Proposed Syllabus of M.Sc. (Information Science)

COURSE : M.Sc (Information Science)

DURATION: 2 Years full-time (4 semesters)

ELIGIBILTY CRITERIA : B.Sc (in Physics, Mathematics, Statistics, Computer Science, Electronics)/BCA with strong mathematics background.

INTAKE : 30 Students per year.

ADMISSION PROCESS : Through Common Entrance Test (conducted by WBUT)/ Institute Level Entrance Test

STRUCTURED SYLLABUS

SEMESTER – I

THEORY					
Sl. No.	Paper Code	Paper Name	Credit	Contact Hours/wk	Marks
1.	MI 101	Discrete Mathematics	4	4	100
2.	MI 102	Fundamentals of Information Science	4	4	100
3.	MI 103	Principles of Computer Programming	4	4	100
4.	MI 104	Algorithms & Data Structures	4	4	100
5.	MI 105	Computer Organization & Architecture	4	4	100
Total of Theory			**20**	**20**	**500**
PRACTICAL					
1.	MI 193	Programming Lab with C	2	3	100
2.	MI 194	Algorithm & Data Structure Lab	2	3	100
Total of Practical			**4**	**6**	**200**
Total of the Semester			**24**	**26**	**700**

SEMESTER – II

THEORY					
Sl. No.	Paper Code	Paper Name	Credit	Contact Hours/wk	Marks
1.	MI 201	Quantitative Techniques for Information Science	4	4	100
2.	MI 202	Knowledge Management & Systems	4	4	100
3.	MI 203	Object Technology	4	4	100
4.	MI 204	Operating System	4	4	100
5.	MI 205	Database Management Systems	4	4	100
Total of Theory			**20**	**20**	**500**
PRACTICAL					
	MI 293	Object Technology Lab	2	3	100
	MI 295	DBMS Lab	2	3	100
Total of Practical			**4**	**6**	**200**
Total of the Semester			**24**	**26**	**700**

SEMESTER – III

THEORY

Sl. No.	Paper Code	Paper Name	Credit	Contact Hours/wk	Marks
1.	MI 301	Data Communication & Networking	4	4	100
2.	MI 302	Information Theory & coding	4	4	100
3.	MI 303	Project Management & Operations Research	4	4	100
4.	MI 304	Business Communication & Technical Report writing	4	4	100
5.	MI 305	Internet & Web Designing	4	4	100
		Total of Theory	**20**	**20**	**500**
PRACTICAL					
1.	MI 391	Networking Lab	2	3	100
2.	MI 395	Internet & Web Designing Lab	2	3	100
		Total of Practical	**4**	**6**	**200**
SESSIONAL					
1	MI 381	Seminar: Literature Review & Methodology of Project	2	2	100
		Total of Sessional	**2**	**2**	**100**
		Total of the Semester	**26**	**28**	**800**

SEMESTER – IV

THEORY

Sl. No.	Paper Code	Paper Name	Credit	Contact Hours/wk	Marks
1.	MI 401	Elective – I	4	4	100
2.	MI 402	Elective – II	4	4	100
		Total of Theory	**8**	**8**	**200**
SESSIONAL					
1.	MI 481	Project [credit 6=2 (presentation)+4(defense)}	6	6	100
2.	MI 482	Grand Viva	4	4	100
		Total of Sessional	**10**	**10**	**200**
		Total of the Semester	**18**	**18**	**400**

ELECTIVE SUBJECTS

Elective – I
   A. E-Commerce & ERP
   B. Compiler Design
   C. Software Engineering
   D. Data Mining & Data Warehousing

Elective – II
   A. Digital Image Processing
   B. Soft Computing
   C. Digital Library & Multimedia
   D. Cryptography & Information Security

(MI 101) Discrete Mathematics   4 Credits

Basic concept of Sets, Relations, Functions, Groups, Rings and Fields.
Recursion and Recurrence Relation: Basic idea, Sequence and discrete function. Generating functions and applications.
Mathematical Logic: Propositional logic, Logical connectives, logical equivalence, validity of arguments, WFF, Predicates and quantifiers.
Combinatorics: Inclusion-Exclusion principle, Pigeonhole principle, Generalized Pigeonhole principle and related problems.
Advanced Graph Theory: Basic terminologies, Handshaking theorem, Isomorphism of graphs, Metrix Representation of Graphs, Walks, Paths, Circuits, Shortest Path Problem, Dijkstra's Algorithm, Trees, Properties of Trees, Cotrees and Fundamental Circuits, Shortest Spanning Trees - Kruskal's Algorithm,Prim's Algorithm,DFS,BFS, Cut Sets, Fundamental Cut Sets and Cut Vertices, Planar and Dual Graphs, Networks, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow, Graph coloring, Chromatic polynomial, Matching and Covering.

Suggested Readings

Text:
1.Liu C. L., "Introduction to combinatorial mathematics", McGraw Hill, 1968.
2 Mott J. L., Kandel A. and Baker T. P., "Discrete mathematics for Computer Scientists and Mathematicians", PH, 1986.
3 Rosen—Discrete Mathematics, 2/e, TMH
4 S.K. Mapa—Higher Algebra (Abstract & Modern)
5 Robert J. McElice , Robert B. Ash & Carol Ash, "Introduction to discrete mathematics", Tata McGraw Hill
6 Deo N., "Graph Theory with Applications to Engineering and Computer Science", PHI, 1980
7 Tremblay and Manohar, "Discrete mathematical structures with applications to computer science", McGraw Hill, 1975 8 Kolamn, Busby and Ross, "Discrete mathematical structures", 3/ed, PHI, 1996.
9 Fraleigh J. B., "A first course in abstract algebra Narosa", 1990
10 Smullyan R. M., "First Order Logic Springer Verlag", 1968

11. V. Krishnamurthy, "Combinatorics, Theory and Applications", East-West Press, 1985
12. Johnsonbaugh Richard, Discrete Mathematics, Pearson Education INC
13. Bondy and Murthy: Graph theory and application. Addison Wesley.
14. Somasundaram, "Discrete Mathematical structures", PHI
15. S.B. Singh, "Discrete Structures", Khanna Publishing House.

Reference:

1.Lipschutz—2000 Solved Problems in Discrete Mathematics, TMH
2.Balakrishnan—Graph Theory (Schaum),MH
3.Hararay—Graph Theory
4.S.B. Singh - Combinatorics and Graph Theory, Khanna Publishing House.

(MI 102) Fundamentals of Information Science   4Credits

Unit – I: Introduction to Information Science
Definition, scope, transition to modern information science, research in information science

Unit – II: Information and references Sources
Types and Importance;
Documentary Sources: Primary, Secondary and Tertiary; Non print materials including digital information sources,
Traditional Vs. Digital sources of information;
Institutional and Human Sources;
Reference Sources including Indian reference sources;
Evaluation of Reference and Information Sources

Unit – III: Fundamental concepts of Information and Reference Services
Definition & Characteristics of Information,
Linguistic & biological approaches to Information
Concept, definition, scope and types of references
Search strategy and techniques;

Unit – IV: Users of information
Information users and their information needs;

Categories of information users;
Information needs – definition, scopes and models;
Information seeking behaviour;
User studies: Methods, techniques and evaluation and User education.

Unit-V: Introduction to ICT
Data, information and knowledge, ICT – definition, scope, application in human activities, social implication, Application of ICT in activities of library and information centres;

Unit-VI: Information Science as Profession
Categories of Information science profession, Information creation/discovery profession, Management related profession, Storage related profession, Changes in the Information science Profession,

Suggested Readings:
1. Encyclopedia of Information Science and Technology, Mehdi Khosrow-Pour, Idea Group Reference
2. Fundamentals of information studies: understanding information and its environment, L. June, K.Wallace C, Neal Schuman, 2007.
3. Library and information science: an introduction, B. Chakraborty, P. Mahapatra, World Press, 2008.
4. International encyclopedia of information and library science, F. John, S. Paul, 2003.
5. Information science in theory and practice, V. Brain C, V. Alinas, 2004.
6. Information users and usability in the digital age, G. C. Chowdhury, S. Chowdhury.

(MI 103) Principles of Computer Programming   4 Credits

Introduction: Characteristics of Computers, Evolution of Computing, Binary Number Systems, Types of Computer Software, Software Development Steps, Types of Programming Languages, Internet Evolution, Basic Internet Terminology, Getting Connected to Internet Applications. Problem Solving Techniques using Computers: Algorithm, Flow Charts, Pseudocode.

Basic Programming Concepts: Problem solving steps using Computer.

Introduction to Programming Language C: Overview of C language, Lexical elements of C- Data Types, managing input/output operations, Operators and Hierarchy of Operations, Expressions in C, Decision Making and Repetitive Statements, break, continue, Array, Pointers, dynamic memory allocation, String handling, Functions: User Defined Functions and Library Functions, Parameter Passing, Storage Classes, enumerated data types, Command line arguments, C Preprocessors, Union & Structures, File handling in C.

Suggested Readings:
1. B.W. Kernighan and D.M.Ritchie, the C Programming Language, PHI. (Reference)
2. R.C. Hutchinson and S.B. Just, Programming using the C Language, McGraw-Hill. (Reference)
3. B.S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C, McGraw-Hill.
4. H. Schildt, C Made Easy, Osborne McGraw-Hill. (Reference)
5. Y. Kanetkar, Let Us C, BPB Publications.
6. E.Balagururswami, Basic Computation & Principles of Computer Programming, TMH
7. Jeyapoovan .T, A first Course in Programmimng with C, Vikas
8. Venugopal K.R & Prasad S.R Mastering C, TMH
9. R.S. Salaria, Problem Solving and Programming in C, Khanna Publishing House
10. Nasib S. Gill, Handbook of Computer Fundamentals, Khanna Publishing House.

(MI – 104) Algorithms & Data Structures   4 Credits

INTRODUCTION: Algorithm - pseudo code for expressing algorithms analysis – time complexity and space complexity - efficiency of algorithms - O-notation – Omega notation and Theta notation.

DIVIDE AND CONQUER: General method binary search - merge sort - quick sort.

GREEDY METHOD: General method- Knapsack problem - job sequencing with deadlines - minimum-cost spanning trees : Prim's and Kruskal's algorithms - Single source shortest paths : Dijkstra's algorithm.

DYNAMIC PROGRAMMING: General method - Multistage Graphs All pairs shortest paths, Single source shortest paths - optimal binary search trees - O/1 Knapsack problem - Traveling sales person problem.

BACK TRACKING: General method - n-queen problem - sum of subsets problem – graph colouring - Hamiltonian cycles - Knapsack problem.

BRANCH AND BOUND : Least Cost(LC) search, Bounding - LC branch and bound – FIFO branch and bound - Travelling sales person problem.

Basic Data Structures: Arrays, Stacks, Queues, dequeue, Linked Lists, Trees, AVL tree, Priority Queues, and Heap. Basic algorithms for Creation, Manipulation and Applications of Data Structures

Hashing: Hash Functions, Hash Table, and Collision Resolution Techniques.

Algorithmic Complexity: Time-Space trade-off, and Asymptotic notations.

Searching Algorithms: Linear Search and Binary search.

Sorting Algorithms: Selection, Bubble, Insertion, Quick, Merge, Heap Sort and Radix sort

Tree : Binary tree, Complete binary tree, AVL Tree, Binary Tree Traversal, threaded Binary Tree, Heterogeneous Binary Tree, Representing lists as binary Tree, Trees and their application, B+ Tree, RED BLACK Tree and their application.

Graph: Application of graphs(C representation of graph, Transitive closure, Warshall's algorithm, Shortest path algorithm), Flow Problem, Linked Representation of graph, Graph traversal and Spanning Forests.

Suggested Readings:
1. E. Howrowitz , Sahni, S.Rajasekaran, Fundamentals of computer algorithms,Galgotia publications, 2004.
2. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Prentice Hall of India Pvt.Ltd., 1997.
3. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C,*Addition-wesley, Third Indian Reprint, 2000.
4. Lipshutz, Data Structure, McGraw Hill.
5. Standish, Data Structure, Addison-Wesley.
6. A. M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1996.
7. S. Lipschutz, Data Structure, Schaum Series.
8. D. E. Knuth, Fundamental Algorithms, Narosa Publication.
9. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.
10. Sahni S, data Structures, Algorithms and Applications in C++, Mc Graw- Hill, 2002.
11. Goodrich, M. and Tamassia, R. Data Structures and Algorithms in Java 3ed, John Wiley and Sons, Inc
12. R.S. Salaria, Data Structures and Algorithms Using C, Khanna Publishing House.
13. R.B. Patel, Expert Data Structures with C, Khanna Publishing House.

(MI 105) Computer Organization & Architecture   **4 Credits**

Concepts and Terminology: Digital computer components Hardware & Software and their dual nature, Role of Operating Systems (OS).

The ALU: ALU organization, Integer representation, Serial and Parallel Adders, is 1s and 2s complement, binary arithmetic, Multiplication of signed binary numbers, Logic gates, basic logic operations, truth tables, Boolean expression, simplification, Basics of Combinational circuits and Sequential circuits Floating point number arithmetic, Overflow detection, Status flags.

Memory Unit: Memory classification, Bipolar and MOS storage cells. Organization of RAM, address decoding, Registers and stack, ROM and PROM-basic cell. Organization and erasing schemes, Magnetic memories-recording formats and methods. Disk and tape Units. Concept of memory map. Timing diagrams, T-States, Timing diagram Controlling arithmetic and logic instructions. Instruction sequencing with examples. Introduction to Micro-programming, Variations in Micro-programming configuration.

General Organization: Instruction work formats, Addressing modes registers, Von-Neumann concept, interconnecting system components, Interfacing buses, Timing diagrams, Examples from popular machines.

Text books :

1 Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
2 Hamacher, "Computer Organisation",
3 Computer Organization and System Software, EXCEL BOOKS
4. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
5. Mano, M.M., "Computer System Architecture", PHI.
6. Burd- System Architecture,Vikas

(MI-193) Programming Lab with C   2 Credits

1. C programming on variables and expressions.
2. Precedence of operators, Type casting.
3. Decision control structures— if and nested if-else.
4. Loop controls— do, while, for and case control structure.
5. Unconditional jumps— break, continue, goto.
6. Modular program development using functions.
7. Arrays and matrix operations—add, subtract, multiply.
8. Recursion
9. Pointers, address operators and pointer arithmetic.
10. Structures and Unions, Accessing their members.
11. Self-Referential Structures and Linked lists.
12. Files and file operations, standard streams.
13. Dynamic memory allocation and deallocations.
14. Different mathematical operations using <math.h>.
15. Pointers to pointers, arrays, functions, structures and unions.
16. Command line arguments, enums and prepocessors.

(MI-194) Algorithm & Data Structure Lab   2 Credits

01   Matrix Operations-Add, Multiply, Rank, Det.etc.
02   Stack & Queue operations using Arrays.
03   Self-referential structures & single linked list operations.
04   Implementing Stack and queues using linked lists.
05   Implementing Polish Notations using Stacks.
06   Circular and double linked list operations.
07   Implementing priority queue & dequeue using lists.
08   Evaluating polynomial operations using Linked lists.
09   Implementing set related operations & Hashing.
10   linear & binary search, bubble sort technique.
11   Insertion sort, selection sort & merge sort techniques.
12   Quick sort, counting sort and Shell sort techniques.
13   Radix (bucket) and address calculation sort methods.
14   Binary tree traversals (preorder, inorder, postorder).
15   Heap sort & AVL tree implementations.
16   Graph representation with matrix & adjacency lists.
17   Divide and conquer method (quick sort, merge sort, Strassen's matrix multiplication)

SEMESTER – II

(MI – 201) Quantitative Techniques for Information Science   4 Credits

1. Probability distributions
(i) Discrete distributions - Binomial, Poisson
 (ii) Continuous distributions - Uniform, Exponential, Normal, Log Normal

2. Sampling Methods and Sampling Distributions
(i) Statistics and Parameter
(ii) Types of sampling - random and non-random sampling
(iii) Sampling distributions - conceptual basis; standard error; sampling from normal populations; Central Limit Theorem; relationship between sample size and standard error; Finite Population Multiplier

3. Estimation
(i) Point Estimation – properties of estimators; the method of moments and the method of maximum likelihood
(ii) Interval Estimation – basic concepts; interval estimates and confidence interval; calculation of interval estimates of mean and proportion from large samples; interval estimation using the t distribution; determining the sample size in estimation

4. Hypothesis Testing
(i) Basic Concepts – Null and Alternative Hypotheses; Type I and Type II errors; the p – value; the significance level; power of a test
(ii) One Sample Tests – hypothesis testing of means when the population standard deviation is known and when it is unknown; hypothesis testing of proportions for large samples

(iii) Two Sample Tests – tests for difference between means – large sample sizes and small sample sizes; test for difference between proportions – large sample sizes; testing difference between means with dependent samples

5. Chi–square and Analysis of Variance
   (i) Chi-square as a test of (a) independence and (b) goodness of fit
   (ii) ANOVA – basic concepts; the F distribution and the F statistic; inferences about a population variance; inferences about two population variances

6. Non-parametric tests (demonstration of software package)
   (i) Basic concepts
   (ii) The Sign Test
   (iii) The Signed-Rank Test
   (iv) Rank Sum Tests – The Mann-Whitney U Test; The Kruskal-Wallis Test
   (v) Tests based on runs
   (vi) Rank Correlation
   (vii) Kolmogorov-Smirnov Test

Suggested Readings:
   1. Johnson and Wichern – Applied Multivariate Statistical Analysis(3rd edition); PHI/Pearson Education
   2. Levin & Rubin - Statistics for Management (7th edition): Prentice Hall/Pearson Education
   3. Hooda R.P – Statistics for Business & Economics

(MI – 202) Knowledge Management & Systems   4 Credits

1: **Overview** : An overview of the key concepts, terminology and the historical context of practical Knowledge Management in the workplace. How every successful organizations use Knowledge Management. Knowledge as an organizational process versus simply a collection of data that can be stored in a database.
2: **Knowledge Workers** : Knowledge Management from the employees' perspective, KM techniques to enhance employee effectiveness in organization.
3: **Process** : Knowledge Management as a process. Process reengineering, competency measurement, how to best apply collaborative systems, approaches to unobtrusive knowledge capture, filtering and refining knowledge, methodologies for applying knowledge for decision support, Knowledge Management & traditional business processes, business models.
4: **Technology :** Computer and communications technologies that can be used to enhance the organizational and behavioral aspects of a Knowledge Management initiative. A survey of technologies for knowledge collection (e.g., data mining, text summarizing, the use of intelligent agents, and a variety of information retrieval methodologies), knowledge storage and retrieval (e.g., knowledge bases and information repositories), and knowledge dissemination and application (e.g., intranets and internets, groupware, decision support tools, and collaborative systems).
5: **Solutions :** KPI (Key Performance Indicators), Benchmarking, Evaluation of KM initiatives, Impact on the corporate vision
6:**Economics of knowledge Organization:** Financial aspects of Knowledge Management, from a return-on-investment perspective. Pricing models for information infrastructure development, overhead costs, contractual issues, and hidden costs of Knowledge Management, and how to justify the cost of investing in new technologies, knowledge economy in terms of the knowledge value chain.
7: **Successful implementation**: Resource analysis for practical knowledge management implementation challenges, working with vendors, achieving employee buy-in.
8:**Building and Managing Systems:** Building Information Systems Managing Projects Managing Global Systems
9:**Decision Support Systems and Business Intelligence:** The Concept of Decision Support Systems (DSS), A Framework for Business Intelligence (BI), A Work System View of Decision Support, The Major Tools and Techniques of Managerial Decision Support, Implementing Computer Based Managerial Decision Support Systems

Suggested Reading :
1.Essentials of Knowledge Management by Byron Bergeron
2.Bharat, Bhaskar : Electronic Commerce - Technologies & Applications. TMH
3.Westland & Clark : Global Electronic Commerce, Universities Press
4.Davis & Olson, Management Information System, Tata McGraw Hill
5.Loudon and Loudon, Management Information System, Prentice Hall/Pearson Education
6.Mahadeo Jaiswal & Monica Mittal : Management Information Systems, OUP
7.O' Brien, Introduction to Management Information System, Tata McGraw Hill
8.Turban, Decision Support and Business Intelligence Systems, Pearson Education
9.George M. Marakas, Decision Support Systems, 2nd Edition, Pearson Education
10.Janakiraman V.S. and Sarukesi. K., Decision Support Systems, Prentice Hall of India
11.Lofti, Decision Support System and Management, International Edition, McGraw Hill Inc., New Delhi

(MI – 203) OBJECT TECHNOLOGY   4 Credits

1.   Difference with procedure oriented programming.
2.   Data Abstraction and Information Hiding : Objects, Classes and Methods, Encapsulation, Inheritance, Polymorphism, Object.
3.   Fundamentals of Object Oriented design in UML: Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram, UML extensibility- model constraints and comments,
4.   Variables, Expressions and Statements: Values, Variables and keywords; Operators operator precedence, Expressions and Statements; Taking input and displaying output (print statement); Putting Comments.
5.   Modules, importing Modules (entire module or selected objects), invoking built in functions, generating random numbers.
6.   Defining functions, invoking functions, passing parameters (default parameter values, keyword arguments),scope of variables, void functions and functions returning values.
7.   Conditional constructs and looping: if else statement, While, For (range function), break, continue, else, pass, Nested loops, use of compound expression in conditional constructs and looping.
8.   Strings: Creating, initialising and accessing the elements; String operators: +, *, in, not in, range slice[n:m]; Comparing strings using relational operators; String functions
9.   Lists: Concept of mutable lists, creating, initializing and accessing the elements, traversing, appending, updating and deleting elements; List operations (joining, list slices); List functions & methods: len, insert, append, extend, sort, remove, reverse, pop
10. Stacks and Queues with lists
11. Data File:Opening and closing files, file object, access_modes, reading and writing a file Read(), readline(), readlines(), write(), file positions (seek(), tell()), renaming and deleting a file.
12. Classes: Defining classes (attributes, methods), creating instance objects, accessing attributes & methods, using Built in class attributes (dict, doc, name, module, bases), using _ _init_ _() , _ _del_ _() method and __ str_ _( ) in a class, private attributes (limited support), importance of "self"
13. Inheritance: Single and multiple inheritance- Overriding methods, using super() in derived class to invoke _init_() or overriden methods of parent class

Suggested Readings:

1. The Unified Modeling Language User Guide By Grady Booch, James Raumbaugh and Ivar Jacobson.
2. Object Oriented Software Engineering By Ivar Jacobson
3. Applying UML and Patterns By Craig Larman
4. Page Jones, Meiler - "Fundamentals of object oriented design in UML"
5. Roff: UML: A Beginner's Guide TMH
6. Mahapatra: Introduction to System Dynamic Modelling, Universities Press
7. Muller : Instant UML, Shroff Publishers / Wrox
8. Srimathi, Object Oriented Analysis & Design Using UML, Scitech
9. Alhir : UML in a Nutshell, Shroff Publishers / O'reilly
10. JAVA 2- The Complete Reference, TMH
11.Beginning JAVA 2 SDK 1.4, Horton, SPD/WROX
12.Programming in JAVA, EXCEL
13.Object Oriented Programming With C++ & JAVA, Samanta,PHI
14.Object Oriented Application Development Using JAVA, Doke, VIKAS
15.Programming with Java 2,Xavier,Scitech
16.Object Oriented Programming with JAVA, Wu, TMH
17.Beginning JAVA 2 :SDK 1.4,Horton, SPD/WROX
18.Projects on Java 2, Xavier, Scitech
19.Jana, C++ & Object Oriented Programming, PHI
20.Patrick Naughton, Herbert Schildt – "The complete reference-Java2" - TMH
21. Mastering Object Oriented Programming Using C++, Khanna Publishing House.

(MI – 204) Operating System   4 Credits

Introduction: Definition, Design Goals, Evolution; Batch processing, Multi-programming, Time sharing; Structure and Functions of Operating System.

Process Management: Process states, State Transitions, Process Control Structure, Context Switching, Process Scheduling, Threads.

Memory Management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Combined Systems, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing, Working Set Model, Paging.

Concurrent Processes: Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Busy form of waiting, Lock and unlock primitives, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors, Conditional Critical Regions, System Deadlock, Wait for Graph, Deadlock Handling Techniques: Prevention, Avoidance, Detection and Recovery.

File and Secondary Storage Management: File Attributes, File Types, File Access Methods, Directory Structure, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling, Protection & Security.

Suggested Readings:
1. Ekta Walia, "Operating System Concepts", Khanna Publishing House
2. Milenekovie, "Operating System Concept", McGraw Hill.
3. Petersons, "Operating Systems", Addision Wesley.
4. Dietal, "An Introduction to Operating System", Addision Wesley.
5. Tannenbaum, "Operating System Design and Implementation", PHI.
6. Gary Nutt, "Operating System, A Modern Perspective", Addision Wesley.
7. Stalling, Willium, "Operating System", Maxwell Macmillan
8. Silveschatza, Peterson J, "Operating System Concepts", Willey.
9. Crowley, "Operating System", TMH.
10. Singhal,Shivaratri,Advanced Concepts in O/S,TMH.
11. P.K.Sinha,Distributed O/S,PHI
12. Advanced Unix Programming in the Unix Environment- Stevens [Pearson]
13. Dhamdhere: Operating System TMH
14. Balakrishna Prasad, Operating Systems, Scitech
15. A. N. Haberman, Introduction to Operating System Design, Galgotia.
16. 16. P. B. Hansen, Operating System Principles, PHI

(MI – 205) Database Management Systems   4 Credits

Intoduction: Database Systems, View of Data Models, Database Languages, DBMS Architecture, Database Users and Data Independence.

ER Modeling, relation types, role and Structural Constraints, Extended ER Modeling Features, Design of an ER Database Schema, Reduction of ER Schema to Tables.

Relational Model: Relational Model Concepts, Relational Algebra.

Introduction to SQL: SQL data types and literals, Types of SQL commands, SQL operators, Tables, views and indexes, Queries and sub queries, Aggregate functions.

Relational Database Design: Functional and multi-valued Dependencies, Desirable Properties of Decomposition, Normalization 1NF, 2NF, 3NF, 4NF, 5 NF and BCNF.

Selected Database Issues: Security, Transaction Management, Introduction to Query Processing and Query Optimization, Concurrency Control, and Recovery Techniques.

Suggested Readings:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hil
4. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
5. Ullman JD., "Principles of Database Systems", Galgottia Publication.
6. Feuerstein ; Oracle PL/SQL Programming – 3/edition, Shroff Publishers / O'reilly
7. Jain: Advanced Database Management System CyberTech
8. Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill
9. Elmasri&Navathe, *Fundamentals of Database Systems*, Pearson Education Asia
10. Introduction to Database Systems,Bipin C. Desai
11. Database Design, McGraw Hill.
12. Database Management Systems, R.P. Mahapatra, Khanna Publishing House.

(MI-293) Object Technology Lab   2 Credits

1. Simple Java applications - for understanding reference to an instance of a class (object), methods
   - Handling Strings in Java
2. Simple Package creation. - Developing user defined packages in Java
3. Interfaces - Developing user-defined interfaces and implementation
   - Use of predefined interfaces

4. Threading
   - Creation of thread in Java applications
   - Multithreading
5. Exception Handling Mechanism in Java
   - Handling pre-defined exceptions
   - Handling user-defined exceptions
6. Swings and Applets

(MI – 295) DBMS Lab   2 Credits

SQL:
1. Creating, altering and dropping tables with integrity constraints.
2. Retrieving and modifying data from a database
3. Retrieving data from database using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING clause.
4. Use of scalar and aggregate functions.
5. Retrieving data from a database using Equi , Non Equi , Outer and Self Join.
6. Using sub queries, rowid and rownum for retrieving data.
7. Use of views, indexes and sequences.
PL/SQL:
8. Introduction to PL/SQL, using output from server.
9. Use of implicit & explicit cursors in data handling.
10. Exception handling – Oracle defined and User defined.
11. Use of stored procedures & functions in data manipulation.
12. Use of trigger in data manipulation.

SEMESTER – III

(MI – 301) Data Communication & Networking   4 Credits

Introduction: Networks models – OSI model, Internet model.

Physical layer: Signals - Analog, Digital, Digital transmission - Coding, Sampling, Analog Transmission - Modulation of Digital and analog signals, Multiplexing, Switching, Transmission Media.

Data link layer : Error detection and Correction, Data link control and protocol, Point to point access, Multiple access , LANS- Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN's, Connecting LANs - Connecting devices.

Network layer: Internetworking, Addressing, Routing, Networks layer protocols – ARP, RARP, IP, ICMP, Ipv6, Routing- Introduction, Routing Algorithms & Protocols.

Transport layer: UDP, TCP, and Congestion Control.

Application layer protocol: DNS, FTP, HTTP, WWW, Network Management Protocol, Internet Security.

Suggested Readings:

1. An Integrated Approach to Computer Networks - Bhavneet Singh, Khanna Publishing House.
2. Computer Networks –A. Tanenbaum, (PHI pub.)
3. Data and Computer Communication –Willam Stallings, PHI pub.
4. Data Communication & Network –Forouzan (TMH)
5. Internetworking with TCP/IP Vol I-Comer (PHI pub.)
6. Data Communications and distributed Networks] V.B, Black, (Prentice Hall pub.)
7. W. Stallings: Local and Metropolitan Area Networks, 4th ed., Macmillan, New York, 1993.
8. L. Gracial and I. Widjaja: Communication Networks, Tata-McGraw Hill, New Delhi, 2000.
9. L. L. Paterson and B. S. Davie: Computer Network, Morgan Kaufman, San Mateo, 2000.
10.   W. Stallings: ISDN and Broadband ISDN With Frame Relay and ATM, Prentice Hall, Englewood Cliffs.
11.   J. Martin, Computer Network and Distributed Data Processing, Prentice Hall.
12.   W.Stallings, Local Networks, McMillan
13.   M.Schwertz,   Computer Communication Network Design   and Analysis, Prentice Hall.
14.   Keshav, An Engineering Approach to Computer Networks, Addison-Wisley.
15.   Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.

(MI – 302) Information Theory & Coding   4 Credits

Error-Detecting Codes, Variable-Length Codes: Huffman Codes, Miscellaneous Codes, Entropy and Shannon's First Theorem, The Channel and Mutual Information, Channel Capacity, Some Mathematical Preliminaries, Shannon's Main Theorem,   Algebraic Coding Theory, Review of probability theory, Entropy, Mutual information, Data compression, Huffman coding, Asymptotic equipartition property, Universal source coding, Channel capacity, Differential entropy, Block codes and Convolutional codes

Suggested Readings:
1. R. Ash: Information Theory, Interscience Publ., Singapore, 1965.
2. E. R. Berlekamp: Algebraic Coding Theory, McGraw Hill, New York, 1986.
5. R. W. Hamming: Coding and Information Theory, Prentice Hall, Englewood Cliffs, 1980.
6. A. Khinchin, Mathematical Foundations of Information Theory, Dover Publn., London, 1957.
7. Information theory, coding and cryptography – Ranjan Bose, TMH
8. R. W. Yeung, A First Course in Information Theory, New York, NY: Kluwer Academic/Plemu, Publishers, 2002.
9. H. Stark and J. W. Woods, Probability, Random Processes, and Estimation Theory for Engineers. 2nd Ed., Upper Saddle River, NJ: Prentice-Hall, Inc., 1994
10. Information Measures – Information and its description in Science & Engineering – by C. Arndt. Springer – Verlag.
11. R. G. Gallager, Information Theory and Reliable Communication, New York, NY: John Wiley and Sons, Inc., 1968.
12. J.S.Chitode

(MI – 303) Project Management & Operations Research   4 Credits

Module I

1. SCHEDULING Gantt Chart, Johnson's Rule .

2. NETWORK ANALYSIS Network Analysis: PERT/CPM techniques, Shortest path algorithms and their applications (Dijkstra's algorithm; Flloyd's algorithm, Kruskal's algorithm, Ford-Fulkerson method).
3. INSPECTION AND QUALITY CONTROL: Types and criteria of inspection; Statistical Quality Control; Control Charts.
4. ESTIMATION OF INVESTMENT & ROI : ARR, Break Even Analysis,IRR, NPV, Payback Period,

Module II

1.. LINEAR PROGRAMMING   Formulation of LP Models, Graphical LP Solution, Simplex Method, Artificial Variables – Big M - Method and Two-phase Method, Duality, Sensitivity Analysis, Shadow Price and their economic interpretation

2. TRANSPORTATION, TRANSHIPMENT AND ASSIGNMENT MODELS   Construction of Transportation, Transshipment and Assignment Models

3. GOAL PROGRAMMING Construction of Goal Programming Models, Goal Programming Algorithms

4. INTEGER LINEAR PROGRAMMING ILP Algorithms - Branch and Bound, Cutting Plane Algorithm

5. DECISION ANALYSIS Decision Making under Certanty – Analytic Hierarchy Process, Decision Making under Risk and Uncertainty

6. MARKOV PROCESSES AND MARKOV CHAINS State transition diagrams, Calculation of the state of the system at any time period, Calculation of the long-run system state (both for systems with and without absorbing states): Fundamental Matrix and associated calculations.

7. QUEUEING MODELS M/M/1 Queues and applications, M/M/c and M/M/c/k Queues and their applications

8. SIMULATION MODELS   Construction of Simulation Models, Generation of Random numbers from discrete distributions

9. GAME THEORY - 2 Person zero sum games, Saddle point, Mixes strategies use of dominance rules, Solution by graphical methods.

10.REPLACEMENT MODELS - Types of replacement problems, Replacement of assets that deteriorate with time

11. EOQ MODELS – Without shortage, with shortage, with price breaks

Suggested Readings

Anderson, Sweeny and Williams - Quantitative Methods for Business (8th edition); Thomson learning
Hillier, F.S. and Lieberman, G.J. : Operations Research (8th edition), TMH
Kasana, H.S. & Kumar, K.D. - Introductory Operations Research; Springer
Render B, Stair R M Jr, Hanna M E : Quantitative Analysis for Management (9th edition); Pearson Education
Ross, Sheldon – Simulation; Elsevier

Taha, H.A. : Operations Research - An Introduction (8th edition), Prentice Hall/Pearson Education
Vohra, N. D. Quantitative Techniques for Management (3rd edition), TMH
Winston, Wayne L. – Operations Research: Applications and Algorithms (4th edition); Thomson Learning

(MI- 304) Business Communication & Technical Report Writing   4 Credits

1. **Introduction Business Communication :** Basic forms of communicating; Communication models and processes; Effective communication; Theories of communication; Audience Analysis.
2. **Self-Development and Communication :** Development of positive personal attitudes; SWOT analysis; Vote's model of interdependence; Whole communication.
3. **Corporate Communication :** Formal and informal communication networks; Grapevine; Miscommunication (Barriers); Improving communication. Practices in business communication; Group discussions; Mock interviews; Seminars; Effective listening exercises; Individual and group presentations and reports writing. Principles of Effective Communication. Corporate dressing.
4. **Writing Skills :** Planning business messages; Rewriting and edition; The first draft; Reconstructing the final draft; Business letters and memo formats Appearance request letters; Good news and bad news letters; Persuasive letters; Sales letters; Collection letters; Office memorandum.
5. **Report Writing :** Introduction to a proposal, short report and formal report, Technical Report writing,Technical Notes preparation.
6. **Oral Presentation :** Principles of oral presentation, factors affecting presentation, sales presentation, training presentation, conducting surveys, speeches to motivate, effective presentations skills.
7. **Non-Verbal Communication :** Body languages : meanings
8. **Effective Listening :** Principles of effective listening; Factors affecting listening exercises.
9. **Modern Forms of Communicating :** Fax; E-mail; Video conferencing; etc.
10. **Interview sessions-** do's and don'ts of facing a successful interview. Conversion practice is done on given situation topics.
11. **Group Discussions**: language of conversion & strategies.

Suggested Readings

1. Monipally: Business Communication , Tata McGraw Hill
2. Ronald E. Dulek and John S. Fielder : Principles of Business Communication; Macmillan
3. Madhukar : Business Communications; Vikas Publishing House
4. Rai & Rai: Business Communication, Himalaya Publishing
5. Kaul : Business Communication; Prentice Hall
6. Senguin J : Business Communication; Allied Publishers
7. Robinson, Netrakanti and shintre : Communicative Competence in Business English; Orient Longman
8. Kulbhushan Kumar: Effective Communication Skills, Khanna Publishing House

(MI- 305) Internet & Web Designing   4 Credits

1. Introduction to the Internet and Web Learning Objectives: Recognize the Internet as an interconnected network which carries various information and services , Describe the World Wide Web (WWW) architecture , Describe the client-server architecture and HTTP protocol, Identify main bodies who control the standards for WWW

2.Web page design with HTML and CSS, Javascript : Describe the structure of a HTML page using various HTML tags Modify the presentation of information of a given HTML page by adding images and various formatting, Create web pages with inter-page and intra-page links , Add and manage frames , Describe the use of HTML forms and include them in a HTML page, Describe a style sheet language in contrast to markup language , Describe programming concepts of CSS language , Create a website using HTML and CSS

3. Client-side programming with JavaScript: List client-side scripting languages , Explain the programming concepts and data types in JavaScript language, Identify the object-oriented concepts used by JavaScript, Identify the document object model (DOM) of a HTML document and access , different components using JavaScript, Explain event handling in JavaScript , Use JavaScript to create a simple webpage with dynamic content, Create a webpage including forms and use JavaScript to validate fields

4. MVC Architecture: Explanation, Need, Drawbacks, J2EE WEB SERVICES, Different components & containers.
Servlet: Introduction, Advantages over CGI, How it works?, Servlet life cycle, Servlet API (Different
interfaces & classes of generic servlet & HTTP servlet), Accessing user information by means of Request & Response, Servlet session management techniques and relative comparison.
JSP: Introduction, Comparison between JSP & servlet., Architecture/Life cycle, Different types of JSP architectures and relative comparison.; JSP tags ,Directives, Scripting elements, Actions; JSP implicit objects, Accessing user information using implicit objects.

EJB :Introduction, Comparison of EJB & Java Beans , Applications, Drawbacks, Different types of enterprise beans ,Services provided by EJB container.
RMI: Introduction and applications, Architecture ,Use of RMI Registry.
JNDI: Introduction and applications, Comparison between LDAP and JNDI
JDO (Java Data Objects): Introduction, Integration of EJB and JDO, JDO & RMI
 JINI :Introduction, Applications
 JDBC: Introduction, Database driver ,Different approaches to connect an application to a database
server, Establishing a database connection and executing SQL statements, JDBC prepared statements, JDBC data sources.

Suggested Readings:

1. Learning PHP, MySQL, and JavaScript by Robin Nixon
2. "Professional JAVA Server Programming", Allamaraju and Buest ,SPD Publication
3. "Beginning J2EE 1.4" Ivor Horton, SPD Publication.
4. "Advanced Programming for JAVA 2 Platform" Austin and Pawlan, Pearson
5. Eloquent JavaScript - A Modern Introduction to Programming by Marijn Haverbeke
6. Internet & Web Designing, Soma Das Gupta, Khanna Publishing House

(MI-391) Networking Lab   2 Credits

1. Simulation of Ethernet (CSMA / CD - IEEE 802.3) , Aloha and Slotted Aloha protocols, Implement ARP to find the medium access control address of the destination using the destination's internet protocol address.
2. IPC (Message queue)
3.NIC Installation & Configuration (Windows/Linux)
4.Familiarization with
        o Networking cables (CAT5, UTP)
        o Connectors (RJ45, T-connector)
        o Hubs, Switches
5.TCP/UDP Socket Programming
6.Multicast & Broadcast Sockets
7.Implementation of a Prototype Multithreaded Server
8.Implementation of
        o Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
        o Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
9. Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

(MI-395) Internet & Web Designing Lab   2 Credits

LIST OF EXPERIMENTS
1.Create a web page with the following using HTML
i) To embed an image map in a web page
ii) To fix the hot spots
iii) Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML
4. Creating applets incorporating the following features:
 Create a color palette with matrix of buttons
 Set background and foreground of the control text area by selecting a color from color palette.
 In order to select Foreground or background use check box control as radio buttons
 To set background images
5. Programs in Java using Servlets:
 To invoke servlets from HTML forms
 To invoke servlets from Applets
6. Creating three-tier applications using JSP and Databases for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL
8. Program using DOM / SAX

MI 381 Seminar: Literature Review & Methodology of Project   2 Credits

Project topic should be chosen with care because it will play a vital role in the M.Sc. Information Science program as well as shaping the career. You should choose an area (of Industrial/Academic/Research importance at present/future), where you feel the urge to explore deeper. At the same time it is important to see the practicality of the topic.

Approval of the project proposal is mandatory: If approved, the student can commence working on it, and proceed further.

Seminar of literature review of the project surveys scholarly article, books and other sources providing a description, summary and critical evaluation of each work relevant to your research problem. It can be arranged thematically or chronologically. Works cited in the literature survey must have proper referencing. The review of literature should lead to synthesis and identification of problem gap.

Each presentation lasts 20 minutes, including questions. Student also has to write a formal report (about 30 to 40 pages) of their presentation material and hand in before the final examination.

Methodology should be precise, focused and must include the following:

      i)   Statement of Project problem
      ii)   Project design: The design of a study defines the study type, hypothesis, and if applicable data collection methods and a statistical analysis plan.
      iii)   Sampling design
      iv)   Planning of analysis of data
      v)   Plan about time scheduling of project.

SEMESTER – IV

(MI 401) Elective-I   4 Credits

A. E-Commerce & ERP

Electronic Commerce : Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems
Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce .
Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.
E – strategy : Overview, Strategic Methods for developing E – commerce.
Four C's : (Convergence, Collaborative Computing, Content Management & Call Center).
Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce.
Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security.
Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing.

Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).
Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.
E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections.
E – Marketing :. Home –shopping, E-Marketing, Tele-marketing
Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).
Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.
Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse .
Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials management, Quality Management, Sales & Distribution ERP Package, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation, ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E- Commerce, ERP and Internet, Future Directions in ERP

Suggested Readings :

1. E-Commerce,M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

B. Compiler Design

Module I
Introduction to Compiling [2L]
Compilers, Analysis-synthesis model , The phases of the compiler, Cousins of the compiler.
Lexical Analysis [5L]
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Module II

Syntax Analysis [8L]
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.
Syntax directed translation [4L]
Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Module III

Type checking [3L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions.
Run time environments [4L]
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module IV

Intermediate code generation [3L]
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).
Code optimization [4L]
Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.
Code generations [3L]
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text books:
1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" – PHI
3.Tremblay and Sorenson Compiler Writing-McgrawHill International .
4.Chattopadhyay , S- Compiler Design (PHI)

C. Software Engineering

UNIT I:
Software and software process models: software categories and characteristics, legacy software, software myths, Software engineering A layered technology, A process framework, waterfall model, incremental and evolutionary models. *Requirement engineering:* Requirement engineering task, initiating the requirement engineering process, eliciting requirements, developing use cases, building analysis model, Negotiating requirements, validating requirements, data modeling, functional modeling and behavioral modeling.

UNIT II:
Design Engineering: Design process and design quality, design concepts, design model, architectural design, Interface design.
UNIT III
Testing Strategies and Tactics: Unit testing, integration testing, validation testing, system testing, white box testing, black box testing.

UNIT IV:
Product Metrics: Software quality, framework for product metrics, Metrics for analysis model, Metrics for design model, Metrics for source code, Metrics for testing, metrics for maintenance.
UNIT V:
Managing Software Projects: Management spectrum, people, product, process, project, software project estimation, decomposition techniques, Empirical estimation, project scheduling and tracking, risk management, Quality management and change management.

Textbooks:

1. R. Pressman, Software Engineering: A Practioner's Approach, 6th Edition.2005.
2. J. D. Musa, A. Iannino, K. Okumoto: Software Reliability – Measurement, Prediction and Application, McGraw Hill, New Delhi, 1987.
3. R. Fairly: Software Engineering Concepts, Tata McGraw Hill, New Delhi, 1999.
4. P. Jalote: An Integrated Approach to Software Engineering, 2nd ed. Narosa, New Delhi, 1997.
5. P. Oman and S. L. Pfleeger: Applying Software Metrics, IEEE Computer Society Press, Los Alamos, California, 1996.
6. S. L. Pfleeger: Software Engineering – Theory and Practice, Prentice Hall, New York, 1998.
7. C. Larman: Applying UML and Patterns, Addison-Wesley, Reading, Mass., 1998.
8. Capability Maturity Model: The Guidelines for Improving the Software Process, CMU, Software Engg. Inst., 1995.
9. Nasib S. Gill, Software Engineering, Khanna Publishing House, 2016.

D. Data Mining & Data Warehousing

Data warehousing Components –Building a Data warehouse Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

BUSINESS ANALYSIS:
Reporting and Query tools and Applications – Tool Categories – TheNeed for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) –Need– Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

DATA MINING
Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives Integration of a Data Mining System with a Data Warehouse – Issues – Data Preprocessing.

ASSOCIATION RULE MINING AND CLASSIFICATION
Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts-Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation– Support Vector Machines – Associative Classification – Lazy Learners–Other Classifications method prediction

CLUSTERING AND APPLICATIONS AND TRENDS IN DATA MINING
Cluster Analysis - Types of Data – Categorization of Major Clustering Methods - Kmeans – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Suggested Readings:

1. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, 2007.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining", Person Education, 2007.
4. K.P. Soman, Shyam Diwakar and V. Ajay ", Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta, " Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
5. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.
6. Vivek Bhambri, Data Mining and Warehousing, Khanna Publishing House.

(MI 402) Elective-II   4 Credits

A. Digital Image Processing

Introduction: Capturing and representation of images. Image pre-processing, image analysis, applications of image processing.

Image Sampling and Quantization: Image sampling, digitization and recording. Two dimensional sampling theory, limitations and reconstruction, Image quantization.

Image Transform: Orthogonal and Unitary transforms and their properties, Convolution, DFT, DCT, Sine Transform, Walsh-Hadamard Transform, Harr Transform, Slant Transform, KL transform, Applications of image transforms.

Image Enhancement: Point operations, Mask operations, Histogram processing. Spatial domain and Frequency domain processing. Pseudo color processing, Color image enhancement. Fuzzy logic in image enhancement.

Image Restoration: Image models, Noise models, Inverse and Wiener filtering, Different Fourier domain filters. Coordinate transformation and geometric correction.

Image segmentation and Analysis: Edge detection, Boundary and region extraction, Moment representation, Morphological operations, Texture analysis, Scene matching and detection.

Image Compression: Compression and bandwidth, entropy, predictive and non-predictive compression. Transform coding and standards, Compression techniques used in different image file formats.

Mathematical morphology: basic concepts, erosion, dilation, opening, closing. Advanced applications like biomedical image processing, digital watermarking, etc

Suggested Books:
1. Digital Image Processing, Gonzalves and Wintz, Pearson Education.
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis, Chanda & Majumder,PHI.
4. Fundamentals of Digital Image Processing, Jain, PHI.
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS.
6. Digital Image Processing and Pattern Recognition – Malay K. Pakhira, PHI Learning, 2011.
7. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
8. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982

B. Soft Computing

Introduction to artificial neural network
Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Applications of Artificial Neural Networks.

Competitive learning networks, Kohonen self organizing networks, Hebbian learning; Hopfield Networks, Associative Memories, The boltzman machine; Applications.

Fuzzy Logic
Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets,
Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers,
Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic.

Genetic algorithms
Genetic algorithms, Evolution strategies (Ess), Evolutionary programming(EP),Genetic Programming(GP),Selecting, crossover, mutation, schema analysis, analysis of selection algorithms; convergence; Markov & other stochastic models.

Other Soft computing approaches
Simulated Annealing, Tabu Search, Ant colony based optimisation, etc.

Text:
1. "Neuro-Fuzzy and Soft computing", Jang, Sun, Mizutani, Pearson
2. "Neural networks: a comprehensive foundation", Haykin, Pearson
3. "Genetic Algorithms", Goldberg, Pearson
4. "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI.

C. Digital library & Multimedia

Module-I
Orientation / Fundamentals of information retrieval
Course information, policies and scope, breadth of research encompassed by DLs. Document indexing, TF*IDF, Boolean retrieval model, Vector space model, Algebraic models of retrieval
Storing information
Multimedia encodings: text (SGML, Unicode, TEI, XML), page images (CCITT FAX IV) images (JPEG, PNG, PS), video (MPEG), audio (MP3,WAV), synchronized media (SMIL).
Classification
Traditional classification schemes (DDC, LCSH, MeSH), metadata types, Dublin core, Warwick framework.
DL policy, interoperability and access rights
Identifiers: Open Archives Initiative, metadata harvesting, OpenURL. DL economics and social policy and issues.

Module-II

UNIT-I
Definition - Taxonomy - Multimedia Information Representation - Text -Images - Audio - Video - Multimedia Architecture - Multimedia Applications -Challenges of Multimedia Systems.
UNIT-II
Compression Principles - Need for Compression - Redundancy and Visibility -Text Compression - Binary Image Compression - Color, Gray Scale and Still -Video Image Compression - Audio Compression - Video Compression.
UNIT-III
Data and File Formats: RTF, TIFF, RIFF, MIDI, JPEG, AVI Video File Formats, MPEG Standards - TWAIN Architecture - Digital Audio and Video as Multimedia I/O Technology - Animation.
UNIT-IV
Multimedia Application Design - Virtual Reality & Design – Organizing Multimedia Databases - Application Workflow Design Issues – Distributed Application Design Issues.
UNIT-V
Multimedia Presentation and Authoring - Hypermedia Messaging – Multimedia in Future : High Definition Television and Desktop Computing – Knowledge Based Multimedia systems.

Text Books

1. Understanding digital libraries, 2nd Edn., The Morgan Kaufmann Series Inc., Michael Lesk.
2. Digital Library Use: Social Practice and Evaluation, Digital Libraries & Electronics Pub., Ann Peterson Bishop et al.
3. How to build digital library, The Morgan Kaufmann series, Ian H. Witten, David Bainbridge
4. The whole digital library handbook, Diane Kresh.
5. Exploring the digital library: A guide for teaching and learning, Kay Johnson, E. Maqusi.
6. Prabhat K. Andleigh and Kiran Thakrar, Multimedia System Design, Pearson Education.
7. Ralf Steinmetz and Klara Nahrstedt, Multimedia Computing, Communications and Applications, Pearson Education.
8. Fred Halsall, Multimedia Communications : Applications, Networks, Protocols and Standards, Pearson Education.
9. John F Koegel Buford, Multimedia Systems, Pearson Education.
10. Judith Jeffcoate, Multimedia in Practice - Technology and Applications, Prentice Hall of India, 2001.
11. Keyes: Multimedia Handbook, MH.
12. G. Blair, L. Blair, A. Chetwynd, H. Bowman: Formal Specification of Distributed Multimedia Systems, UCL Press, London.
13. S. Khoshafian, A. Brad Baker: Multimedia and Imaging Databases, Morgan Kaufmann
14. V.K. Jain, Multimedia and Animation, Khanna Publishing House, 2018.
15. Ramesh Bangia, Fundamentals of Multimedia, Khanna Publishing House.

D. Cryptography & Information Security

Module-I

1. Cryptography: Techniques, Mathematical foundation, Stream Ciphers, Block Ciphers, Cryptanalysis.
2. Symmetric / Secret Key Encryption: Algorithm Types and Modes, DES (Data Encryption Standard), Double DES, Triple DES, AES (Advanced Encryption Standard), IDEA (International Data Encryption Algorithm), Blowfish, RC5
3. Public Key Encryption: Principles of public key crypto-systems, mathematical foundation, RSA algorithm, key management, Deffie-Hellman key exchange, Elliptic curve cryptography, Digital Signatures using DSA (Digital Signature Algorithm), DSS (Digital Signature Standard) and RSA

Module-II

1.Overview of Security Parameters: Confidentiality, integrity and availability- Security violation and threats-Security policy and procedure- Assumptions and Trust- Security Assurance, Implementation and Operational Issues- Security Life Cycle.

2. Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models. Security Policies: Confidentiality policies, integrity policies, hybrid policies, noninterference and policy composition, international standards. Systems
3. Design: Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.
4. Logic-based System: Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security.
5. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.

Text Book:

1. Cryptography and Network Security: Principles and Practice; Fourth or Fifth Edition. By William Stallings, Prentice Hall, Hardcover.
2. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press, hardcover, March,1995.
3. Network Security Essentials: Applications and Standards by William Stallings. Prentice Hall, Hardcover, Published November 1999.
4. John E. Canavan, "Fundamentals of Network Security", Artech House, 2001.
5. Matt Bishop and Sathyanarayana S.Venkatramanayya, "Introduction to Computer Security", Pearson Education, 2005
6. Matt Bishop, "Computer Security: Art and Science", Pearson Education, 2003
7. Dhanjani and Justin Clarke, "Network Security Tools", O'Reilly, 2005.
8. Thomas R. Peltier, "Information Security Risk Analysis", CRC Press LLC, 2005.
9. Vesna Hassler, "Security Fundamentals for E-Commerce", Artech House, 2001.
10. Dorothy E. Denning, "Information Warfare and Security", Addison Wesley.
11. Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", John Wiley and Sons, 2008.
12. M. Stamp: Information Security: Principles and Practice, John Wiley & Sons, 2005
13. Cryptography and Network Security, V.K. Jain, Khanna Publishing House, 2017.
14. Information Security & Cyber Laws, Sarika Gupta, Khanna Publishing House, 2018.

MI 481 Project [credit 6=2 (presentation)+4(defense)]　　　6 Credits

The Project work constitutes a major component in most professional programmes. It needs to be carried out with due care, and should be executed with seriousness by the students. The project work is not only a partial fulfillment of the MSC-Information Science requirements, but also provide a mechanism to demonstrate your skills, abilities and specialization.

Student will do their project in any Industry / academic research Lab/Institute.

A student is required to work for a dissertation on a topic assigned/approved by the teachers' committee under the supervision of a suitable College faculty member.

Practical Training: The work for a dissertation should be substantial and relate to some important problem in an area of information science and/or its applications and should have substantial theoretical or practical significance. A critical review of recent advances in an area of information science and/or its applications with some contribution by the student is also acceptable as a dissertation.

The work should be commenced at the beginning of the third semester and be completed along with the courses of the fourth semester. The dissertation should be submitted by the middle of May of the year of completion. The dissertation will be evaluated by a committee consisting of the supervisor and an external expert. The student has to defend his/her dissertation in an open seminar. The dissertation is considered to be equivalent to eight (06) credit courses out of which 2 credits for project presentation and 4 credits for defense of the project.

The majority of the students are expected to work on a real-life project preferably in some industry/Research and Development Laboratories/Educational Institution/Software Company. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. It is beneficial (not mandatory) for students if they publish their research work in any journal/proceedings for future course of study.

Reference:

1.Thesis Project: A Guide for students in Computer science and Information systems, M. Berndtssan. J. Hanssan, B. Olsson. B.Lundell, Springer.

MI 482 Grand Viva　　　4 Credits

Questions will be asked from the subjects taught in the entire course.