FACULTY OF SCIENCE

SYLLABI
FOR
M.Sc. (HONOURS SCHOOL) COMPUTER SCIENCE
(SEMESTER SYSTEM)

EXAMINATIONS 2014- 2015

--:O:--
### SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

**PANJAB UNIVERSITY, CHANDIGARH**

Outlines of Tests, Syllabi and Courses of Reading for M. Sc. (H.S.) Computer Science (Two Year Degree Programme) for Session 2014-2015

<table>
<thead>
<tr>
<th>Paper Code</th>
<th>Paper Name</th>
<th>Theory/Practical Lectures</th>
<th>Univ. Exam Marks</th>
<th>Int. Ass. Marks.</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIRST YEAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FIRST SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCS-113</td>
<td>Software Engineering</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-110</td>
<td>Data Base Management System (Elective I)</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-114</td>
<td>Operating Systems</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-310</td>
<td>Analysis and Design of Algorithms – NEW (Elective II)</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-309</td>
<td>Practical based on MCS-310 – NEW</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>MCS-112</td>
<td>Practical based on MCS-110 and MCS-114</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>22</strong></td>
</tr>
<tr>
<td><strong>SECOND SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCS-407</td>
<td>Advance Java and Network Programming-NEW (Elective III)</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-210</td>
<td>Artificial Intelligence (Using LISP) (Elective IV)</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-203</td>
<td>Interactive Computer Graphics</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-211</td>
<td>Data Mining and Data Warehousing</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-205</td>
<td>Practical based on MCS-203</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>MCS-408</td>
<td>Practical based on MCS-407-NEW</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>22</strong></td>
</tr>
<tr>
<td><strong>SECOND YEAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THIRD SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCS-306</td>
<td>Soft Computing Techniques Using Neural Networks (Elective III)</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-302</td>
<td>Optimization Techniques</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-307</td>
<td>Software Project Management</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-310</td>
<td>Analysis And Design Of Algorithms-OLD</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-308</td>
<td>Practical Based On MCS-306 &amp; MCS-210</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>MCS-309</td>
<td>Practical Based On MCS-310-OLD</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>MCS-304</td>
<td>Major Project Phase I (SRS, DFD, Database Design, Input/Output Design)</td>
<td>2</td>
<td>75</td>
<td>--</td>
<td>3</td>
</tr>
<tr>
<td>MCS-305</td>
<td>Seminar I (Based On MCS-304)</td>
<td>2</td>
<td>75</td>
<td>--</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>28</strong></td>
</tr>
<tr>
<td><strong>FOURTH SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCS-406</td>
<td>Theory Of Computations</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-407</td>
<td>Advance Java And Networking Programming –OLD (Elective IV)</td>
<td>4</td>
<td>80</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MCS-408</td>
<td>Practical Based On MCS-407-OLD</td>
<td>8</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>MCS-404</td>
<td>Major Project: Phase II (Coding, Testing &amp; Deployment)</td>
<td>2</td>
<td>150</td>
<td>--</td>
<td>6</td>
</tr>
<tr>
<td>MCS-405</td>
<td>Seminar II (Emerging Trends)</td>
<td>2</td>
<td>50</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>
GUIDELINES FOR SUBMISSION OF PROJECT REPORT (MCS-304 & MCS-404)

The report should consist of the following:
- Cover page including Project title, Name of the student, Name of the Department and Names of the Project Guides (both External and Internal).
- Acknowledgements.
- Certificates from company and department duly signed by external guide, Principal and internal guide.
- Contents with page numbers.
- Introduction (includes background and application or importance of the project)
  - Objectives
  - System Analysis
- System Feasibility study
  - Software requirement specifications
  - Design with system flowcharts and input/output design.
  - Implementation and Testing
    - Hardware and software used
    - Listing of well commented programs with result/output or detailed algorithms with input and output.
- Further scope of the project
  - Bibliography
  - Appendices (any other information related to project)

Each student should observe the following norms while submitting the synopsis/thesis for the Project:
(a) Use both sides of the paper instead of only single side.
(b) Use one and half interline spacing in the text (instead of double space)
(c) Stop using a blank sheet before the page, carrying figure or table.
(d) Try to insert figure/table in the text page itself (instead of using a fresh page for it, each time.)

Students must consult/inform the internal guides regarding the progress of their work at least once in 20 days. It is the duty of the student to be in touch with his internal guide. The student must prepare 5 copies of the report including one copy for self. The remaining four are to be submitted before 31st May every year as per the following:

1. Main Library
2. Department Library
3. Internal Guide
4. Company

One softcopy of the work is to be submitted to the concerned head of the department/institution along with the report. The student must present his/her work in 15 minutes mainly focusing on his/her contribution with the help of slides followed by demonstration of the practical work done. The project Viva will be completed before 15th June every year exact dates will be informed before 31st May every year. An external examiner, internal examiner and the internal guide will conduct project viva.
SYLLABUS AND COURSE OF READINGS
FIRST SEMESTER

Paper Title: SOFTWARE ENGINEERING

Paper Code: MCS-113
Max. Marks : 80 Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives: The course aims to give students a theoretical foundation in Software Engineering and help them learn its principles and methods including emerging practices and support tools. It also familiarizes students with concepts of Software testing and quality assurance and its various techniques.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction:
   Software Engineering goals, SDLC, Software Process Models : Waterfall, Prototyping, Spiral; Fourth generation techniques, Software inspection, Communication skills for software engineer, preview and inspection procedures, Composition of inspection team, Checklist, Human factors in software engineering, Software requirements, Definition, Software requirements specifications (SRS), Components of SRS.

2. Software Project Planning:

UNIT-II

3. Software Design:

4. Quality Assurance:
   Overview of software quality, Software quality attributes, Factors affecting software quality, Building software quality assurance plan, Components of SQAP, Quality management principles, Essence of international standards: ISO 9000 quality standard, SEI capability maturity model.
UNIT-III

5. Software Testing and Techniques:
Software Testing, Objectives of software testing, Software testing process, Static and dynamic analysis, Black-Box testing & its technique: Equivalence class partitioning, Boundary value analysis, Cause-Effect graph, Comparison testing, White-Box testing & its techniques: Basis path testing, Structural testing, Logic based testing, Fault based testing.

6. Software Testing Strategies:
Characteristics, Unit testing, Integration testing, Functional testing, Regression testing, Systems and acceptance testing, Object oriented testing, Alpha and beta testing.

UNIT-IV

7. Software Maintenance
Characteristics, Types of software maintenance, Reverse engineering, Software maintenance process models.

8. System Configuration Management (SCM):
Basic requirements for SCM system, SCM principles, Planning and organizing for SCM, Benefits of SCM, Change management, Version and release management.

Suggested Readings:
Paper Title: DATABASE MANAGEMENT SYSTEM

Paper Code: MCS-110
Course Duration: 60 Lectures of one hour each.

Max. Marks: 80, Time: 3 Hrs.

Objective: The objective of this course is to teach a student concepts related to database, database design techniques, transaction management, Crash recovery, Backup and security of databases.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. **Basic Concepts**: Database, DBMS: Need, Characteristics, Database users, 3-tier architecture, advantages over 2-tier, Components, Advantages, Disadvantages, Views of data-schemas and instances, Data independence, Conventional data models & systems.


UNIT-II

3. **Storage and File Organization**: Overview of physical storage media, RAID, Storage access; File organization: Organization of records in files, Operations on Files, Serial Files, Sequential Files, Index-Sequential Files, Direct Files.

4. **The Relational Model**: Relational Database: Attributes, Domains, Tuples, Relations and their schemes, relation representation, Keys, relationship, relational operations, Integrity constraints.

UNIT-III

4. **Relational Algebra and Relational Calculus**: Relational Algebra: Operations- union, intersection, difference, Cartesian product, projection, selection, division and relational algebra queries; Relational Calculus: Tuple oriented and domain oriented relational calculus and its operations.
6. Transaction and Concurrency control: Concept of transaction, ACID properties, Serializibility, States of transaction, Concurrency control: Locking techniques, Time stamp based protocols, Granularity of data items, Deadlock.

UNIT-IV


8. Security and privacy: Database security issues, Discretionary access control based on grant & revoking privilege, Mandatory access control and role based access control for multilevel security, Encryption & public key infrastructures.

Suggested Readings:

1. Introduction to database systems: C.J.Date
2. Database Management Systems: Bipin Desai
3. Database system concepts: Korth
4. Principles of Database Management: James Martin
5. Computer Database organization: James Martin
7. Object-oriented modeling and design: Rumbaugh and Blaha
8. Object-oriented analysis and design: Grady Booch
SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

Paper Title: OPERATING SYSTEMS
Paper Code: MCS-114 Max. Marks: 80 Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives: To understand the various concepts of Operating System like process management, synchronization, deadlocks, storage and memory management.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Operating System:
Introduction to operating system, its need and services; Operating system classification: Single user, Multi user, Simple batch processing, Multiprogramming, Multitasking, Parallel systems, Distributed system, Real time system;

2. Process Management:

UNIT-II

3. Synchronization:
Critical section problem, Peterson’s solution, Synchronization hardware, Semaphores: Mutual exclusion, Binary semaphores, Bounded concurrency, Producer-consumers, Reader-writers problem; Deadlocks & starvation, Problems of synchronization: Bounded buffer, Dining philosophers; Monitors.

4. Deadlocks:
System model, Deadlock characterization: Necessary conditions, Resource allocation graph, Method for handling deadlock; Deadlock prevention: Mutual exclusion, Hold and wait, No preemption, Circular wait, Deadlock avoidance: Safe state, Resource allocation graph algorithm, Banker’s algorithm; Deadlock detection, Recovery from deadlock.
5. Memory Management-I:
Static and dynamic memory allocation, Memory allocation to process: Stacks, Heap, Memory allocation model; Reuse of memory: Performing fresh allocations using a free list, memory fragmentation, Merging free areas; Contiguous memory allocation: Fragmentation, Swapping;

6. Memory Management-II:

UNIT-IV

7. Storage Management I:
File Concept: Attributes, Operations, Types, Structure; Access methods: Sequential and direct access, Index ; Directory structure: Single level, Two Level, Tree Structured, acyclic Graph directories; File System mounting, File sharing, Protection: Types of access, access Control.

8. Storage Management II:
File system structure, File system implementation, Directory implementation, Allocation methods, Free space management, Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK; Disk management, Swap space management, RAID.

Suggested Readings:
5. Richie: Operating System, BPB.
Paper Title: ANALYSIS AND DESIGN OF ALGORITHMS-NEW

Paper Code: MCS-310  Max. Marks: 80 Time: 3 Hrs.

Objective: The objective of the module is to create skills in students to design and analyze algorithms.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Algorithms and Analysis:
   Introduction, Algorithms specification, Recursive algorithms, space and time complexity, Asymptotic Notation (O, _, and Θ, o) practical complexities, Best, average and worst case performance of algorithms, examples, Introduction to recurrence relations.

2. Divide and Conquer:
   General method, Binary search, Merge sort, Quick sort, Selection problem, Strassen's matrix multiplication and analysis of these problems.

UNIT-II

3. Greedy Method:
   General Method, Knapsack problem, Job sequencing with deadlines, Minimum spanning Trees, Single source shortcut paths and analysis of these problems.

4. Dynamic Programming:
   General method, Optimal binary search trees, 0/1 Knapsack, the travelling salesperson problem.

UNIT-III

5. Back Tracking:
   General method, 8 queen's problem, Graph coloring, Hamiltonian cycles, Analysis of these problems.

6. Branch-And-Bound:
   Method, 0/1 Knapsack and Travelling Salesperson problems, Efficiency considerations.
UNIT-IV

7. **Lower-Bound Theory:**
   Introduction to Algebraic problems, Introduction to lower bounds, Comparison Trees, Techniques for Algebraic problems, Some Lower Bounds on Parallel Computation.

8. **NP-hard and NP-complete problems:**
   Basic concepts, Statement of Cook’s Theorem, Examples of NP-hard graph and NP-scheduling problems, some simplified NP-hard problems.

**Suggested Readings:**
SEMESTER II

Paper Title : ADVANCED JAVA AND NETWORK PROGRAMMING-NEW

Course Duration : 60 Lectures of one hour each.

Objectives : To create enterprise application development skills among students using Advanced Java.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Review of Java Basic Features, Applets, AWT Controls, Event handling, Multithreading, I/O files.

2. Swing : Features, components, swing vs AWT, swing containers, controls, using Dialogs, sliders, progress bars, tables, creating user interface using swing.

UNIT-II

3. Java Database Connectivity: Connectivity model, Java.SQL package, JDBC Exception classes, Database connectivity, Data manipulation and navigation, creating database applications.

4. Java RMI: Distributed object technologies, RMI architecture, creating RMI applications.

UNIT-III

5. Java Servlets: Servlets vs CGI, Servlet lifecycle, creating and running servlets.

UNIT-IV

7. Java Beans: Component architecture, Components, Advantages of Beans, Bean Developer kit (BDK), JAR files, introspection, developing Beans, Using Bound properties, The Java Beans API, Introduction to EJB (Enterprise Java Beans), Types of EJB, Uses of EJB.


Suggested Readings:
1. Schildt, Herbert: The Complete Reference Java 2, TMH.
2. Ivan Bayross: Web Enabled Commercial Application Development using Java 2.0, BPB.
7. Jim Keogh/Davidson: Data Structures—Principles and fundamentals, Wiley India Pvt. Ltd.
SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

Paper Title : ARTIFICIAL INTELLIGENCE (USING LISP)

Course Duration: 60 Lectures of one hour each.

Objectives: The objective of this course is to familiarize students with concepts of AI, its tools & technologies.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.
Prerequisite: System Software, Operating System, Data and File Structure.

UNIT-I

1. Introduction to Artificial Intelligence (AI) and Problem Space:
Introduction AI technique, Turing test, History and developments in AI, applications of AI, State space representation, production systems, systematic control strategies : Breadth first search and Depth first search, problem characteristics, product system characteristics, issues in the design of search programs.

2. Heuristic Search Technologies:
Introduction to heuristic search, Generate and test, Hill Climbing, Best First search, A*, Problem reduction, AO*, constraint satisfaction and Means-ends-analysis techniques.

UNIT-II

3. Knowledge representation:
Information and knowledge, Knowledge acquisition and manipulation, Issues in knowledge representation, Knowledge representation methods - Propositional logic and first order predicate logic, Resolution principle, Horn's clauses, Features of language PROLOG, Semantic networks, Partitioned semantic nets, Frames, Scripts and conceptual dependencies.

4. Game playing:
MiniMax search procedure, reducing alternatives using Alpha-Beta pruning method examples.

UNIT-III

5. Expert systems:
Introduction, examples, characteristics architecture, people involved and their role in building an expert systems, case studies of expert systems, MYCIN and DENDRAL; features of knowledge acquisition systems : MOLE and SALT.
6. **Natural Language understanding and processing:**
Introduction, Complexity of the problem, Chompsky hierarchy of grammars, Techniques for Syntactic processing, Semantic Analysis, Discourse and pragmatic processing

**UNIT-IV**

7. **Tools and Technologies for AI:**
Introduction to AI language LISP: Symbolic expression, creating, appending and modifying lists, defining functions, Predicates, Conditionals, Recursion, Iteration, Printing and reading, Lambda expressions and higher order function, List storage.

**Laboratory work:**
1. Programming in LISP & PROLOG.
2. Hands on experience with expert system shell.

**Suggested Readings:**
Paper Title: INTERACTIVE COMPUTER GRAPHICS

Paper Code: MCS-203          Max. Marks: 80 Time: 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives: The aim is to introduce the students to key concepts of Computer Graphics like display devices, co-ordinate system, transformations, line and circle drawing, pointing, positioning, projections, etc.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Display Devices:
Line and point plotting systems, Raster, vector, pixel and point plotters, Continual Refresh and storage displays, Digital frame buffer, Plasma panel displays, Display processors, Character generators, Colour-display techniques: shadow mask and penetration CRT, Colour look-up tables, hard-copy colour printers.

UNIT-II

2. Display Description:
Screen co-ordinates, user co-ordinates, use of homogeneous coordinates, Display code generation, Graphical functions, the view algorithm, Two-dimensional transformation, Line-drawing, Circle drawing algorithms.

UNIT-III

3. Interactive Graphics:
Pointing and positioning devices (cursor, light pen, digitizing tablet, the mouse, track balls), Interactive graphical techniques, Positioning, (Elastic or Rubber Band lines, Linking, zooming, panning, clipping, windowing, scissoring), Mouse Programming.

4. 3-D Graphics:
Wire-frame, perspective display, perspective depth, Projective transformations, Hidden line and surface elimination (Black face removal algorithm).
UNIT-IV

5. **Turbo-C Graphic Language:**
Primitives (constants, actions, operators, variables), plotting and geometric transformations, display subroutines, Concept of Animation, Saving, Loading and Printing graphics images from/to disk, Animated algorithms for Sorting, Towers of Hanoi.

6. **Open GL:** Primitives of the language and interface with C/C++.

7. **Programming Projects:** Two Dimensional Transformations, 3-dimensional Transformations, Interactive Graphical Techniques, GUI, Turbo C (Graphics Routines) is to be used as the standard teaching tool.

**Suggested Readings:**
Paper Title: DATA MINING AND DATA WAREHOUSING

Paper Code: MCS-211  Max. Marks: 80 Time: 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives: This course will introduce concepts and techniques of data mining and data warehousing, including concept, principle, architecture, design, implementation, application of data warehousing and data mining. Some systems for data warehousing and/or data mining will also be introduced. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction:
Data Warehousing: Definition, usage and trends, Characteristics of a Data Warehouse, DBMS vs. data warehouse

2. Developing Data Warehouse:
Building a Data warehouse, Data warehousing components, Architecture for a warehouse, Three-tier Data warehouse architecture, Steps and Crucial decisions for the design and construction of Data Warehouses, Design performance and technological considerations, Metadata.

UNIT-II

3. Developing Data Mart based Data warehouse:
Types of data marts, Loading a data mart, Metadata for a data mart, Data model for a data mart, Maintenance of a data mart, Software components for a data mart, External data, Reference data, Performance issues, Security in data mart, Nature of data in data Mart: External data, Reference data.

4. OLTP and OLAP Systems:
OLTP vs. OLAP, types of OLAP, Relational vs. Multidimensional OLAP, Data modeling, Schemas for multidimensional view: Star schema, Snowflake schema, implementing data warehouse; Categories of OLAP tools.

UNIT-III

5. Data Mining:
Introduction to data mining definition, KDD versus data mining, Steps of data mining process, Application areas for data mining, Data preprocessing: Data cleaning, Data integration and transformation, Data reduction; Tools for data mining.

**UNIT-IV**

7. **Classification and Prediction**: Definition, issues regarding classification and prediction, classification by decision tree induction, Bayesian Classification, Prediction: Linear and Non-Linear Regression

8. **Clustering**: Definition, Types of data in cluster analysis, Clustering paradigms, Partitioning Algorithms: K-means and K-method, CLARANS; Hierarchical methods: BIRCH, CURE.

**Suggested Readings:**
5. Jiawei Han, Micheline Kamber, 2000: Data Mining: Concepts and Techniques, Morgan Koffman Elsvier.
SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

SEMESTER III

Paper Title: SOFT COMPUTING TECHNIQUES USING NEURAL NETWORKS

Course Duration: 60 Lectures of one hour each.

Objectives: To get the knowledge and exposure for Advanced AI Techniques to solve the problem lying in fuzzy environment.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

Fundamentals:

1. Introduction to Soft Computing: Basic soft computing techniques: Neural networks, Fuzzy logic, Genetic algorithms; Hybrid systems, Application to soft computing.


UNIT-II

Neural Network Learning Models:

3. Supervised Learning Networks : Introduction to supervised learning, Architecture and training algorithms for perception network and back propagation networks


UNIT-III

**Fuzzy Logic:**

6. **Fuzzy Logic:** Introduction and Application to Fuzzy logic, Classical sets, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership functions, Defuzzification methods.

7. **Fuzzy Logic Control Systems:** Architecture and Operation of Fuzzy Logic Control (FLC) systems, FLC System Models, Applications of FLC Systems.

UNIT-IV

**Genetic Algorithms:**

8. Introduction to genetic algorithms; Biological background, Genetic algorithms versus traditional algorithms. Basic terminologies in genetic algorithm: Genes, fitness and populations.


**Suggested Readings:**

5. Rao and Rao: C++ Neural Networks & Fuzzy Logic, BPB.
Paper Title: OPTIMIZATION TECHNIQUES

Paper Code: MCS-302
Course Duration: 60 Lectures of one hour each.

Max. Marks: 80 Time: 3 Hrs.

Objectives: To introduce linear programming, dynamic programming and related Optimization Theories to solve real life / simulated problems.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I


UNIT-II

2. Special types of linear programming problems -Transportation and assignment problems.

3. Integer programming: Introduction, Branch and bound techniques, Binary linear programming.

UNIT-III

4. Assignment and Travelling salesman problems

5. Dynamic Programming, Deterministic and probabilistic dynamic programming.

UNIT-IV

6. Queuing models: Application and characteristics of queuing models, Structure of basic queuing system.

7. PERT and CPM: Phases of project management, PERT and CPM computations.

8. Simulation: Definition: Types of simulation models; Phases of simulation; Applications of simulation; Inventory and queuing problems; Advantages and disadvantages.
Suggested Readings:
Paper Title: SOFTWARE PROJECT MANAGEMENT

Course Duration: 60 Lectures of one hour each.

Objective: To familiarize the students with Project management, Project Planning and Scheduling, advance DSS, ERP and Software metrics.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Project Management: Introduction to project and project management, problems with software projects, Project management knowledge area and framework, Stages of project: feasibility study:cost-benefit analysis, Planning, project execution, project and product life cycle; Project stakeholders: All parties of project, role of project manager; Exploration of open source software tools for project management.


UNIT-II

3. Project Planning: Integration management: Introduction, Project plan development, Plan execution; Scope management: Introduction, methods for selecting projects, project charter, scope statement, work breakdown structure; Stepwise project planning: Overview, Main steps in project planning.

4. Project Scheduling: Time Management: Importance of project schedules, Schedules and activities, Sequencing and scheduling activity; Project network diagrams: Network planning models, Duration estimating and schedule development, Critical path analysis, Program evaluation and review Techniques.
UNIT-III


UNIT-IV


8. DSS: Decision structure, Decision support trends, DSS components, Using DSS: What-if analysis, sensitivity analysis, Goal seeking analysis, Optimization analysis, Executive information systems, Enterprise portals and decision support, knowledge management systems.

Suggested Readings:

Paper Title: ANALYSIS AND DESIGN OF ALGORITHMS-OLD

Paper Code: MCS-310                Max. Marks: 80 Time: 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objective: The objective of the module is to create skills in students to design and analyze algorithms.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Algorithms and Analysis:
   Introduction, Algorithms specification, Recursive algorithms, space and time complexity, Asymptotic Notation ($O$, $\_\_$, and $\Theta$, $o$) practical complexities, Best, average and worst case performance of algorithms, examples, Introduction to recurrence relations.

2. Divide and Conquer:
   General method, Binary search, Merge sort, Quick sort, Selection problem, Strassen's matrix multiplication and analysis of these problems.

UNIT-II

3. Greedy Method:
   General Method, Knapsack problem, Job sequencing with deadlines, Minimum spanning Trees, Single source shortcut paths and analysis of these problems.

4. Dynamic Programming:
   General method, Optimal binary search trees, 0/1 Knapsack, the travelling salesperson problem.

UNIT-III

5. Back Tracking:
   General method, 8 queen's problem, Graph coloring, Hamiltonian cycles, Analysis of these problems.

6. Branch-And-Bound:
   Method, 0/1 Knapsack and Travelling Salesperson problems, Efficiency considerations.
UNIT-IV

7. **Lower-Bound Theory:**
Introduction to Algebraic problems, Introduction to lower bounds, Comparison Trees, Techniques for Algebraic problems, Some Lower Bounds on Parallel Computation.

8. **NP-hard and NP-complete problems:**
Basic concepts, Statement of Cook's Theorem, Examples of NP-hard graph and NP-scheduling problems, some simplified NP-hard problems.

**Suggested Readings:**
SEMESTER IV

**Paper Title:** THEORY OF COMPUTATIONS  
**Paper Code:** MCS-406  
**Max. Marks:** 80  
**Time:** 3 Hrs.

**Course Duration:** 60 Lectures of one hour each.

**Objectives:** The goal of this course is to provide students with an understanding of basic concepts of Theory of Computation.

**Note:**  
(i) The Question Paper will consist of Four UNITS.  
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.  
(iii) The students are required to attempt one question from each UNIT and the compulsory question.  
(iv) All questions carry equal marks.

**UNIT-I**

1. **Recursive Languages:** Recursive definition, Alphabets, Language, Regular expression, definitions of Finite state machine, Transition graphs, Deterministic & non-deterministic finite state machines, Regular grammar, Left-linear and right linear, Thomson’s construction to convert regular Expression to NDFA & subset algorithm to convert NDFA to DFA. Minimization of DFA, Finite state machine with output (Moore machine and Meally Machine), conversion of Moore machine to Meally machine & vice-versa.

**UNIT-II**

2. **Properties of Regular languages:** Conversion of DFA to regular expression, Pumping lemma, Properties and limitations of finite state machine, Decision properties of regular languages, Application of finite automata.

3. **Context Free Grammar:** Context free grammar, Writing context free grammar for problems, Derivation tree and ambiguity, Application of context free grammars, Chomsky and Greibach Normal form, Conversion of CFG to CNF and GNF. Properties of context free grammar, CYK algorithm.

**UNIT-III**

4. **PDA:** Push down stack machine, Design of deterministic and non-deterministic push-down stack, Parser design.

UNIT-IV

6. **Incommutability**: Halting problem, Turing enumerability, Turing acceptability and Turing decidabilities, Unsolvable problems about Turing machines.

7. **Computation Complexity**: P, NP and NP Complete Problems.

**Suggested Readings:**
SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

Paper Title : ADVANCED JAVA AND NETWORK PROGRAMMING-OLD

Course Duration : 60 Lectures of one hour each.

Objectives: To create enterprise application development skills among students using Advanced Java.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Review of Java Basic Features, Applets, AWT Controls, Event handling, Multithreading, I/O files.

2. Swing : Features, components, swing vs AWT, swing containers, controls, using Dialogs, sliders, progress bars, tables, creating user interface using swing.

UNIT-II

3. Java Database Connectivity: Connectivity model, Java.SQL package, JDBC Exception classes, Database connectivity, Data manipulation and navigation, creating database applications.

4. Java RMI: Distributed object technologies, RMI architecture, creating RMI applications.

UNIT-III

5. Java Servlets: Servlets vs CGI, Servlet lifecycle, creating and running servlets.

UNIT-IV

7. **Java Beans**: Component architecture, Components, Advantages of Beans, Bean Developer kit (BDK), JAR files, introspection, developing Beans, Using Bound properties, The Java Beans API, Introduction to EJB (Enterprise Java Beans), Types of EJB, Uses of EJB.

8. **Java Server Pages**: Introduction, JSP Architecture, JSP objects, developing Web Applications.

_Suggested Readings:_
1. Schildt, Herbert: *The Complete Reference Java 2*, TMH.
2. Ivan Bayross: *Web Enabled Commercial Application Development using Java 2.0*, BPB.
8. Leendert: *Algorithms and data structure in C++*, Wiley India Pvt. Ltd.
OLD/ELECTIVE PAPERS

PAPER TITLE : ARTIFICIAL INTELLIGENCE -OLD
Course Duration: 60 Lectures of one hour each.
Objective: The objective of the module is to familiarize students with concepts of AI, its tools & techno logics.

Note :

i. The Question Paper will consist of Four Sections.
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
iii. The students are required to attempt ONE question from each Section and the Compulsory question.
iv. All questions carry equal marks.
Prerequisite : System Software, Operating System, Data and File Structure.

SECTION-A

1. Introduction to Artificial Intelligence (AI) and Problem Space:
   Introduction AI technique, Turing test, History and developments in AI, applications of AI, State space representation, production systems, systematic control strategies : Breadth first search and Depth first search, problem characteristics, product system characteristics, issues in the design of search programs.
2. Heuristic Search Technologies :
   Introduction to heuristic search, Generate and test, Hill Climbing, Best First search , A*, Problem reduction, AO*, constraint satisfaction and Means-ends-Analysis techniques.

SECTION-B

3. Knowledge Representation :
4. Game Playing :
   MiniMax search procedure, reducing alternatives using Alpha-Beta pruning method examples.

SECTION-C

5. Expert Systems :
   Introduction, examples, characteristics Architecture, people involved and their role in building an expert systems, case studies of expert systems, MYCIN and DENDRAL; features of knowledge acquisition systems : MOLE and SALT.
6. Natural Language understanding and Processing :
Introduction, Complexity of the problem, Chompsky hierarchy of grammars,
Techniques for Syntactic processing, Semantic Analysis, Discourse and pragmatic
processing
_ Introduction to Perception and Action.
_ Introduction to Parallel and distributed AI.

SECTION-D

7. Introduction to Neural Networks, Fuzzy Logic and Genetic Algorithms and their
applications.

8. Tools and Technologies for AI :
Introduction to AI language LISP : Symbolic expression, creating, appending and
modifying lists, Defining functions, Predicates, Conditionals, Recursion, Iteration,
Lambda Expressions and Higher order function.

Laboratory Work :
1. Programming in LISP & PROLOG.
2. Hands on experience with expert system shell.

SUGGESTED READINGS :
Algorithms, Prentice Hall of India.
Press.
10. Bharti & Chaitany, 2005 : Natural Language Processing, PHI.
PAPER TITLE : SOFTWARE ENGINEERING - OLD
Paper Code : MCS - 102 Max. Marks : 80 Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.
Objective: The objective of the module is to provide an overview of Software Engg. concepts.

Note:

i. The Question Paper will consist of Four Sections.
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
iii. The students are required to attempt ONE question from each Section and the Compulsory question.
iv. All questions carry equal marks.
Prerequisite: Computer Organization & Assembly Language Programming, Problem Solving and C- Programming.

SECTION-A

1. Introduction:

2. Software Specifications:
Software requirements, Definition, Software requirements specifications (SRS), Components of SRS.

SECTION-B

3. Software Project Planning & Scheduling:
Objectives, Decomposition techniques, Problem based estimation, Cost estimation models, COCOMO model, Risk in estimation.

4. System Analysis:
Principles of Structured Analysis, DFD, E-R-diagram, Data Dictionary

SECTION-C

5. Software Metrics:

6. Software Design:
Objectives, Principles, Concepts, Design Process, Design Methodologies, Structured design, Modular design, Object oriented design, User-interface design, Features of a Modern GUI, Windows, icons, error messages etc.
SECTION-D

7. System Administration and Training :

8. Hardware and Software Selection :
Hardware acquisition, Benchmarking, Vendor selection, Software selection, Performance and acceptance criteria, Site preparation.

SUGGESTED READINGS :
PAPER TITLE: ADVANCED JAVA PROGRAMMING -OLD
Paper Code: MCS-103                                Max. Marks: 80 Time: 3 Hrs.
Course Duration: 60 Lectures of one hour each.
Objective: The objective of the module is to familiarize and create skills in Programming using advanced Java.

Note:
i. The Question Paper will consist of Four Sections.
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
iii. The students are required to attempt ONE question from each Section and the Compulsory question.
iv. All questions carry equal marks.

SECTION-A
1. Review of Java Basic Features, Applets, AWT Controls, Event Handling, Multithreading, I/O files.
2. Swing : Features, components, swing vs AWT, swing containers, controls, using Dialogs, sliders, progress bars, tables, creating user interface using swing.

SECTION-B
3. Java Database Connectivity : Connectivity model, Java. SQL package, JDBC Exception classes, Database connectivity, Data manipulation and navigation, creating database applications.
4. Java RMI : Distributed object technologies, RMI architecture, creating RMI applications.

SECTION-C
5. Java Servlets : Servelets vs CGI, Servlet lifecycle, creating and running servlets.

SECTION-D

SUGGESTED READINGS:
SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

PAPER TITLE: .NET FRAMEWORK AND C# -OLD
Course Duration: 60 Lectures of one hour each.
Objective: The objective of the module is to familiarize and create skills in Programming using Net and C#.

Note :
 i. The Question Paper will consist of Four Sections.
 ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
 iii. The students are required to attempt ONE question from each Section and the Compulsory question.
 iv. All questions carry equal marks.

SECTION-A

INTRODUCTION TO .NET ENVIRONMENT :
The .NET strategy, the origins of the .NET technology, the .NET framework, the common language runtime, framework base classes, user and programs interface, visual studio .NET, .NET languages, benefits of the .NET approach

INTRODUCTION TO C#
Introducing C#, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations. , difference between C++ and C#, difference between Java and C#.

SECTION-B

OBJECT ORIENTED ASPECTS OF C#
Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

I/O, OBJECT SERIALIZATION AND REMOTING:
System. I/O, Streams, TextWriter, TextReader, BinaryWriter, BinaryReader, Serialized Object Persistence and formatters, Remoting

SECTION-C

WRITING WINDOWS FORMS APPLICATIONS AND DEPLOYING WINDOWS FORMS APPLICATIONS
WRITING ASP.NET APPLICATIONS AND DEPLOYING ASP.NET APPLICATIONS

SECTION-D

ACCESSING DATA WITH ADO.NET
Looking Inside ADO.NET, Database, Using Objects, Using DataAdapters and Datasets, Using Binding to a DataGrid Control, Creating Applications.

SUGGESTED READING :
1. Jones, Bradley L, 2005 : Sams Teach Yourself C# in 21 Days
Paper Title: .NET FRAMEWORK AND C#

Paper Code: MCS-115      Max. Marks : 80 Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.
Objectives: This course aims at making a student capable of developing console, windows and web applications using C# on .NET platform.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to .NET environment:

The .NET strategy, the origins of the .NET technology, the .NET framework, the common language runtime, framework base classes, user and programs interface, visual studio .NET, .NET languages, benefits of the .NET approach.

2. Introduction to C#:

Introducing C#, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations, difference between C++ and C#, difference between Java and C#.

UNIT-II

3. Object oriented aspects of C#:

Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

4. I/O and object serialization:

UNIT-III

5. Writing windows forms applications and deploying windows forms applications:
Writing windows forms applications: Understanding windows forms, Window form controls, Menus, MDI forms, Using inheritance in windows forms, Using common dialog controls, Deploying windows forms applications: Introduction to deployment, ClickOnce deployment, creating an installation package for project.

6. Writing asp .net applications and deploying asp.net applications:
Introduction to ASP.NET, Using validation controls, Managing state in ASP.NET web applications, Deploying ASP.NET Applications with windows installer.

UNIT-IV

7. Accessing data with ado .net:
ADO.NET: Architecture, Components, Database, Data Reader, Data Adapter, Dataset, Viewing data using DataGridView Control, creating applications.

Suggested Readings:

PAPER TITLE : OPERATING SYSTEMS (O.S)-OLD

Paper Code : MCS - 201      Max. Marks : 80 Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.
Objective: The objective of the module is to create skills of students in operating systems concepts.

Note :
i. The Question Paper will consist of Four Sections.
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
iii. The students are required to attempt ONE question from each Section and the Compulsory question.
iv. All questions carry equal marks.

SECTION-A

1. Introduction to Operating System :
OS, Types of OS, functions/operations of OS, History of OS. User services/jobs.

2. Memory Management -I:
Address Protection, segmentation, virtual memory, paging, page replacement algorithms.

SECTION-B

3. Memory Management -II:
Cache memory, hierarchy of memory types, associative memory.

4. Support for Concurrent Process :
Mutual exclusion, shared data, critical sections, busy form of waiting, lock and unlock primitives, synchronization.

SECTION-C

5. Scheduling :
Process states, virtual processors, interrupt mechanism, scheduling algorithms.
Preemptive Scheduling & Non-Preemptive scheduling.

SECTION-D

6. System Deadlock :
Prevention, detection and avoidance.

7. Multiprogramming System :
Queue management, File and directory systems, disk scheduling. FCFS, SSTF, SCAN,C-SCAN, LOOK, C-LOOK.

SUGGESTED READINGS :
PAPER TITLE: DESIGN AND ANALYSIS OF ALGORITHMS-OLD
Course Duration: 60 Lectures of one hour each.
Objective: The objective of the module is to create skills in students to design and analysis of algorithms.

Note :
i. The Question Paper will consist of Four Sections.
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
iii. The students are required to attempt ONE question from each Section and the Compulsory question.
iv. All questions carry equal marks.
Prerequisite : Computer Programming and Problem Solving, Data and File Structure.

SECTION-A

1. Algorithms and Analysis :
   Introduction, Algorithms specification, Recursive algorithms, space and time complexity, Asymptotic Notation (O, _, and _, o) practical complexities, Best, average and worst case performance of algorithms, examples, Introduction to recurrence relations.

2. Divide and Conquer :
   General method, Binary Search, Merge sort, Quick sort, Selection sort, Strassen's matrix multiplication and analysis of these problems.

SECTION-B

3. Greedy Method :
   General Method, Knapsack problem, Job sequencing with dead lines, Minimum spanning Trees, Single Source Shortcut paths and analysis of these problems.

4. Dynamic Programming :
   General method, Optimal Binary Search Trees, 0/1 Knapsack, the travelling salesman problem.

SECTION-C

5. Back Tracking :
   General method, 8 queen's problem, Graph colouring, Hamiltonian cycles, Analysis of these problems.

6. Branch-And-Bound :
   Method, 0/1 Knapsack and Travelling Salesperson problems, Efficiency considerations.
SECTION-D

7. Lower-Bound Theory:
Techniques for Algebraic problems, Some Lower Bounds on Parallel Computation.

8. NP-hard and NP-complete problems:
Basic concepts, Statement of Cook's Theorem, Examples of NP-hard graph and NP scheduling problems, some simplified NP-hard problems.

SUGGESTED READINGS:
SYLLABUS FOR M. Sc. (H.S.) COMPUTER SCIENCE

Paper Title: DATA AND FILE STRUCTURES (USING C)

Paper Code : MCS-209                              Max. Marks : 80 Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives: The emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs.

Note:
(i) The Question Paper will consist of Four UNITS.
(ii) Examiner will set total of nine questions comprising two questions from each UNIT and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each UNIT and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Data Structures:
   Concepts and definition of data types, Linear and non-linear data structures.

2. Array: Representation of one and multidimensional arrays in memory, ADT, Operations: traversing, insertion, deletion, reversing, searching, sorting, merging two arrays; Matrix operations: addition, multiplication; Sparse matrices: ADT, representation; Applications of array: Polynomial evaluation and addition of two polynomial.

UNIT-II

3. Linked list: Introduction, sequential vs linked representation, Operations: Traversal, Creation, Insertion, Deletion, Reversing; Application of linked lists: Polynomial addition; Introduction to the operations of Circular linked lists and doubly linked lists; Fundamental concepts of dynamic memory allocation and garbage collection.

4. Stacks And Queues : Sequential and linked representations, ADT, Stack Operations: Traversal ,Pop , Push; Applications of stack: polish notation, infix to post fix , evaluating post fix expression; Queues: Sequential and linked representation ,Queue operations : Traversal, insertion, deletion, Dequeue, Circular queues.

UNIT-III

5. Trees: Terminology, ADT, Types: Binary tree, Complete binary tree , Threaded Binary tree, Binary search tree, B-trees ; Binary tree : properties, sequential and linked representation, Traversal Techniques: inorder, pre-order, post order; BST operations: traversal ,searching, insertion, deletion.
6. Sets and Graphs:
Sets: representation, union and find algorithms; Graphs: ADT, types, sequential and linked representation; Operations: Insertion, deletion, traversal: DFS, BFS; Minimum cost spanning trees: Kruskal and Prim’s algorithm.

UNIT-IV

7. Searching and Sorting: Definition of recursion and its applications, Towers of Hanoi; Sorting Techniques: Bubble sort, Selection sort, Merger sort, Heap sort, Quick sort; Implementation of Linear and binary searching techniques in C.

8. File structures:
Sequential file organization, variable length records and text files. Indexing structures: B-trees, ISAM, Hashing techniques for direct files.

Suggested Readings:
8. Deshpanday: C and data structures, Wiley India Pvt. Ltd.
PAPER TITLE : PARALLEL PROGRAMMING  
Paper Code : MCS – 301  Max. Marks : 80 Time : 3 Hrs.  
Course Duration: 60 Lectures of one hour each.  
Objective: The objective of the module is to develop an understanding of concepts of parallel processing.  

Note :  
i. The Question Paper will consist of Four Sections.  
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.  
iii. The students are required to attempt ONE question from each Section and the Compulsory question.  
iv. All questions carry equal marks.  

SECTION-A  
1. Introduction : Need for Computational speed; Applications of parallel computers in various fields including Mathematics, Physics, Chemistry and Computer Science; Configuration of some existing Mainframe and Super Computers for parallel processing; issues in parallel processing.  
2. Parallel Processing Architectures : Parallelism in Sequential Machines, Abstract model of parallel computer, multiprocessor architecture, programmability issues.  

SECTION-B  
4. Shared Memory Programming : General Model, Process Model under UNIX.  

SECTION-C  
5. Thread-based Implementation : Thread Management, Thread Implementation.  

SECTION-D  
7. Algorithms for Parallel Machines : Speedup, Complexity and Cost, Parallel Reduction, Quadrature Problem, Matrix Multiplication, Parallel Sorting Algorithms and Solving Linear System.  
8. Parallel Programming Languages : Fortran 90, nCUBE C, Occam, C-Linda.  

Laboratory Exercise  
Using FORTRAN – 90 or ‘C’. Write Parallel programs for sorting, matrix multiplication, merging operations, Graph algorithms, solving linear systems.
Minor Project Work
- Design and simulate parallel environment using MPI and PVM.
- Design and Develop distributed applications using parallel and distributed computing.

SUGGESTED READINGS:
1. Sasikumar M., Shikhara Dinesh, Prakash P. Ravi, 2004: Introduction to Parallel Processing, PHI.
3. Joel M. Crichlow, 1997: An Introduction to Distributed and Parallel Computing, PHI.
4. Rajaraman V., 1990: Elements of Parallel Computing, PHI.
PAPER TITLE: UNIX SYSTEM PROGRAMMING

Paper Code: MCS - 401
Course Duration: 60 Lectures of one hour each.

Course Description:
This course begins with a review of Unix shell scripting and a survey of development tools that are commonly found in Unix environments. The main body of the course focuses on the interface between application programs and the Unix kernel. The course spans topics ranging from file and directory management, process control, inter-process communication, and socket programming.

Course Objectives:
1. To develop an understanding of the various components of the Unix/Linux operating systems from a system programmer’s perspective including both the shell and programming interfaces.
2. To develop the ability to use a variety of components of the system library.

Pre-requisites:
1. Computer Operating Systems
2. Good C programming skills
3. Experience with using a UNIX operating system

Question Paper Scheme:

Note:
i. The Question Paper will consist of Four Sections.
ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
iii. The students are required to attempt ONE question from each Section and the Compulsory question.
iv. All questions carry equal marks.

SECTION-A

1. Review of Unix
History of Unix – flavors, origins; Unix standardization and implementations; Shell scripting; Programs and Processes; System Calls vs Library functions.

2. Unix-Kernel Interface via C
Meaning of operating system kernel; Unix-kernel; Error handling with system calls; What is system programming?; C as a system programming language.

SECTION-B

3. File Processing using Direct I/O System Calls
File and directory structure; permissions; sequential and random file access; accessing directories; I/O redirecions; concept of direct (or block) I/O; How is file maintained in Unix?; Description of I/O system calls – umask(); creat(); open(); read(); write(); lseek(); dup(); link(); access(); chmod(); chown().
4. **Process Management using System Calls**
Process concept; process model in unix; process environment; process creation and termination; process control; description of process management system calls – fork(); getpid(); getppid(); exit(); wait(); sleep.

**SECTION-C**

5. **Program Call Interface**
Execve() system call; derived exec** functions; system calls to access real and effective User IDs; Unix command programs; How shell executes command programs?; environment around command process; structure of shell command.

6. **Signals in Unix**
Signal concept; catching and handling signals; signal system calls – kill(); signal().

**SECTION-D**

7. **Interprocess Communication**
Process synchronization and communication concepts; Pipes – popen(), pclose(); Named pipes; Semaphores; Shared memory.

8. **Socket Programming**
Introduction to sockets; TCP/IP architecture; Client/server programming.

**Textbook:**

**References:**
PAPER TITLE : E-COMMERCE AND WEB TECHNOLOGIES
Course Duration: 60 Lectures of one hour each.
Objective: To develop an understanding of concepts of E-Commerce and various tools used in web Technologies.

Note :
 i. The Question Paper will consist of Four Sections.
 ii. Examiner will set total of NINE questions comprising TWO questions from each Section and ONE compulsory question of short answer type covering whole syllabi.
 iii. The students are required to attempt ONE question from each Section and the Compulsory question.
 iv. All questions carry equal marks.

SECTION-A

SECTION-B
2. **Website designing and hosting**: Life cycle of website building, website content and traffic management. How ISPs work, choosing on ISP, choosing and registering a domain name.

SECTION-C
4. **Payment Systems**: From Barter to money, requirements of Internet-based payments, electronic payment media: Credit cards, debit cards, smark cards, issues and implications.
5. **Marketing on the Internet**: Pros and cons of online shopping, internet marketing techniques and cycles, attracting and tracking customers.

SECTION-D

SUGGESTED READINGS:
1. Elias M. Awad, 2006 : Electronic Commerce from vision to fulfillment, PHI.

**********