysis	75	25	-	100	5
4	MCS-104	Discrete Structures	75	25	-	100	6
5	MCS-105	Soft Computing	75	25	-	100	7
6	MCS-106P	Programming Laboratory-I(Based on Advanced Data Structures)	-	25	75	100	8
					Total Marks	**600**	

M.Sc. (Computer Science)
SEMESTER-I

MCS-101
Advanced Data Structures

Time: 3 Hrs.

Total Marks: 100
Theory Marks: 75
Theory Internal Assessment M: 25

Note: The question paper covering the entire course shall be divided into three sections.

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I
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.

Unit -II
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: 75
                                                  Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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: 75
                                              Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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: 75
Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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: 75
Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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: 75
Practical Internal Assessment M: 25

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

M.Sc. (Computer Science)

Semester II

Sr. No.	Paper Code	Paper Name	Marks				Page No.
			Theory	Internal Assessment	Practical	Total	
1	MCS-201	Theory of Computation	75	25	-	100	10-11
2	MCS-202	Image Processing	75	25	-	100	12
3	MCS-203	Design and Analysis of Algorithms	75	25	-	100	13-14
4	MCS-204	Cloud Computing	75	25	-	100	15-16
5	MCS-205	Distributed Database System	75	25	-	100	17-18
6	MCS-206P	Programming Laboratory-II	-	25	75	100	19
					Total Marks	600	

M.Sc. (Computer Science)
SEMESTER-II

MCS-201
Theory of Computation

Time: 3 Hrs.   Total Marks: 100
                                                          Theory Marks: 75
                                          Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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. 3$_{rd}$ 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: 75
                                              Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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: 75
                                          Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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
Cloud Computing

Time: 3 Hrs.

Total Marks: 100
Theory Marks: 75
Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

Introduction: Definition, Vision, Reference Model, Benefits, Limitations, Terminology, Open Challenges.

Virtualization: Definition, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance.

Cloud Computing Architecture: Service Models, Deployment Models, Cloud Entities, Cloud Clients, Service Level Agreement (SLA) and Quality of Service (QoS) in Cloud Computing.

Unit -II
Programming Models in Cloud: Thread Programming, Task Programming and Map–Reduce Programming.

Cloud Security: Infrastructure Security, Data Security, Identity and Access Management, Privacy Management, Security as a Service on Cloud.

Advance Topic in Cloud: Energy Efficiency in cloud, Market Oriented Cloud Computing, Big– Data Analytics, Federated Cloud Computing.

Textbooks:

1. RajkumarBuyya, Christian Vecchiola and Thamarai Selvi, Mastering Cloud Computing: Foundation and Application Programming, Tata McGraw Hill, ISBN–13: 978–1–25–902995–0, New Delhi, India, Feb 2013.

2. Tim Mather, SubraKumaraswamy, ShahedLatif, Cloud Security and Privacy, O'Reilly,ISBN–13: 978–8–18–404815–5.

Reference Books:

1. Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd., ISBN–13: 978–8–12–652980–3, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New–Era Infrastructure, Wiley India Pvt. Ltd, ISBN–13: 978–8–12–652883–7, New Delhi, India, 2011.
3. Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Cloud Computing for Dummies, Wiley India Pvt. Ltd, ISBN–13: 978–0–47–059742–2, New Delhi, India, 2011.

M.Sc. (Computer Science)

SEMESTER-II

MCS-205
Distributed Database Systems

Time: 3 Hrs.   **Total Marks: 100**
                                                                    Theory Marks: 75
                                                    Theory Internal Assessment M: 25

Section A: It will have question No.1 consisting of 10 very short answer questions from the entire syllabus. Students will attempt 6 questions. Each question will carry **2.5 marks** with answer to each question up to 10 lines in length. The total weightage being **15 marks**.

Section B: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 2, 3, 4 and 5 will be set by the examiner from Unit-I of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks.**

Section C: It will consist of essay type/numerical questions up to five pages in length. Four questions numbering 6, 7, 8 and 9 will be set by the examiner from Unit-II of the syllabus. The students will be required to attempt any two questions. Each question will carry **15 marks.**
The total weightage of this section shall be **30 marks**.

Unit -I

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.

Unit -II

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

Time: 3 Hrs.   **Total Marks: 100**
Practical Marks: 75
Practical Internal Assessment M: 25

Implementations based on Design & Analysis of Algorithms or Distributed Database System or Cloud Computing or Image Processing

M.Sc. (Computer Science)

Semester III

Sr. No.	Paper Code	Paper Name	Marks				Page No.
			Theory	Internal Assessment	Practical	Total	
1	MCS-301	Advanced Software Engineering	80	20	-	100	21
2	MCS-302	System Software	80	20	-	100	22
3	MCS-303	Data Mining and Warehousing	80	20	-	100	23
4	MCS-304	Concept of Core and Advanced Java	80	20	-	100	24
5	MCS-305	Network Programming	80	20	-	100	25
6	MCS-306P	Programming Laboratory-III(Based on Advanced Java and Network Programming)	-	20	80	100	26
					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 of 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.

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.

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

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

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

References:
1. Complete Reference: Java, Herbet Schildt & Naughton, Tata Mc Graw, 5Th Edition, 2006.
2. Java Unleashed, Jane Jawoske, SAM5, Tech Me dia 2006.

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 for TCP.

UDP Communication Semantics, UDP Echo Server, Echo Client protocol usage by common internet application for UDP.

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	28-29
2	MCS-402	Microprocessor and its Applications	80	20	-	100	30
3	MCS-403	Optional Paper Option (i) : Object Oriented Modelling, Analysis and Design Option (ii): Big Data Analytics Option (iii): Natural Language Processing	80	20	-	100	31-33
4	MCS-404	Programming Laboratory-IV(Based on Advanced Web Technologies using ASP.NET)	80	20	-	100	34
5	MCS-405	Project Work	-	40	160	200	35
					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 command Line 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.

References:
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
Option (i)
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 Modeling Pseudocode 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-403
Option (ii)
Big Data Analytics

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.

Section- A
An Overview of Big Data and Big Data Analytics. Understanding Hadoop Ecosystem (Hadoop Distributed File System, MapReduce, Hadoop YARN, HBase, Combining HBase and HDFS, Hive, Pig, Sqoop, ZooKeeper, Flume, Oozie). MapReduce Framework, Techniques to Optimize MapReduce Jobs, Role of HBase in Big Data Processing

Section- B
Developing Simple MapReduce Application, Points to Consider while Designing MapReduce. Controlling MapReduce Execution with InputFormat, Reading Data with Custom RecordReader, Organizing Output Data with OutputFormats, Customizing Data with RecordWriter, Optimizing MapReduce Execution with Combiner, Controlling Reducer Execution with Partitioners.

Section- C
YARN Architecture, Working of YARN, YARN Schedulers, Backward Compatibility withYARN, YARN Configurations, YARN Commands, YARN Containers. Introduction to NoSQL. Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models.

Section- D
Analytical Approaches, Introducing to various Analytical Tools, Installing R, Handling Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and Using Objects, Interacting with Users, Handling Data in R Workspace, Executing Scripts, Reading Datasets and Exporting Data from R, Manipulating and Processing Data in R, Working with Functions and Packages in R, Performing Graphical Analysis in R, Techniques Used for Visual Data Representation, Types of Data Visualization

References: 1. Big Data, Black Book by DT Editorial Services, Dreamtech Press.
2. Big Data Computing and Communications edited by Yu Wang, Hui Xiong, Shlomo Argamon, XiangYang Li, JianZhong Li Springer
3. Big Data Analytics Beyond Hadoop by Vijay Srinivas Agneeswaran, FT Press.

M.Sc. (Computer Science)
SEMESTER-IV

MCS-403
Option (iii)
Natural Language 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.

Introduction: Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Processing of Indian Languages. Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution.

Structures : Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation, UNL Based Machine Translation, Translation involving Indian Languages.

Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

Speech Recognition: Signal processing and analysis method, Articulation and acoustics, Phonology and phonetic transcription, Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

Recommended Books: 1. Allen J., Natural Language understanding, Benjamin/Cunnings, (1987).
2. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
3. Jensen K., Heidorn G.E., Richardson S.D., Natural Language Processing: The PLNLP Approach, Springer (2013).
4. Roach P., Phonetics, Oxford University Press (2012).
5. Jurafsky, Dab and Martin, James, Speechand Language Processing, Second Edition, Prentice Hall, 2008.

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.