

**DAV UNIVERSITY JALANDHAR**

**FACULTY OF SCIENCE**



**Course Scheme and Syllabus  
for**

**Master of Computer Applications  
(Two Years Degree Course)**

**1<sup>st</sup> to 4<sup>th</sup> Semester**

**(As per Choice Based Credit System)**

**Syllabi Applicable for 2022 Batch**

**Master of Computer Applications**  
**Syllabus 2022-24**

**Duration:** 2 years (4 Semesters)

**Eligibility:** Bachelor's degree of minimum three years duration in BCA/B.Sc.(IT)/B.Sc.(CS) or equivalent/B.Voc. with Computer as a major subject and with mathematics at 10+2 level or at graduation level with at least 50% aggregate marks (45% in case of candidate belonging to SC/ST)

Or

Bachelor Degree in Computer Science & Engineering or equivalent with at least 50% aggregate marks (45% in case of candidate belonging to SC/ST)

Or

Any bachelor's degree of minimum three years duration with mathematics at 10+2 level or at graduation level **and** minimum One Year Diploma in Computer Applications/Science/IT or equivalent from any recognized University/Institution at least 50% aggregate marks (45% in case of candidate belonging to SC/ST)

**Master of Computer Applications  
Syllabus 2022-24**

**Semester 1**

<b>S.No</b>	<b>Paper Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
1	CSA517	Discrete Mathematical Structures	Core	4	0	0	4
2	CSA518	Advanced Database Management System	Core	4	0	0	4
3	CSA519	Data Structures and File Processing	Core	4	0	0	4
4	CSA520	Software Testing and Quality Assurance	Core	4	0	0	4
5	CSA521	Python Programming	Core	4	0	0	4
6	CSA522	Advanced Database Management Systems Laboratory	Core	0	0	4	2
7	CSA523	Data Structures and File Processing Laboratory	Core	0	0	4	2
8	CSA524	Python Programming Laboratory	Core	0	0	4	2
				<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>

**Semester 2**

<b>S.No</b>	<b>Paper Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
1	CSA525	Advanced JAVA & Network Programming	Core	4	0	0	4
2	CSA526	Linux and Shell Programming	Core	4	0	0	4
3	CSA527	Advanced Web Technology	Core	4	0	0	4
4	CSA577	Design and Analysis of Algorithms	Core	4	0	0	4
5	CSA578	Computer Based Optimization Techniques	Core	4	0	0	4
6	CSA528	Advanced JAVA & Network Programming Laboratory	Core	0	0	4	2
7	CSA529	Advanced Web Technology Laboratory	Core	0	0	4	2
8	CSA530	Linux and Shell Programming Laboratory	Core	0	0	4	2
				<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>

**Master of Computer Applications  
Syllabus 2022-24**

**Semester 3**

<b>S. No</b>	<b>Paper Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
1	CSA612	Theory of Computer Science	Core	4	0	0	4
2	CSA628	Computer Networks and Data Communication	Core	4	0	0	4
3	CSA629	Advances in Operating System	Core	4	0	0	4
4	CSA676	Artificial Intelligence	Core	4	0	0	4
5	CSAXXX	Discipline Elective I	DSE	4	0	0	4
6	CSA630	Computer Networks and Data Communication Laboratory	Core	0	0	4	2
7	ENG551	Technical Writing and Communications Skills	AECC	0	0	2	1
8	CSA631	Summer Training Seminar	Core	0	0	2	1
9	CEC101	Community Engagement Course	Core	1	0	0	1
	CEC102	Community Engagement Course	Core	0	0	1	1
				<b>21</b>	<b>0</b>	<b>9</b>	<b>26</b>

**Semester 4**

<b>S. No</b>	<b>Course Title</b>		<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
1	CSAXXX	Discipline Elective I	DSE	4	0	0	4
2	CSAXXX	Discipline Elective I	DSE	4	0	0	4
3	CSAXXX	Discipline Elective I	DSE	4	0	0	4
4	CSAXXX	Discipline Elective II	DSE	0	0	4	2
5	CSAXXX	Discipline Elective II	DSE	0	0	4	2
6	CSA689	Major Project	DSE	0	0	16	8
				<b>12</b>	<b>0</b>	<b>24</b>	<b>24</b>

**Master of Computer Applications  
Syllabus 2022-24**

<b>Discipline Elective-I</b>	
CSA605	Data Mining and Data Warehousing
CSA606	Mobile Computing
CSA607	Emerging Trends in Information Technology
CSA608	Distributed and Parallel Processing
CSA609	Information Systems
CSA616	System Simulation and Modeling
CSA617	Embedded Systems
CSA619	Advanced Software Engineering
CSA620	Compiler Design
CSA627	Research Methodology
CSA632	Big Data Analytics
CSA633	Machine Learning
CSA634	Internet of Things
CSA635	R Programming
CSA636	Mobile Application Development
CSA637	Scientific Computing using MATLAB
CSA638	Graphics & Multimedia
CSA671	Microprocessor and Its Applications
CSA678	Digital Image Processing
CSA682	Soft Computing
CSA683	System Software
CSA691	Natural Language Processing
<b>Discipline Elective-II</b>	
CSA639	Big Data Analytics Laboratory
CSA640	Machine Learning Laboratory
CSA641	Internet of Things Laboratory
CSA642	R Programming Laboratory
CSA643	Mobile Application Development Laboratory
CSA644	Scientific Computing using MATLAB Laboratory
CSA645	Graphics & Multimedia Laboratory
CSA680	Digital Image Processing Laboratory
CSA689	Major Project

**Master of Computer Applications**  
**Syllabus 2022-24**

**Note:**

1. Students will adopt MOOC course or 4 to 6 weeks Summer Training under registered company after 2<sup>nd</sup> Semester. If student has adopted summer training program then examination will be conducted along with 3<sup>rd</sup> semester practical.
  
2. The Major Project will include the development of application/system software under the supervision of internal supervisor assigned from the department. For evaluation, 20% weightage will be given to the synopsis of the project and 80% weightage will be given to the Viva, Project Execution, and Project Report.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Discrete Mathematical Structures**

**Course Code: CSA517**

**Course Duration: 45-60 Hours**

**Course Objective:** The objective of this course is to acquaint the students with the basic concepts in Discrete Mathematics viz. sets, functions, relations, groups, graphs etc. required for the implementation of various computer science courses.

**Course Outcomes:**

<b>CO-1</b>	Understand the set theory, Relation and Functions.
<b>CO-2</b>	Understand Group Theory and Recurrence relations
<b>CO-3</b>	Apply the operations of simple and multi graphs, directed and undirected graphs, Eulerian and Hamiltonian Graphs, Shortest path algorithms
<b>CO-4</b>	Learn to apply Vectors and Matrices and Counting and Probability Theory

**UNIT – A**

**12 Hours**

**Set Theory**

- Set and its Representations, Types of sets
- Subsets
- Operations on Sets-Union, Intersection and Difference of Sets
- Venn Diagrams, Statement Problems
- Laws- Associative Laws, Distributive Laws, Demorgan's Laws

**Relation and Functions**

- Relations, Pictorial Representations of Relations, Composition of Relations, Types of Relations, Closure Properties
- Equivalence Relations and Partitions, Hasse diagram, Lattices, Bounded Lattices, Distributive Lattices.
- Functions, Special functions, Composition of Functions, one-one, onto and Inverse of a function
- Mathematical functions, Exponential and Logarithmic Functions

**UNIT – B**

**Group Theory**

**13 Hours**

- Group Axioms, Semi groups, Properties of Groups
- Subgroups
- Cosets, , Normal subgroup
- Permutation Group
- Dihedral Group

**Recurrence relations**

- Characteristic Equation
- Homogeneous and non-homogeneous linear recurrence relations with constant coefficients
- Generating Functions for some standard sequences

**UNIT – C**

**10 Hours**

**Master of Computer Applications  
Syllabus 2022-24**

**Graphs**

- Basic Terminology, Special Graphs,
- Handshaking Theorem,
- Isomorphism of Graphs,
- Walks, Paths, Circuits, Eulerian and Hamiltonian Paths
- Planar and Non Planar Graphs,
- Coloring of Graph, Directed graphs, Travelling Salesman Problem

**Logic and Propositional Calculus**

- Propositions,
- Basic logic operators
- Logic equivalence involving Tautologies and Contradiction
- Algebra of Propositions
- Conditional and Biconditional Statements
- Logical Implication, Propositional Functions, Quantifiers

**UNIT – D**

**10 Hours**

**Vectors and Matrices**

- Vectors, Matrices
- Matrix Addition, Scalar Multiplication
- Matrix Multiplication, Transpose
- Square matrices
- Invertible Matrices, Inverses, Determinants

**Counting and Probability Theory**

- Basic counting principle, Factorial Notation
- Binomial Coefficients, Permutations, Combinations
- Sample Space and Events
- Finite Probability Spaces
- Conditional Probability
- Independent Events, Binomial Distribution
- Random variables

**Reference Books:**

1. Rosen, K. H., *Discrete Mathematics and its Applications*, 6<sup>th</sup> Edition, McGraw Hill, 2007.
2. Malik, D.S. and Sen, M.K., *Discrete Mathematical Structures: Theory and Applications*, Thomson Cengage Learning, New Delhi, 2004.
3. Lipschutz, S. and Lipson M., *Schaum's Outline of Discrete Mathematics*, Schaum's Outlines, New Delhi, 2007
4. Ram, B., *Discrete Mathematics*, Pearson Publications, 2011.
5. Liu, C. L., *Elements of Discrete Mathematics*, McGraw Hill, International Edition, Computer Science Series, 1986.
6. Trembley, J.P. and Manohar, R.P., *Discrete Mathematical Structures with Applications to Computer Science*, McGraw Hill.
7. Joshi, K.D., *Foundations of Discrete Mathematics*, Wiley, 1989
8. Alan Doerr and Kenneth Levarseur., *Applied Discrete Structures for Computer Science*, Creative Commons, 2012.



**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advanced Database Management System**  
**Course Code: CSA518**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** The concepts related to database, database design techniques, transaction management, SQL, PL/SQL and database operations are introduced in this subject. This creates strong foundation for data base creation.

**Course Outcomes:**

<b>CO-1</b>	Express the basic concepts of DBMS and RDBMS.
<b>CO-2</b>	Apply normalization theory to the normalization of a database.
<b>CO-3</b>	Apply the concept of Transaction Management & Recovery techniques in RDBMS.
<b>CO-4</b>	Analyze various advanced databases prevailing in market, PL/SQL, Parallel and Distributed Databases, XML Database and multidimensional Databases.
<b>CO-5</b>	Demonstrate No SQL databases (Open Source) & XML databases.

**UNIT– A**

**10 Hours**

**Introduction to Data Base and Data Models**

- General Architecture of a Data Base Management Software, Advantages and Disadvantages of DBMS, Entity Relationship model, hierarchical model from network to hierarchical, relational model, object oriented database, object relational database

**Data Base Design**

- Functional dependencies; Normalization,
- Multivalued dependencies, decomposition, Relational algebra and calculus, Need and types of query optimization procedures, phases of query optimization

**UNIT – B**

**10 Hours**

**Data Base Protection**

- Concurrency, recovery, Integrity, Protection, essentials of security authorization, types of database security

**Relational Query Language**

- SQL, client/server architecture, Technical introduction to Oracle.

**Software Development using SQL**

- SQL data types, Querying database tables
- Conditional retrieval of rows, working with Null values, matching a pattern from the table querying multiple tables: Equi joins, Cartesian joins, Outer joins
- Self joins; Set operator: Union, Intersect, Minus, Nested queries

**UNIT – C**

**10 Hours**

**Introduction to PL/SQL**

- The PL/SQL block structure, PL/SQL data types, Variables and constants, assignment and expressions, Writing PL/SQL code, cursor management in PL/SQL

**Master of Computer Applications  
Syllabus 2022-24**

- Concept of stored procedures, Database triggers, types of triggers, Dropping triggers, storage of triggers

**Parallel Databases**

- **Database System Architectures:** Centralized and Client-Server Architectures, Server System Architectures, Parallel Systems,
- **Parallel Databases:** I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism

**UNIT – D**

**15 Hours**

**Distributed Database Concepts**

- Distributed database, Characteristics of distributed databases, Distributed database design, fragments and replications; Distributed Transaction, Distributed Query Processing, Phases of Distributed query optimization, Operation site allocation plan, Reliability of distributed DBMS.

**Advanced databases**

- Multidimensional Databases, Temporal Databases, Spatial databases, NOSQL Databases and their characteristics

**XML databases**

- XML Databases, XQL and XQuery, XML Schema, XML query processing

**Reference Books:**

1. Desai. B.C., *An Introduction to Database Systems*, New Delhi: Galgotia Publ. Private Ltd, 2000.
2. C.J.Date, A.Kannan, S. Swamynathan, *An Introduction to Database Systems*, 8th Edition, Pearson Education, 2006.
3. Silberschatz, Korth and Sudarshan, *Database System Concepts*, Third Ed., New York: McGraw Hill International Editions, Computer Science Series, 2010.
4. Peter Rob Carlos Coronel, *Data Base Systems* (3rd Edition), New Delhi: Galgotia Publications (P) Ltd, 2001.
5. Elmasri, Navathe, *Fundamentals of Database System*, 7e, Pearson India.
6. Kleinberg J., Tardos E., *Algorithm Design*, 1st Edition, Pearson, 2012.
7. Ivan Bayross, *SQL, PL/SQL The Programming Language of Oracle*, 4th Revised Edition, BPB Publications, 2009.
8. Peter Rob Carlos Coronel, *Database Systems*, Cengage Learning, 8th ed, 2007.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Data Structures and File Processing**  
**Course Code: CSA519**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** 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.

**Course Outcomes:**

<b>CO-1</b>	Ability to analyse algorithms and algorithm complexity.
<b>CO-2</b>	To extend the knowledge of summarize searching and sorting techniques
<b>CO-3</b>	Ability to describe stack, queue and linked list operation
<b>CO-4</b>	Ability to have knowledge of tree and graphs
<b>CO-5</b>	To acquire the knowledge of Heap, Hash Table, hashing functions and File Structure

**UNIT- A**

**12 Hours**

**Preliminaries**

- Introduction to Data Structures: Primitive and Composite, Various data structures
- Common operations on data structures, algorithm complexity
- big O notation, timespacetradeoff between algorithms
- Complexity of Algorithms, Records and Pointers.

**Arrays**

- Arrays defined, representing arrays in memory, various operations on linear arrays
- Multi dimensional arrays, Matrices, Sparse Matrices
- Linear Search, Binary Search
- Insertion Sort, Selection Sort, Bubble Sort
- Merge Sort, Radix Sort

**UNIT – B**

**13 Hours**

**Linked Lists**

- Types of linked lists, representing linked lists in memory
- Advantage of using linked lists over arrays
- Various operation on linked lists

**Stacks**

- Description of stack structure, implementation of stack using arrays and linked lists
- Applications of stacks converting arithmetic expression from infix notation to polish and their subsequent evaluation
- Quicksort technique to sort an array, parenthesis checker.

**Queues**

- Implementation of queue using arrays and linked lists
- Deques, Priority Queues and their implementation, applications of queues.

**UNIT – C**

**10 Hours**

**Master of Computer Applications  
Syllabus 2022-24**

**Trees**

- Description of tree structure and its terminology, binary search tree
- Implementing binary search tree using linked lists
- Various operations on binary search trees, AVL Trees

**Heaps**

- Description of heap structure, implementing heaps using arrays
- Various operations on heaps, Applications of heaps
- Heapsort technique to sort an array

**UNIT – D**

**10 Hours**

**Graphs and Hash Tables**

- Representation of Graphs and Applications: Adjacency Matrix, Path Matrix
- Warshall's Algorithm, Linked Representation of a Graph
- Traversing a Graph, DFS and BFS.
- Direct address tables, hash tables
- Collision resolution by chaining, hash functions
- Open addressing – linear probing, quadratic probing, double hashing

**Files**

- Operations on files, Types of files
- File Organizations: Sequential files, Indexed Sequential file, Directed files and multikey files
- File performance criteria and terms.

**Reference Books:**

1. Lipschutz Seymour, *Theory and Problems of Data Structures*, Schaum Outline Series, New Delhi: Tata McGrawHill Book Company, 2001.
2. Mark Allen Weiss, *Data Structures and Algorithm Analysis In C*, Mexico City: Addison Wesley, (An Imprint of Pearson Education), New Delhi: Prentice Hall of India Pvt. Ltd, 1993.
3. Esakov Jeffery, Weiss Tom, *Data Structures: An Advanced Approach Using C*, New Delhi: Prentice Hall International, Inc, 2007.
4. Trembley and Sorenson, *An Introduction to Data Structures with Application*, New York : McGraw Hill Company, 1984.
5. Tanenbaum, *Data Structures using C*, New Delhi: Pearson Education, 2009.
6. Kleinberg J., Tardos E., "Algorithm Design", 1st Edition, Pearson, 2012.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Software Testing and Quality Assurance**

**Course Code: CSA520**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** The students will gain the knowledge about software testing techniques, STEP methodology, software testing strategies, software metrics, software quality assurance tools and techniques, quality management, quality models and system configuration management.

**Course Outcomes:**

<b>CO-1</b>	Understand software testing and quality assurance as a fundamental component of software life cycle.
<b>CO-2</b>	Define the scope of SW Testing & Quality Assurance projects, Software Testing Strategies and Metrics of Software.
<b>CO-3</b>	Efficiently perform Testing & Quality Assurance activities using modern software tools & Quality Management & Quality Models.
<b>CO-4</b>	Estimate cost of Testing & Quality Assurance activities using modern software tools & Quality Management & Quality Models.
<b>CO-5</b>	System Configuration Management, Planning and Organizing SCM.

**UNIT-A**

**Introduction**

**15 Hours**

- Software Testing, Objectives of Software Testing, Software Testing Process, Static and Dynamic Analysis
- STEP Methodology, Elements of STEP and STEP Architecture

**Software Testing Techniques**

- BBT & its Technique, Boundary Value Analysis, Cause-Effect Graph, White-Box Testing and its Techniques
- Domain and Boundary Testing, Logic Based Testing, Data Flow Testing

**UNIT-B**

**15 Hours**

**Software Testing Strategies**

- Characteristics, Integration Testing, Functional Testing
- Object Oriented Testing, Alpha and Beta Testing, Overview of Testing Tools
- Test planning, functional testing, stability testing and debugging techniques

**Metrics for Software**

- Importance of Metrics to Software Project, Software Quality Metrics
- Software Metrics: Product Metrics: Software Size Metrics, Control Complexity Metrics, Object-Oriented Metrics, Software Quality Metrics

**UNIT-C**

**Master of Computer Applications  
Syllabus 2022-24**

**Quality Assurance**

**15 Hours**

- Concept of Software quality, product and process quality, software quality metrics, quality control and total quality management,
- Quality tools and techniques, quality standards, Software Quality Attributes, Factors Affecting Software Quality
- Building software quality assurance plan, Components of SQAP

**Quality Management & Quality Models**

- Software Quality System, Quality Management Principles, Essence of International Standards
- ISO 9000 Quality Standard, SEI Capability Maturity Model

**Designing software quality assurance system**

- Statistical methods in quality assurance, fundamentals of statistical process control, process capability, Six-sigma quality

**UNIT-D**

**15 Hours**

**Reliability**

- Basic concepts, reliability measurements, predictions and management
- Factors affecting software reliability, Software reliability vs hardware reliability, Software reliability metrics

**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

**Reference Books:**

1. Schulmeyer G.G. and McManus J. (eds.), *Handbook of Software Quality Assurance*, New Delhi: Prentice Hall, 3<sup>rd</sup> Ed. 1999
2. Deutsch, Wills and Hall, *Software Quality Engineering: A Total Technique and Management Approach*, New Delhi: PHI, 1993.
3. Futrell Robert T., Snafer Donald F., Shafter Linda I., *Quality Software Project Management*, New Delhi: Pearson, 2002.
4. Perry, William E., *Effective Methods for Software Testing*, New York: Wiley, 2006.
5. Hutcheson, *Software Testing Fundamentals*, Wiley India Pvt. Ltd, 2007.
6. Gill Nasib Singh, *Software Engineering: Software Reliability, Testing and Quality Assurance*, Khanna Book Publishing, 2009.
7. Galin Daniel, *Quality Assurance: From theory to implementation*, New Delhi: Pearson Education Ltd., 2004
8. Kan S.H., *Metrics and Models in Software Quality Engineering*, New Delhi: Pearson, 2<sup>nd</sup> Ed, 2014.
9. Myers Glenford J., *The Art of Software Testing*, New York: John Wiley, 2<sup>nd</sup> Ed. 2011.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Python Programming**  
**Course Code: CSA521**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Duration: 45-60 Hours**

**Course Objective:** This course provides the knowledge about developing programs and scripts using Python programming language. All the advanced concepts of programming will help benefit the students in research as well in software development.

**Course Outcomes:**

<b>CO-1</b>	Familiar with Python environment, data types, operators used in Python. Compare and contrast Python with other Programming languages.
<b>CO-2</b>	Learn the use of control structures and numerous data types with their methods.
<b>CO-3</b>	Design and define functions, modules, packages and exception handling methods.
<b>CO-4</b>	Create and handle files in Python and learn Object oriented programming Concepts.
<b>CO-5</b>	GUI Programming in Python (using Tkinter/wxPython/Qt) and Database Connectivity.

**UNIT-A**

**Introduction to Python Language**

**15 Hours**

- Programming language, History of Python, Origin of Python Programming, Features, Limitations, Applications, Getting and Installing Python, Python Environment Variables, Python Help, Python differences from other languages.

**Python Data Types and Input Output**

- Keywords, Identifiers, Variables, Statements, Indentation, Documentation, Data Type, Type Conversion.
- Python Input and Output.

**Operators and Expressions**

- Arithmetic, Comparison, Assignment, Logical, Bitwise, and Python special operators.
- Expressions, Precedence and Associatively.

**UNIT-B**

**15 Hours**

**Control Structures**

- Decision Making Statements
- Python Loops

**Python Native Data Types**

Creation of following Data Types along with methods and functions

- Number, String, Tuple, Set, Dictionary

**Python Functions and Modules**

## **Master of Computer Applications Syllabus 2022-24**

- Creating Functions, Advantages of Functions, Types of Functions, Built-In, User Defined Functions, Anonymous Functions, Call by Value, Call by Reference, Recursion.
- Designing of Modules. Importing Modules

### **UNIT-C**

**15 Hours**

#### **Python Class and Objects**

- Designing Classes, Creating Objects, Accessing Objects, \_\_init\_\_ method, constructor, garbage collection, destroying objects.
- Inheritance and Operator Overloading.

#### **File Handling**

- File creation, open() and close() methods, read() and write() methods, file modes, file encoding, file object attributes, renaming and deleting files, Python directory, directory methods and functions.

#### **Exception Handling**

- Python Exception, Built-in Exception, Exception Handling, Try, except, finally, Python user defined exceptions.

### **UNIT-D**

**15 Hours**

#### **GUI Programming in Python (using Tkinter/wxPython/Qt)**

- What is GUI, Advantage of GUI, Introduction to GUI, Layout Management, Events and Bindings, Fonts, Colors, Drawing on Canvas, Line, Oval, Rectangle, etc. Widget such as Frame, Label, Button, Check Box, Entry, ListBox, Radiobutton, Message, Text, Spinbox, etc.

#### **Database connectivity in Python**

- Installing mysql connector, accessing connector module module, using connect, cursor, execute & close functions, reading single & multiple results of query execution

### **Reference Books:**

1. M. C. Brown, *The Complete Reference Python*, Osborne/McGraw-Hill, 2018.
2. S. Maruch, A. Maruch, *Python for Dummies*, John Wiley & Sons, 2011.
3. A. B. Downey, *Think Python*, O'Reilly Media Inc., 2012.
4. B. Slatkin, *Effective Python*, Addison Wesley Professional, 2015.
5. J. M. Zelle, *Python Programming: An Introduction to Computer Science*, Franklin, Beedle & Associates, Inc., 2004.



**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advanced Database Management Systems  
Laboratory  
Course Code: CSA522**

L	T	P	Credits	Marks
0	0	4	2	50

**Course Outcomes:**

<b>CO-1</b>	Implementation of SQL: DDL, DML, DCL, TCL.
<b>CO-2</b>	Implementation of Nested Queries, Join Queries, Cursors, Procedures and Functions.
<b>CO-3</b>	Implementation of Triggers, various DBA roles/techniques: Creation of user, Granting of privileges to the users, Creation of roles, Loading of privileges into user defined roles
<b>CO-4</b>	Import/Export data between various databases and flat files.

1. Implementation of SQL: DDL, DML, DCL, TCL
2. Implementation of Nested Queries and Join Queries.
3. Implementation of Cursors.
4. Implementation of Procedures and Functions
5. Implementation of Triggers
6. Implementation of various DBA roles/techniques: Creation of user, Granting of privileges to the users, Creation of roles, Loading of privileges into user defined roles,
7. Import/Export data between various databases and flat files

**Course Title: Data Structures and File Processing Laboratory  
Course Code: CSA523**

L	T	P	Credits	Marks
0	0	4	2	50

1. Implementation of Data Structures: **Arrays Linked List, Stack, Queues, Trees**, etc
2. Implementation Searching: Linear and Binary
3. Implement Sorting: Bubble, Selection, Insertion, and Quick
4. Binary tree using pre-order, post-order and in-order traversals
5. Implementation of Traversal on graph using Depth First Search and Breadth First Search
6. Implement AVL Trees as well as various operations of searching, insertion and deletion on AVL Trees.

**Course Outcomes:**

<b>CO-1</b>	Ability to analyse algorithms and algorithm correctness.
<b>CO-2</b>	To extend the knowledge of summarize searching and sorting techniques.
<b>CO-3</b>	Ability to describe stack, queue and linked list operation.
<b>CO-4</b>	Ability to have knowledge of tree and graphs concepts.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Python Programming Laboratory**  
**Course Code: CSA524**

L	T	P	Credits	Marks
0	0	4	2	50

**Course Outcomes:**

<b>CO-1</b>	Familiar with Python environment, data types, operators used in Python.
<b>CO-2</b>	Learn the use of control structures and numerous data types with their methods.
<b>CO-3</b>	Design and define functions, modules, packages and exception handling methods.
<b>CO-4</b>	Create and handle files in Python and learn Object oriented programming Concepts.
<b>CO-5</b>	GUI Programming in Python (using Tkinter/wxPython/Qt) and Database Connectivity.

1. Implementation of Python programs: Control Structures, Lists, Tuples,
2. Strings, Dictionary, Sets, Files,
3. Exception handling, Classes and Objects,
4. Inheritance, Overloading, GUI Programming,
5. Database Connectivity, etc

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advanced JAVA and Network Programming**

**Course Code: CSA525**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** To introduce Advanced JAVA concepts to the students with the design of network protocols.

**Course Outcomes:**

<b>CO-1</b>	Learn to Create Graphical User Interface (GUI) using AWT and swing components.
<b>CO-2</b>	To understand creating GUI based application, Data Base Connectivity and Remote method Invocation.
<b>CO-3</b>	Attain the basic knowledge of TCP and UDP protocols.
<b>CO-4</b>	Learn to create, design and implement sockets and user data gram protocols.

**UNIT – A**

**10 Hours**

**Abstract Window Toolkit**

- Review of Java Basic Features
- Applets
- AWT Controls
- Event Handling
- Multithreading, I/O Files

**Swing**

- Features, Components, Swing Vs AWT, Swing Containers, Controls, Using Dialogs,
- Sliders, Progress Bars, Tables, Creating User Interface using Swing

**UNIT – B**

**15 Hours**

**Java Database Connectivity**

- Connectivity model, Java. SQL package, JDBC Exception Classes
- Database connectivity
- Data manipulation and navigation
- Creating Database Applications

**Java RMI**

- Distributed object technologies
- RMI architecture
- Creating RMI applications.

**UNIT – C**

**10 Hours**

**TCP Connection**

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

**UDP Connection**

**Master of Computer Applications  
Syllabus 2022-24**

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

**UNIT-D**

**10 Hours**

**Networking**

- Networking basics
- Client/server model
- Java and the Net, TCP/IP client sockets
- TCP/IP server sockets
- Inet Address, URL
- Data grams, creating networking applications

**Socket Programming**

- Sockets Address Structures
- Byte ordering & Manipulation Functions
- TCP Socket System Calls

**Reference Books:**

1. Stevens W. Richard, *Networking Programming*, New Delhi: Pearson Education (2<sup>nd</sup> Ed), 2015.
2. Cornell, Gary and Horstmann Cay S, *Core Java*, Vol I and Vol II, CA: Sun Microsystems Press, 2008.
3. Bayross Ivan, *Web Enabled Commercial Application Development using Java 2.0*, New Delhi: BPB, 2003.
4. Schildt Herbert, *The Complete Reference Java 2*, New Delhi: TMH, 2005.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Linux and Shell Programming**

**Course Code: CSA526**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** This course provides an introduction to programming with file handling utilities, security by file permissions, process utilities, basic linux commands, Scripts and filters. To familiarize students with fundamentals of the Bourne again shell (bash), shell programming, pipes, input and output redirection Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts, kernel support for file, file structure related system calls (file API's), inter process communication, semaphore and shared memory .

**Course Outcomes:**

<b>CO-1</b>	Familiarity with basic LINUX OS concepts and commands.
<b>CO-2</b>	Acquire knowledge in file I/O and process management.
<b>CO-3</b>	Implementation of Shell programming.
<b>CO-4</b>	Understand Inter-process communication using linux.

**15 Hours**

**UNIT—A**

**Introduction to Linux And Linux Utilities**

- A brief history of LINUX, architecture of LINUX
- Linux/Unix operating system, Linux/Unix architecture
- Features of Linux/Unix, Accessing Linux system
- Starting and shutting down system, Logging in and Logging out

**Commands in Linux**

- Introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text Processing utilities and backup utilities , tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio File oriented commands, directory oriented commands..

**UNIT—B**

**10 Hours**

**The Linux File system**

- Linux/Unix files, inodes and structure and file system
- File system components, Standard file system
- File system types, file system mounting and unmounting.

**Processes in Linux**

- Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling
- Starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets. File locking: creating lock files, locking regions, use of

## Master of Computer Applications Syllabus 2022-24

read and write with locking, competing locks, other lock commands, deadlocks.

### UNIT—C

**10 Hours**

#### Shell Programming

- Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization, control structures, loops, subprograms, creating shell scripts
- Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

### UNIT—D

**10 Hours**

#### Inter Process Communication

- Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos
- semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.

#### Introduction To Sockets

- Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications

#### Reference Books:

1. Sobell Mark G., *A Practical Guide to Linux Command and Shell Programming*, New Delhi: Pearson Publishers, India 2012.
2. Robbins, *Linux Programming by Example: The fundamentals*, New Delhi: Pearson Publishers, India 2011.
3. Drew and Mike Harwood, *Linux + Certification Guide*, New Delhi: TataMc-Graw Hill Publishers, 2009.
4. John Goerzen, *Linux Programming Bible*, IDG Books, New Delhi 2000.
5. Behrouz A. Forouzan, Richard F. Gilberg.Thomson, *Unix and shell Programming*, Cengage Learning; 1st Edition, 2003.
6. W. Richard. Stevens, *Advanced Programming in the UNIX Environment, 3rd edition*, Pearson Education, New Delhi, India, 2005.
7. Robert Love, *Linux System Programming*, O'Reilly Media, 2013.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advanced Web Technology**  
**Course Code: CSA527**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:**

- To build web applications using ASP and client side script technologies based on Microsoft's IIS.
- Creating web based applications using ADO.Net
- To build Web services and creating XML files for writing and reading data from XML

**Course Outcomes:**

<b>CO-1</b>	Understand, analyze and apply the role of languages like HTML, DHTML, CSS, XML, Javascript, VBScript, ASP, PHP and protocols in the workings of the web and web applications.
<b>CO-2</b>	Analyze a web project and identify its elements and attributes in comparison to traditional projects.
<b>CO-3</b>	Create web pages using HTML, DHTML and Cascading Styles sheets. CO4: Analyze and build interactive web applications using ASP and ASP.NET.
<b>CO-4</b>	Build web applications using PHP, XML documents and XML Schema, and consume web services.

**10 Hours**

**UNIT—A**

**Introducing**

- History of the Internet and World Wide Web
- HTML 4 protocols – HTTP, SMTP, POP3, MIME, IMAP

**Overview of ASP .NET Framework**

- ASP.NET and the .NET Framework, Understanding the framework class Library, Understanding the Common language Runtime, Installing the ASP.NET Framework

**UNIT—B**

**13 Hours**

**Introduction of ASP .NET**

- Creating your First ASP .NET Web, Understanding ASP.NET Pages, Understanding ASP.NET Controls, Overview of ASP.NET Controls, Understanding HTML Controls, Understanding and Handling Control Events
- Understanding Control Trees, Using Code –Behind pages, Deciding Between Single-File and Code-Behind Pages, Handling Page Events, Using the Page. IsPostBack Property, Debugging and Tracing ASP.NET Pages, Debugging Pages with Visual Web Developer, ASP.Net Applications, Web Server (IIS Server)

**Web Forms & Web Forms Control**

- Introduction, Web Forms, WEB FORM CONTROL, Server Control, Client Control, WEB FORMS & HTML, Adding control to a web form,

## **Master of Computer Applications Syllabus 2022-24**

Submitting Form Data, Accepting User Input, Using the Label Control

- Using the Checkbox Control, Using the Radio Button Control, Performing Cross-Page Posts, Specifying a Default Button, Displaying Images, Using the ImageMap Control, Using the Panel Control, Using the HyperLink control, Running a Web applications, Multi forms, Creating a Multiform

### **UNIT—C**

**12 Hours**

#### **Form Validation:**

- Introduction, Client Side and Server Side Validation, Client Side Validation, Server Side Validation, Overview of the Validation Controls, Validation Control and JavaScript, Using Page.IsValid, Validation Controls
- Using the RequiredFieldValidator control, Using the CompareValidator Control, Using the RangeValidator control, Calendar Control, Ad-rotator Control (Displaying Advertisements), Using the RegularExpressionValidator Control, Using the CustomValidator Control, Using the ValidationSummary Control, Creating Custom Validation Controls, Creating a LengthValidator Control, Creating an Ajaxvalidator control

#### **State Management & Rich Control::**

- Introduction, State Management, Client – Side State Management, Server - Side State Management., Advantages of State Management, Accepting File UPLOADS, Saving Files to the file System, Displaying Different Page Views, Displaying a Tabbed Page view, Displaying a Multi – Part form, Displaying a Wizard

### **UNIT—D**

**10 Hours**

#### **Introduction of ADO .NET:**

- Introduction, The ADO.NET Data Architecture, Component classes that make up the Data Providers, Connected and Disconnected Database, Create an XML Web service using ASP.NET, Create a disconnected ADO.NET Windows application
- Create Connection using ADO .NET object model, Building a Connection String, Connection Classes, Executing Commands, DataSet Classes, Using an XSD Schema to Create a Typed DataSet, Using the Designer to Build a Typed DataSet, Programming with a Typed DataSet, DataAdapter Classes, Filling Typed DataSets
- Using TableAdapters, Adding Additional Queries to a Typed DataSet, Display data on data bound control, Working with List controls, Working with tabular databound controls, Using ASP.NET Parameters with DataSource controls, Overview of SQL Server, Features of SQL Server Express, SQL Server Management tools, Server Database Versus Local Databases

#### **Database Accessing on Web Application:**

- DataBinding Concept with Web, Understanding Templates and DataBinding Expressions, Using Templates, DataGrid Control, Creating DataGrid, Binding standard web server control, Working with tabular databound controls, Display data on web form using DataBound Control

#### **Web Service & XML:**

- Introduction to XML, Reading and Writing DataSet's Data in XML File, Writing Data in XML, Reading data from XML, Remote Method Call using



## **Master of Computer Applications Syllabus 2022-24**

XML, Web Services Overview, Soap Message, ASP.NET Web Services, Web Services Description Language, Building & Consuming a web service, Changes to our source, Performance Counter Web Service, Testing Web Services, Consuming, Contract, Command line tool, Using the Web Service, Web Applications Deployment.

### **Reference Books:**

1. Stephen Walther, *ASP.NET 4 Unleashed*, Sams Publishing, 2010.
2. George Shepherd, *Microsoft ASP.NET 4 Step by Step (Microsoft)*, Paperback Edition, 2010.
3. Scott Mitchell, *Teach Yourself ASP.NET 4 in 24 Hours*, Complete Starter Kit, 2010.
4. A. Russell Jones, *Mastering Asp.Net with Visual C#*, CA, USA: SYBEX Inc. Alameda 2002
5. Wallace B. McClure, *Professional ADO.NET 2: Programming with SQL Server 2005, Oracle, and MySQL* Wrox 2005.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Design and Analysis of Algorithms**

**Course Code: CSA577**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

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

**Course Outcomes:**

<b>CO-1</b>	To develop proficiency in problem solving and Analysis of various Algorithms for mainly Time and Space Complexity.
<b>CO-2</b>	To understand the String processing and Greedy techniques.
<b>CO-3</b>	To get a good understanding of dynamic programming and back tracking techniques
<b>CO-4</b>	To develop a base for Branch and Bound algorithms and Complexity Theory.

**UNIT – A**

**10 Hours**

**Algorithms and Analysis**

- Introduction
- Algorithms specification
- Recursive algorithms
- Space and Time Complexity
- Asymptotic Notation ( $O$ ,  $\Theta$  and  $\Omega$ ) practical complexities, Best, average and worst case performance of algorithms
- Introduction to recurrence relations

**Divide and Conquer**

- General method,
- Binary Search, Merge sort, Quick sort, Selection sort,
- Analysis of these problems

**UNIT – B**

**10 Hours**

**String Processing and Greedy Method**

- KMP
- Boyre-Moore
- Robin Karp algorithms

**Greedy Method**

- General Method, Knapsack problem
- Job sequencing with deadlines
- Minimum spanning Trees
- Single Source Shortcut paths and analysis of these problems

**UNIT – C**

**10 Hours**

**Dynamic Programming**

- General method, Optimal Binary Search Trees
- 0/1 Knapsack
- The Travelling Salesperson Problem

**Back Tracking**

- General method, 8 queen's problem

**Master of Computer Applications  
Syllabus 2022-24**

- Graph Coloring
- Hamiltonian Cycles
- Analysis of these Problems

**UNIT – D**

**15 Hours**

**Branch and Bound**

- Least Cost Search and LC Branch and Bound
- Bounding
- FIFO Branch and Bound
- 0/1 Knapsack Problem
- Travelling Salesperson Problem

**Introduction to Complexity Theory**

- NP-Hard and NP-Complete Problem
- Basic concepts, Cook's theorem, examples of NP-Hard problems
- Approximation Algorithms

**Reference Books:**

1. Horowitz, Ellis and Sahni, *Fundamentals of Computer Algorithms*, New Delhi: Galgotia Publications, 2nd Edition, 2008
2. Aho, A.V., Hopcroft, J.E., Ullman, J.D., *The Design and Analysis of Computer Algorithms*, Addison-Wesley, First Edition, 2003.
3. Bentley, J.L., *Writing Efficient Programs*, New Delhi: Prentice-Hall India, Eastern Economy Edition, 2009.
4. Goodman, S.E. & Hedetniemi, *Introduction to the Design and Analysis of Algorithms*, New Delhi: Tata McGraw-Hill Book Comp, 2004.
5. Anany Levitin, *Introduction to the Design and Analysis of Algorithms*, Pearson Education, 3<sup>rd</sup> Edition, 2012.
6. Michael T Goodrich and Roberto Tamassia : *Algorithm Design*, Wiley India, 2002.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Computer Based Optimization Techniques**  
**Course Code: CSA578**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

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

**Course Outcomes:**

<b>CO-1</b>	Acquainted with various quantitative techniques which are of great importance for quantitative decision-making.
<b>CO-2</b>	Acquainted with the application of statistical techniques in business decision making.
<b>CO-3</b>	This course is an introduction to a broad range of mathematical techniques for solving problems that arise in management to allocate resources and their effective utilization.
<b>CO-4</b>	Understand the concepts and techniques of Operations Research for business decision making and to acquire required skills to solve various problems in OR.

**UNIT – A**

**10 Hours**

**Introduction**

- The Historical development
- Nature, Meaning and Management Application of Operations Research Modelling
- Its Principal and Approximation of O.R.Models
- Main Characteristic and Phases
- General Methods of solving models
- Scientific Methods, Scope, Role on Decision Making
- Development of Operation Research in India

**UNIT – B**

**15 Hours**

**Linear Programming**

- Mathematical formulation of linear programming problems
- Canonical and standard forms of linear programming problems
- Solution by Graphical & Simplex method
- Revised simplex method
- Two phase & Big-M method, Duality, Primal-Dual Relationship
- Simplex Method
- Economic Interpretation of Optimal simplex Solution

**Special Types of Linear Programming Problems**

- Transportation
- Assignment Problems

**UNIT – C**

**10 Hours**

**Master of Computer Applications**  
**Syllabus 2022-24**

**Integer & Dynamic Programming**

- Integer programming problem
- Branch and Bound Techniques
- Characteristics
- Deterministic DP Problems, Recursive Approach and Tabular method

**PERT / CPM**

- Project Planning
- Scheduling
- Activity Cost
- Network Diagram Representation
- Difference between CPM and PERT
- Floats and Slack Times

**UNIT-D**

**10 Hours**

**Queuing Models**

- Introduction, Applications
- Characteristic, Waiting and Ideal time costs
- Transient and Steady states
- Kendall's Notations
- M/M/1, M/M/C, M/Ek/1 and Deterministic Models

**Reference Books:**

1. Hiller, F.S. & Liberman, G.J., *Introduction to Operations Research*, 10<sup>th</sup> Ed. London Holden Day Inc., 2017.
2. Tara, H.A., *Operations Research*, 8<sup>th</sup>Edn., New Delhi:PHI, 2007.
3. Beightler, C.S. & Phillips, D.T., *Foundations of Optimisation*, 2nd.Edn. New Delhi: Prentice-Hall, 1979.
4. McMillan Claude Jr., *Mathematical Programming*, 2nd. Edn., J. Wiley Series, 1975.
5. Srinath, L.S., *Linear Programming*, New Delhi: East-West, 1983..
6. Churchman, C.W. & Arnchoff, E.L., *Introduction to Operations Research*, New York: John Wiley and Sons, 1988.
7. Srinivasan G., *Operations Research: Principles and Applications*, PHI, 2010
8. Prasad Durga, M.V, *Operations Research* , Cengage Publications, 2012.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advanced JAVA & Network Programming**

**Laboratory**

**Course Code: CSA528**

L	T	P	Credits	Marks
0	0	4	2	50

- Implementation of Swings Components
- Implementation of Events Listeners
- Implementation of Remote Method Invocation
- Implementation of Database Connectivity
- Implementation of network protocol design, socket programming using JAVA

**Course Outcomes:**

<b>CO-1</b>	Learn to Create Graphical User Interface (GUI) using AWT and swing components.
<b>CO-2</b>	To understand creating GUI based application, Data Base Connectivity and Remote method Invocation.
<b>CO-3</b>	Attain the basic knowledge of TCP and UDP protocols.
<b>CO-4</b>	Learn to create, design and implement sockets and user data gram protocols.

**Course Title: Advanced Web Technology**

**Laboratory**

**Course Code: CSA529**

L	T	P	Credits	Marks
0	0	4	2	50

- Implementation of ActiveX controls
- Working web forms and web form controls
- Creating web based applications using ADO.Net
- Design Web services and creating XML files for writing and reading data from XML

**Course Outcomes:**

<b>CO-1</b>	Understand, analyze and apply the role of languages like HTML, DHTML, CSS, XML, Javascript, VBScript, ASP, PHP and protocols in the workings of the web and web applications.
<b>CO-2</b>	Analyze a web project and identify its elements and attributes in comparison to traditional projects.
<b>CO-3</b>	Create web pages using HTML, DHTML and Cascading Styles sheets. CO4: Analyze and build interactive web applications using ASP and ASP.NET.
<b>CO-4</b>	Build web applications using PHP, XML documents and XML Schema, and consume web services.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Linux and Shell Programming**

**Laboratory**

**Course Code: CSA530**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>
0	0	4	2	50

- Installation of Linux operating system.
- Working with basic commands
- Implementation of Shell Programming: vi Editor, controls structures, loops
- Creating shell scripts
- Working with C environment in Linux operating System

**Course Outcomes:**

<b>CO-1</b>	Describe the features of the Shell programming.
<b>CO-2</b>	Implementation of linux commands related to Files.
<b>CO-3</b>	Implementation of shell scripts and programming constructs.
<b>CO-4</b>	Process management in linux.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Theory of Computer Science**  
**Course Code: CSA612**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Duration: 45-60 Hours**

**Course Objective:** Understanding and development of theoretical models of computations and their analysis. The models of computations include Finite Automata (and Regular Languages), Push Down Automata (and Context-free Languages), Turing Machine (and their Languages).

**Course Outcomes:**

<b>CO-1</b>	Understanding of regular language, various types of finite automata along with minimization of automata.
<b>CO-2</b>	Ability to develop the finite automata for various regular languages.
<b>CO-3</b>	Understanding of context free language and grammar, ambiguity in grammar and simplification of context free grammar.
<b>CO-4</b>	Understanding of push down automata and ability to develop the push down automata for various context free languages.
<b>CO-5</b>	Understanding of Linear bound automata and ability to develop the Turing machine for various linear bound automata. Understanding of Halting and Undesirability of problem and the Chomsky hierarchy.

**UNIT – A**

**15 Hours**

**Automata Theory**

- Deterministic Finite Automata, Moves
- Non Deterministic Finite Automata
- Moore and Mealy Machines
- Minimization Algorithm

**Regular Languages**

- Regular Sets
- Regular Expressions
- Pumping Lemma for Regular Sets

**UNIT – B**

**15 Hours**

**Context Free Grammars**

- Context free grammars (CFG)
- Derivation Graphs
- Ambiguities in Grammars and Languages
- Properties of Context Free Languages
- Normal Forms
- Pumping Lemma for CFL
- Closure Properties

**Pushdown Automaton**

- Pushdown Automaton (PDA)



**Master of Computer Applications  
Syllabus 2022-24**

- Deterministic Pushdown Automaton (DPDA)
- Non-equivalence of PDA and DPDA
- Language Accepted by PDA

**UNIT – C,**

**15 Hours**

**Linear Bounded Automata (LBA)**

- Power of LBA
- Closure properties

**Turing Machines**

- Turing Machine as A Model of Computation
- Programming with a Turing Machine
- Variants of Turing Machine and Their Equivalence
- Turing Machines and Languages

**UNIT – D**

**15 Hours**

**Undecidability**

- **Chomsky Hierarchy of Languages**
- Recursive and Recursive-Enumerable Languages
- Halting Problem, Undecidable Problems about Turing machines
- Rice theorem
- The Equivalence of the Automata and the Appropriate Grammars

**Reference Books:**

1. G.E. Reevesz, *Introduction to Formal Languages*, New Delhi: McGraw Hill 1983.
2. Hopcroft J. E., Motwani R., and Ullman J. D., *Introduction to Automata Theory, languages, and computation*(2nd ed.), New Delhi: Addison-Wesley, 2001
3. Lewis H.R., Papadimitriou C.H., *Elements of the Theory of Computation* (2nd ed.), NJ:Prentice-Hall,1997.
4. Anderson J.A., *Automata Theory with Modern Applications*, New York: Cambridge University Press, 2006.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Computer Networks and Data Communication**  
**Course Code: CSA628**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** As part of this course, students will be introduced to computer networks and data communication paradigms, about network models and standards, network protocols and their use, wireless technologies.

**Course Outcomes:**

<b>CO-1</b>	Interaction with different hardware devices present in computer networks and discuss various network models.
<b>CO-2</b>	Interaction with data link layer and its protocols.
<b>CO-3</b>	Interaction various Routing algorithms. In addition to that functionality of network layer.
<b>CO-4</b>	Functionality of Transport layer.
<b>CO-5</b>	Implementation of Application layer protocols in real-world scenarios.

**UNIT – A**

**18 Hours**

**Introduction to Data Communication**

- Components of Data Communication, Data Representation
- Transmission Impairments, Switching, Modulation, Multiplexing

**Review of Network Hardware**

- LAN, MAN, WAN
- Wireless networks, Internetworks

**Review of Network Software**

- Layer, Protocols, Interfaces and Services

**Review of Reference Models**

- OSI, TCP/IP and their comparison

**Physical Layer**

- Transmission Media: Twisted pair, Coaxial cable, Fiber optics
- Wireless transmission (Radio, Microwave, Infrared)
- Introduction to ATM, ISDN
- Cellular Radio and Communication Satellites

**UNIT – B**

**15 Hours**

**Data Link Layer**

- Framing, Error control, Sliding window protocols (one bit, Go back n, selective repeat)
- Examples of DLL Protocols–HDLC, PPP

**Medium Access Sub layer**

- Channel Allocation, MAC protocols – ALOHA, CSMA protocols
- Collision free protocols, Limited Contention Protocols
- Wireless LAN protocols
- IEEE 802.3, 802.4, 802.5 standards and their comparison

**Bridges**

**Master of Computer Applications  
Syllabus 2022-24**

- Transparent, source routing, remote

**UNIT – C**

**15 Hours**

**Network Layer**

- Design Issues, Routing Algorithms (Shortest Path, Flooding, Distance Vector, Hierarchical, Broadcast, Multicast)
- Internetworking, IP Protocol, ARP, RARP.

**UNIT – D**

**12 Hours**

**Transport Layer**

- Addressing, Establishing and Releasing Connection
- Flow Control, Buffering
- Internet Transport Protocol (TCP and UDP).
- Congestion Control Algorithms (Leaky bucket, Token bucket, Load shedding)

**Application Layer**

- Domain name system, Email, File transfer protocol
- HTTP, HTTPS, World Wide Web.

**Reference Books:**

1. Tanenbaum. Andrew S. ,*Computer Networks*, 4th Edition, New Delhi: PHI, 2013.
2. Forouzan B. A.,*Data Communications and Networking*, Fifth Edition, New Delhi: Tata McGraw Hill, 2017.
3. Stallings William,*Data Computer Communications*, (8th Edition), New Delhi: PHI, 2008.
4. Bary Nance, *Introduction to Networking*, 4th Edition, New Delhi: PHI, 1997.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advances in Operating Systems**

**Course Code: CSA629**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** To understand and learn the fundamentals of Operating System including dealing with memory management, process management, CPU scheduling, deadlocks and distributed operating systems, distributed resource management, real time operating systems and detailed case studies.

**Course Outcomes:**

<b>CO-1</b>	To extend the concepts of synchronization and deadlock detection in case of cooperating processes.
<b>CO-2</b>	To understand the intricacies of Distributed systems viz Distributed Mutual exclusion and deadlock detection, Agreement protocols.
<b>CO-3</b>	To understand Distributed Resource Management techniques.
<b>CO-4</b>	To identify the different features of real time and mobile operating system and to understand the real-life implementation of various concepts in various operating systems like Linux, iOS, Android etc.

**UNIT– A**

**15 Hours**

**Fundamentals of Operating Systems**

- Overview: Synchronization Mechanisms, Processes and Threads , Process Scheduling
- Deadlocks: Detection, Prevention and Recovery, Models of Resources, Memory Management Techniques.

**Distributed Operating Systems**

- Issues in Distributed Operating System, Architecture, Communication Primitives
- Lamport’s Logical clocks,Causal Ordering of Messages
- Distributed Mutual Exclusion Algorithms-Centralized and Distributed Deadlock Detection Algorithms, Agreement Protocols.

**UNIT – B**

**10 Hours**

**Distributed Resource Management**

- Distributed File Systems, Design Issues, Distributed Shared Memory
- Algorithms for Implementing Distributed Shared memory, Issues in Load Distributing
- Scheduling Algorithms, Synchronous and Asynchronous Check Pointing and Recovery,
- Fault Tolerance, Two-Phase Commit Protocol, Nonblocking Commit Protocol, Security and Protection.

**UNIT– C**

**10 Hours**

**Real Time And Mobile Operating Systems**

- Basic Model of Real Time Systems, Characteristics, Applications of Real Time Systems, Real Time Task Scheduling, Handling Resource Sharing,Mobile Operating Systems
- Micro Kernel Design - Client Server Resource Access, Processes

**Master of Computer Applications  
Syllabus 2022-24**

and Threads, Memory Management, File system.

**UNIT – D**

**CASE STUDIES**

- Linux System: Design Principles - Kernel Modules - Process Management Scheduling
- Memory Management, Input-Output Management, File System - Interprocess
- Communication. iOS and Android: Architecture and SDK Framework - Media Layer -
- Services Layer, Core OS Layer, File System.

**Reference Books:**

1. Mukesh Singhal and Niranjan G. Shivaratri, *Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems*, Tata McGraw-Hill, 2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, *Operating System Concepts*, Seventh Edition, John Wiley & Sons, 2004.
3. Daniel P Bovet and Marco Cesati, *Understanding the Linux kernel*, 3rd edition, O'Reilly, 2005.
4. Rajib Mall, *Real-Time Systems: Theory and Practice*, Pearson Education India, 2006.
5. Neil Smyth, *iPhone iOS 4 Development Essentials – Xcode*, Fourth Edition, Payload media, 2011.

**Master of Computer Applications  
Syllabus 2022-24**

**Title: Artificial Intelligence**  
**Course Code: CSA676**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

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

**Course Outcomes:**

<b>CO-1</b>	Interaction with areas in which AI is implemented.
<b>CO-2</b>	Interaction with FL and FOPL. Representation of knowledge in an expert system.
<b>CO-3</b>	Principle of various searching algorithms. Characteristics if various expert system developed in the past.
<b>CO-4</b>	Implementation of AI in the field of NLP.
<b>CO-5</b>	Implementation of AI in the field of pattern recognition and in real-world scenarios.

**UNIT – A**

**15 Hours**

**Introduction**

- Background and History
- Overview of AI applications Areas

**The Predicate Calculus**

- Syntax and Semantic for Propositional Logic and FOPL
- Clausal Form, Inference Rules
- Resolution and Unification

**Knowledge Representation**

- Network Representation-Associative Network & Conceptual Graphs
- Structured Representation- Frames & Scripts

**UNIT – B**

**15 Hours**

**Search Strategies**

- Strategies For State Space Search-Data Driven And Goal Driven Search
- Search Algorithms- Uninformed Search (Depth First, Breadth First, Depth First With Iterative Deepening) And Informed Search (Hill Climbing, Best First, A\* Algorithm, Etc.)
- Computational Complexity
- Properties of Search Algorithms-Admissibility
- Monotonicity, Optimality, Dominance

**Expert Systems**

- Introduction, Examples
- Characteristics Architecture, People Involved and Their Role in Building an Expert Systems
- Case Studies of Expert Systems, MYCIN And DENDRAL;

**Master of Computer Applications  
Syllabus 2022-24**

Features of Knowledge Acquisition Systems : MOLE And SALT

**UNIT – C**

**15 Hours**

**Natural Language Processing**

- Component Steps of Communication
- Contrast Between Formal and Natural Languages in the Context of Grammar
- Grammars and languages
- Basic parsing techniques

**Introduction to AI languages**

- Introduction to LISP
- Introduction to Prolog

**UNIT-D**

**15 Hours**

**Planning**

- Basic Representation for Planning
- Symbolic-Centralized Vs. Reactive-Distributed

**Pattern Recognition**

- Introduction
- Recognition & Classification Process
- Learning classification patterns
- Clustering

**Reference Books:**

1. Elaine Rich, Kevin Knight and Nair Shiva Shankar B, *Artificial Intelligence*, Third Edition, New Delhi: Tata-McGraw Hill, 2017.
2. Winston, P.H. and Horn, B.K.P, *LISP*, Pearson, 1993.
3. Rajasekharan, S. and VijayalakshmiPai, G. A., *Neural Networks, Fuzzy Logic and Genetic Algorithms*, New Delhi: Prentice Hall of India, 2013.
4. Luger George F., *Artificial Intelligence*, 5<sup>th</sup> edition, Pearson Education, 2001.
5. Patterson Dan W., *Introduction to Artificial Intelligence and Expert system*, New Delhi: PHI, 2005.
6. Bharti &Chaitany, *Natural Language Processing*, New Delhi: PHI, 2006.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Computer Network and Data Communication  
Laboratory  
Course Code: CSA630**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>
0	0	4	2	50

**Course Outcomes:**

<b>CO-1</b>	Interaction with different hardware devices present in computer networks and discuss various network models.
<b>CO-2</b>	Interaction with data link layer and its protocols.
<b>CO-3</b>	Interaction various Routing algorithms. In addition to that functionality of network layer.
<b>CO-4</b>	Functionality of Transport layer.
<b>CO-5</b>	Implementation of Application layer protocols in real-world scenarios.

- Specifications of latest desktops and laptops.
- Familiarization with Networking Components and Devices: LAN Adapters, Hubs, Switches, Routers etc.
- Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
- Preparing straight and cross cables.
- Study of various LAN topologies and their creation using network devices, cables and computers.
- Configuration of TCP/IP Protocols in Windows and Linux.
- Implementation of file and printer sharing.
- Designing and implementing Class A, B, C Networks
- Subnet planning and its implementation
- Installation of ftp server and client
- Implementation of Various routing protocol (With the help of simulation)



**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Technical Writing & Communication Skills**  
**Course Code: ENG551**

L	T	P	Credits	Marks
0	0	2	1	25

**Course Outcomes:**

<b>CO-1</b>	Understand professional writing by studying management communication contexts and genres, researching contemporary business topics.
<b>CO-2</b>	Recognize, explain, and use the formal elements of specific genres of organizational communication: white papers, recommendation and analytical reports.

**Technical Writing** - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

**Communication Skills** - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Data Mining and Data Warehousing**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Code: CSA605**

**Course Duration: 45-60 Hours**

**Course Objective:** To introduce the concepts and techniques of data mining and data warehousing, including concept, principle, architecture, design, implementation, applications of data warehousing and data mining.

**Course Outcomes:**

<b>CO-1</b>	To understand Basic Systems Concepts and Data Warehouse Design Process.
<b>CO-2</b>	To understand Data Mart in detail.
<b>CO-3</b>	Student must be able to understand Data Preprocessing and Outlier detection.
<b>CO-4</b>	Student must know Classification and Clustering.

**UNIT-A**

**10 Hours**

**Introduction**

- Basic Systems Concepts, Differences between Operational Database system and Data Warehouse, Need of Separate Data Warehouse, Data Warehouse Models (Enterprise, Data Mart and Virtual Data Warehouse), Extraction Transformation and Loading, Metadata repository
- Data Warehouse Design Process, Two Tier and Three-Tier Data Warehouse Architecture, Data Warehouse Modelling (Data Cube and OLAP), Data Warehouse Implementation, From online Analytical Processing to Multidimensional Data Mining.
- OLAP, ROLAP, MOLAP and HOLAP, Data Warehouse Back-End Tools and Utilities, Data Cubes, Efficient Computation of Data Cubes

**UNIT-B**

**13 Hours**

**Data Mart**

- Types of Data Marts, Loading a Data Mart, Metadata for a Data Mart, Monitoring requirements for a Data Mart, Security in Data Mart
- From Data Warehouse to Data Mining, Steps of Data Mining Process, Types of Data Mining Tasks, Trends and Application of Data Mining, Statistical Data Mining, Visual and Audio Data Mining, Ubiquitous and invisible Data Mining.
- Privacy, Security and Social Impacts on Data Mining
- Machine Learning, Information Retrieval, Business Intelligence, Major issues in Data Mining.
- Data Objects and Attribute Types, Statistical Description of Data, Data Visualization, Measuring Data Similarity and Dissimilarity, Data Cube Computation, General Strategies for Data Cube Computation

**UNIT-C**

**12 Hours**

**Master of Computer Applications  
Syllabus 2022-24**

**Data Preprocessing:**

- Major Tasks in Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

**Outlier detection:**

- Outliers and their Types, Challenges of Outlier Detection, Statistical Approach to Outlier Detection
- Market Basket Analysis, Frequent Itemsets, Closed Itemsets and Association Rules
- Apriori Algorithm, Improving Efficiency of Apriori algorithm, From Association to Correlation Analysis.

**UNIT-D**

**10 Hours**

**Classification:**

- General Approach to Classification, Decision Tree Induction, Bayes Classification, Rule based Classification, Genetic Algorithm, Random forest, Support Vector Machine Rough Set Approach, Confusion Matrix, Metrics for Evaluating Classifier Performance, Cross Validation

**Clustering:**

- Cluster Analysis, Requirement for Cluster Analysis, Partitioning Methods, Hierarchical Methods, DBSCAN, OPTICS, CLIQUE, Clustering Graph and Network Data.

**Reference Books:**

1. Inmon W. H., *Building the Data Warehouse*, New York: John Wiley 2002.
2. Inmon W. H., *Data Warehousing and Knowledge Management*, New York: John Wiley 1996.
3. Ramez Elmasri, Shamkant B., Navathe, *Fundamentals of Database Systems*, New Delhi: Pearson Education, 2009.
4. Han, Kamber, Morgan Kaufmann, *Data Mining: Concepts and Techniques*, 2<sup>nd</sup> Edition, Elsevier, 2012.
5. Inmon, W.H., C. L. Gasey, *Managing the Data Warehouse*, New York: John Wiley 1999.
6. Fayyad, Usama M., *Advances in Knowledge Discovery and Data Mining*, MIT Press, 1996.
7. Charu C. Aggarwal, *Data Mining: The Textbook*, Springer, 2015.
8. Hongbo Du, *Data Mining Techniques and Applications: An Introduction*, Cengage India, 2010.
9. Tan, Steinbach, Kumar, *Introduction to Data Mining*, Pearson India. 2016.
10. Alex Berson, Stephen Smith, *DATA WAREHOUSING, DATA MINING, & OLAP*, McGraw Hill Education, 1997.
11. Prasad R.N., *Fundamentals of Business Analytics*, Wiley India, Second Edition, 2016
12. Shroff G., *The Intelligent Web: Search, smart algorithms, and big data*, Oxford University Press, 2013.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Mobile Computing**  
**Course Code: CSA606**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** To familiarize students with wireless technology, wireless networking, WAP architecture, WAP applications, database management issues like data replications in mobile computers, data delivery models, mobile agent computing, security in wireless and mobile systems.

**Course Outcomes:**

<b>CO-1</b>	To understand concepts of Mobile Communication.
<b>CO-2</b>	To understand Wireless Networking.
<b>CO-3</b>	Student must be able to understand Data Management Issues and Data delivery models
<b>CO-4</b>	Student must know Mobile Agent Computing and Security in Wireless and Mobile Systems.

**UNIT-A**

**10 Hours**

**Introduction**

- Issues in Mobile Computing
- Overview of Wireless Telephony: cellular concepts, GSM, Channel structure.
- Location Management: HLR-VLR, handoffs, channel allocation in cellular systems, CDMA, GPRS
- Impacts of mobility and portability in computational model and algorithms for mobile environment.
- Analysis of algorithms and termination detection.

**UNIT-B**

**10 Hours**

**Wireless Networking**

- Wireless Networking
- Wireless LAN Overview: MAC Issues, IEEE802.11, Bluetooth, Wireless multiple access protocol, TCP over wireless
- Wireless applications, Data broadcasting, Mobile IP
- WAP Architecture: Protocol Stack, Application Environment, Applications

**UNIT-C**

**10 Hours**

**Data Management Issues**

- Data Replication for mobile computers
- Adaptive Clustering for wireless networks, File System, Disconnected operations

**Data delivery models**

- Push and pull. Data dissemination in wireless channels
- Broadcast disks. Effects of caching

**UNIT-D**

**15 Hours**

## **Master of Computer Applications Syllabus 2022-24**

### **Mobile Agent Computing**

- Transaction processing in Mobile Computing Environment

### **Security in Wireless and Mobile Systems**

- Security and fault tolerance, Threats, Vulnerabilities, Attacks, Integrity, Confidentiality, Policy and relevant definitions
- Authentication – Different techniques
- Cryptography – Symmetric Key Cryptography, Asymmetric key Cryptography, Key management, Digital signatures, Certificate
- Wireless and Mobile system security – Strategies, Routing security, Different schemes for MANET

### **Reference Books**

1. Adelstein Frank, Gupta S.K.S., Richard G.III and Schiwebert Loren, *Fundamentals of Mobile and Pervasive Computing*, New Delhi: McGraw-Hill Professional, 2005.
2. T. Rappaport, *Wireless Communication: Principles and Practice*, New Delhi: Pearson Education (2<sup>nd</sup> Ed), 2010.
3. Reza B'Far (Ed), *Mobile Computing Principles*, New York: Cambridge University Press, 2005.
4. Bellavista Paolo and Corradi Antonio (Eds.), *Handbook of Mobile Middleware*, Auerbach Publication, 2006.
5. Schiller J., *Mobile Communications*, New Delhi: Addison Wesley, 2008.
6. Perkins Charles, *Mobile IP*, New Delhi: Addison Wesley, 2008.
7. Upadhyaya, *Mobile Computing, Implementing Pervasive Information and communications Technologies* Springer, 2008.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Emerging Trends in Information Technology**  
**Course Code: CSA607**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** This course provides understanding of emerging trends in multimedia, lossless and lossy compression techniques, wireless delivery techniques, software intelligent agent and familiarize students with emerging technologies such as Multimedia, Parallel Computing, Mobile Computing and intelligent Agent Technologies.

**Course Outcomes:**

<b>CO-1</b>	To understand basic concepts of Information Technology and Multimedia Systems.
<b>CO-2</b>	To understand Compression Technologies of Multimedia and Audio and Video Conferencing.
<b>CO-3</b>	Student must be able to understand Data Management technologies and Networking Technologies.
<b>CO-4</b>	Student must know Mobile Computing and Intelligent Agent Technology.

**UNIT-A**

**10 Hours**

**Introduction to Information Technology**

- Latest development in Computer hardware :RISC V/S CISC architecture,
- Intel V/S, Motorola chips, Computer peripherals.
- Programming Paradigms, Software Agents, Interoperable objects

**Multimedia Systems**

- Architecture and Subsystems of Multimedia Computer Systems
- Multimedia applications, multimedia building blocks (text, hypertext, image, audio, video, animation)
- Multimedia Authoring- Introduction, methodologies (Frame Based, Time based, Icon Based)

**UNIT-B**

**10 Hours**

**Compression Technologies of Multimedia**

- Introduction and Need of Compression
- Compression Basics, Lossless Compression Techniques
- Lossy Compression Techniques

**Audio and Video Conferencing**

- Technology & Applications
- Application to information technology to various function areas such as education, banking, communication etc.

**UNIT-C**

**10 Hours**

**Data Management technologies**

**Master of Computer Applications  
Syllabus 2022-24**

- Data Ware Housing and Data Mining
- Data Marts and Conceptual Foundation of ERP

**Networking Technologies**

- Computer Networks, LAN, WAN, MAN, topologies.
- Internet, ISDN, PSDN, Wireless Networks
- Internet Telephony, Virtual learning environment, Mobile communications.
- IP Addressing

**UNIT-D**

**15 Hours**

**Mobile Computing**

- Mobile connectivity-Cells, Framework, wireless delivery technology and switching methods
- Mobile information access devices, mobile data internetworking standards
- Cellular data communication protocols, mobile computing applications
- Mobile databases-protocols, scope, tools and technology, M-Business

**Intelligent Agent Technology**

- Introduction to agents, intelligent software systems
- Attributes, intelligent architectures, components of intelligent agent based distributed systems
- Agent communication protocols, Internetworking applications of intelligent Agents.

**Reference Books**

1. Jeffcoate and Judith, *Multimedia in Practice*, Technology & Practice, New Delhi: PHI, 2003.
2. Multiagent Systems, *A Modern Approach to Distributed Artificial Intelligence*, London: Edited by Gerhard Weiss, The MIT Press, 1999.
3. Vaughan and Tay, *Multimedia Making It Work*, TMH, 7th Edition, 2008.
4. Bannerjee and Rahul, *Internetworking Technologies: An Engineering Perspective*, New Delhi: PHI, 2003.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Distributed and Parallel Processing**  
**Course Code: CSA608**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** The objective of this course is to introduce students to the fundamentals and techniques of distributed computing, distributed operating systems and provides them with the basic skills of how to write distributed programs. Topics to be covered include: distributed computing, parallel processing, parallel processing architecture, concurrency, inter-process communications, distributed objects, application programming interfaces (RMI, RPC).

**Course Outcomes:**

<b>CO-1</b>	To understand basic concepts distributed systems and Inter-process Communication
<b>CO-2</b>	To understand Distributed Operating Systems and Parallel Processing.
<b>CO-3</b>	Student must be able to understand Parallel Processing Architectures, Data Dependency Analysis and Thread Based Implementation.
<b>CO-4</b>	Student must know Recovery and Fault Tolerance and Algorithms for Parallel Machines.

**UNIT-A**

**15 Hours**

**Introduction**

- Definition, Characteristics, Goals and applications of Distributed Computing,
- Basic design issues and user requirements

**Inter-process Communication**

- Client Server Communication, Group Communication
- IPC in UNIX. Remote Procedure Calls
- Design issues and implementation

**UNIT-B**

**15 Hours**

**Distributed Operating Systems**

- Introduction, The Kernel, Process and Threads, Communication.
- Simple distributed transactions and Nested transactions, Atomic Commit protocols
- Concurrency control, N distributed transaction,
- Distributed deadlocks
- Transactions with replicated data.

**Parallel Processing**

- Introduction, Need for Computational speed; Applications of parallel computers in various fields including Mathematics, Physics, Chemistry and Computer Science

**UNIT-C**

**15 Hours**



**Master of Computer Applications  
Syllabus 2022-24**

**Parallel Processing Architectures**

- Parallelism in Sequential Machines, Abstract model of parallel computer
- Multiprocessor architecture, programmability issues

**Data Dependency Analysis**

- Types of Dependencies, Loop and Array Dependence
- Loop Dependence Analysis, Solving Diophantine Equations.

**Thread Based Implementation**

- Thread Management, Thread Implementation

**UNIT-D**

**15 Hours**

**Recovery and Fault Tolerance**

- Transaction recovery, Fault tolerance, Hierarchical and group masking of faults.

**Algorithms for Parallel Machines**

- Speedup, Complexity and Cost, Parallel Reduction
- Quadrature Problem, Matrix Multiplication
- Parallel Sorting Algorithms and Solving Linear System

**Reference Books:**

1. Sasikumar. M., Shikhara, Dinesh and Prakash Ravi, *Introduction to Parallel Processing*, New Delhi: PHI, 2014.
2. Coulouris George, Dollimore Jean, KindbergTim, *Distributed Systems: Concepts and Design*, New Delhi:Pearson Education 5th edition, 2011.
3. Madnick and Donovan, *Operating System*, New delhi: McGraw Hill, 2017.
4. Wilkinson and Barry, *Parallel Programming Techniques & Applications*, New Delhi: Pearson Education, 2007.
5. Crichlow and Joel M., *An Introduction to Distributed and Parallel Computing*, New delhi: PHI, 1997.
6. RajaramanV., *Elements of Parallel Computing*, New Delhi:PHI, 1990
7. A.S. Tenenbaum, *Operating System: Design and Implementation*, New Delhi:PHI, 2006.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Information Systems**  
**Course Code: CSA609**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
	0	0	4	100

**Course Objective:** This course provides a comprehensive understanding of the information systems, types of systems, subsystems, management information systems, decision support systems, expert systems, enterprise information systems and decision making and analysis.

**Course Outcomes:**

<b>CO-1</b>	To understand basic concepts System and Information Concepts and Management Information System.
<b>CO-2</b>	To understand Decision Support Systems.
<b>CO-3</b>	Student must be able to Expert System and Executive Information and Support Systems.
<b>CO-4</b>	Student must know Decision Making Systems, Modelling and Analysis.

**UNIT-A**

**15 Hours**

**System and Information Concepts**

- General Model, Types of systems, Subsystems
- Attributes of Information, Evolution of Information Systems, categories of Information Systems, Building and Maintaining Information Systems
- Feedback Control, Systems approach to organization, Law of requisite variety, Control by exception
- Information Concepts, Types of Information, Quality of Information, Value of Information

**Management Information System**

- Definitions, Role of MIS, MIS in Academics
- Structure of MIS based on management activity and functions System and Information concepts to MIS

**UNIT-B**

**10 Hours**

**Decision Support Systems**

- Conceptual Foundations of DSS, Concepts of DSS
- DSS Software, Strategies for DSS, GDSS, and Executive Support System (ESS),
- Fundamentals of Knowledge Management systems, Knowledge Based Decision Support
- DSS Application, Case Study

**UNIT-C**

**10 Hours**

**Expert System**

- Basic concepts of Expert System, Structure of Expert System, How Expert System works

**Master of Computer Applications  
Syllabus 2022-24**

- Expert System Application, Comparison of Conventional & Expert System
- Case Study

**Executive Information and Support Systems**

- Enterprise & Executive Information System, Concept and Definition
- Information needs of Executives, Characteristics and benefits of EIS
- Comparing and Integrating EIS and DSS.

**UNIT-D**

**10 Hours**

**Decision Making Systems, Modelling and Analysis**

- Decision Making Definition and Concept, Phases of Decision Making Process
- Modelling Process, Static and Dynamic Models
- Sensitivity Analysis
- Heuristic programming, Simulation

**Reference Books:**

1. Murdick Robert, Joel E. Ross, *Information Systems for Modern Management*, New Delhi: PHI, 3rd Ed, 1971.
2. Turban E fraim, *Decision Support Systems & Intelligent Systems*, New Delhi: Pearson Education, 2004.
3. Laudon C. Kenneth & Laudon P. Janes, *Management Information Systems*, Pearson Education, 2018.
4. Bellavista Paolo and Corradi Antonio (Eds.), *Handbook of Mobile Middleware*, Auerbach Publication, 2006.
5. Steven Alter, *Information Systems*, 4<sup>th</sup> Edition, Pearson Education, 2003.
6. McNurlin C. Barbara & Spargue H. Ralph, *Information Systems Management in Practice*, fifth Edition, Pearson Education, 2003
7. V. Rajaraman, *Analysis and Design of Information System*, PHI, 3rd Ed, 2011.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: System Simulation and Modelling**  
**Course Code: CSA616**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** In this course, students will analyze specified systems such as inventory system, queuing models and environmental dynamics. They introduce with how to simulate system, simulation techniques, statistical models, random number generations, design and analysis of simulation.

**Course Outcomes:**

<b>CO-1</b>	To understand basic concepts in the Systems and environment and System simulation.
<b>CO-2</b>	To understand Continuous-time and Discrete time Systems.
<b>CO-3</b>	Student must be able to understand Random Numbers.
<b>CO-4</b>	Student must know Queuing Models and Large Scale System.

**UNIT-A**

**12 Hours**

**Systems and environment**

- Concept of model and model building
- Model classification and representation, Use of simulation as a tool, steps in simulation study.

**System simulation**

- Why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods
- Types of system simulation, real time simulation, hybrid simulation
- Simulation of pure-pursuit problem, single-server queuing system and an inventory problem
- Monte-Carlo simulation, Distributed Lag models, Cobweb model

**UNIT-B**

**10 Hours**

**Continuous-time and Discrete time Systems**

- Laplace transform, Transfer functions, state-space models
- Order of Systems, z-transform, feedback systems, Stability, observability, controllability
- Statistical Models in Simulation: Common Discrete and Continuous Distribution, Poisson process empirical distribution

**UNIT-C**

**13 Hours**

**Random Numbers**

- Properties of random numbers, generation of pseudo random numbers
- Techniques of random number generations, tests for randomness
- Random variate generation using inverse transformation

**Master of Computer Applications  
Syllabus 2022-24**

- Direct transformation, convolution method, acceptance-rejection

**Design and Analysis of Simulation Experiments**

- Data collection, identifying distributions with data, parameter estimation
- Goodness of fit tests, selecting input models without data
- Multivariate on time series input models, static and dynamic simulation
- output analysis
- Steady state simulation, terminating simulation confidence interval estimation, output analysis for steady state stimulation, variance reduction techniques

**UNIT-D**

**10 Hours**

**Queuing Models**

- Characteristics of queuing systems, notation, transient and steady-state behaviour performance, network of queue

**Large Scale System**

- Model reduction, hierarchical control
- Decentralized control structural properties of large scale systems

**Reference Books:**

1. Law Averill, *System Simulation Modeling and Analysis*, New Delhi: Tata McGraw-Hill, 2014.
2. Gordan G., *System Simulation*, New Delhi: Pearson Education, 2<sup>nd</sup> Ed. 2015
3. Deo Narsingh, *System Simulation with Digital Computer*, New Delhi: Prentice Hall of India, 2011.
4. Banks J., Garson J.S., Nelson B.L., *Discrete Event System Simulation*, New Delhi: Prentice Hall of India, 4<sup>th</sup> Ed. 2005.
5. SeilaA.F., Ceric V. and TadikamallaP., *Applied Simulation Modeling*, Thomsan Learning, International Student Edition, 2004
6. Banks Jerry, *Handbook of Simulation: Principles, Methodology, Advances, Application and Practice*, New York: Wiley Inter Science, 1998

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Embedded Systems**

**Course Code: CSA617**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** This course provides the knowledge of embedded systems, their applications like Industrial and control applications, networking and telecom applications, common architectures, programming for embedded systems, programming for microcontrollers, Interfacing, and Simulation of PERT Networks.

**Course Outcomes:**

<b>CO-1</b>	To understand basic concepts in the embedded computing systems area.
<b>CO-2</b>	To determine the optimal composition and characteristics of an embedded system.
<b>CO-3</b>	Student must be able to understand Interfacing and Communication Links and Operating Systems for Embedded Systems.
<b>CO-4</b>	Student must know Applications of Embedded Systems and Simulation of PERT Networks.

**UNIT-A**

**12 Hours**

**Introduction to Embedded Systems**

- Overview of embedded systems, features, requirements and applications of embedded systems
- Recent trends in the embedded system design, common architectures for the ES design
- Embedded software design issues, communication software
- Introduction to development and testing tools
- Architecture of Embedded Systems - Hardware Architecture, Software Architecture, Communication Software, Development/Testing Tools

**Programming for Embedded Systems**

- The Process of Embedded System Development - Design Trade-offs, Hardware Software co-design, Implementation, Integration and Testing

**UNIT-B**

**13 Hours**

**Embedded System Architecture**

- Basics of 8 – bit RISC microcontroller (PIC), block diagram
- Addressing modes, instruction set, timers, counters, stack operation, programming using PIC controller
- Basics of 32 – bit microprocessor (ARM), processor and memory organization, data operations, flow of control, pipelining in ARM, ARM bus (AMBA)

**Embedded Software**

- Programming for microcontrollers such as Intel 8051 and PIC

## **Master of Computer Applications Syllabus 2022-24**

- Overview of Java 2 micro edition (J2ME), concept of a MIDLET, applications of J2ME in mobile communication.

### **UNIT-C**

**10 Hours**

#### **Interfacing and Communication Links**

- Serial interfacing, real time clock, SPI / micro wire bus, I2C bus, CAN bus
- PC parallel port, IRDA data link, PCI bus architecture

#### **Operating Systems for Embedded Systems**

- OS Fundamentals, processes and threads, context switching, scheduling issues, inter task communication
- Introduction to memory management, evaluating OS performance, real time operating systems, popular RTOS and their applications.

### **UNIT-D**

**10 Hours**

#### **Applications of Embedded Systems**

- Industrial and control applications, networking and telecom applications
- DSP and multimedia applications, applications in the area of consumer appliances, concept of smart home

#### **Simulation of PERT Networks**

- Critical path computation, uncertainties in activity duration, resource allocation and consideration
- Simulation languages and software, general purpose vs. application - oriented simulation packages

### **Reference Books**

1. Dreamtech Software team, *Programming for Embedded Systems*, New York: Willey – dreamtech, 2002.
2. Lewis Daniel W., *Fundamentals of Embedded Software, where C and assembly meet*, New Delhi: Pearson Education, 2001.
3. Peatman John B., *Design with PIC Microcontrollers*, New Delhi: Pearson Education, 1997.
4. Yuan Michael Juntao, *Enterprise J2ME – Developing Mobile Java Applications*, New Delhi: Pearson Education, 2003.
5. Reese Robert B., *Microprocessors: From assembly language to C using PIC18Fxx2*, Shroff Publishers and Distributors Pvt Ltd. 2005
6. Andrew N. Sloss, Dominic Symes, Chris Wright, *ARM System Developer's Guide – Designing and Optimizing System Software*, Elsevier Publications, 2007
7. SilberschatzA., Galvin P.B. and Gagne G., *Operating System Concepts*, New York: John Wiley & Sons, Inc., 6<sup>th</sup> 2001

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Advanced Software Engineering**  
**Course Code: CSA619**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** This course provides the understanding of software project planning, various software process models, system design analysis, various testing techniques and software engineering tools.

**Course Outcomes:**

<b>CO-1</b>	Understand lifecycle processes and agile approaches of software Development.
<b>CO-2</b>	Apply novel software models and techniques to bring out innovative and solutions for the growth of the society.
<b>CO-3</b>	Model and Analyze structure and behavior of a software system.
<b>CO-4</b>	Design a solution to a given problem and evaluate the same in various scenarios.
<b>CO-5</b>	Create efficient software development approaches for service of technical as well as common society needs.

**UNIT-A**

**15 Hours**

**Introduction**

- Software Engineering goals, Characteristics, Components Applications
- Software Process Models: Waterfall, Spiral, Prototyping, Fourth Generation Techniques
- Concepts of Project Management, Role of Metrics And Measurement
- Software requirements, Definition, Software requirements specifications (SRS), Components of SRS.
- Software engineering features (data abstraction exception handling and concurrency mechanism).

**Software Project Planning**

- Objectives, Decomposition Techniques: Software Sizing, Problem Based Estimation
- Process Based Estimation, Cost Estimation Models: COCOMO Model, The Software Equation

**UNIT-B**

**10 Hours**

**System Analysis**

- Principles of Structured Analysis, Requirement Analysis
- DFD, Entity Relationship Diagram, Data Dictionary

**Software Design**

- Objectives, Principles, Concepts
- Design Mythologies: Data Design, Architecture Design
- Procedural Design, Object–Oriented Concepts



**Master of Computer Applications  
Syllabus 2022-24**

**UNIT-C**

**10 Hours**

**System Administration and Training**

- User manual, Implementation Documentation, Operation plan and maintenance

**Hardware and Software Selection**

**UNIT-D**

**10 Hours**

**Testing Fundamentals**

- Objectives, Principles, Testability
- Test Cases: White Box & Blackbox Testing
  
- Testing Strategies: Verification & Validation
- UNIT Test, Integration Testing, Validation Testing, System Testing
- Software documentation procedures, Software reliability and quality assurance. Quality Matrics and software models
- Software maintenance and configuration management

**Software engineering tools and environment**

- International software engineering standards and their relevance
- Case studies in software engineering

**Reference Books:**

1. Fairley, R.E., *Software Engineering Concepts*, New Delhi: McGraw Hill, 1997.
2. Lewis, T.G., *Software Engineering*, New Delhi: McGraw Hill, 1982.
3. Ochoa Sergio and Roman Gruia-Catalin, *Advanced Software Engineering*, Spinger, 2006.
4. Pressman, *Software Engineering*, New Delhi: Tata McGraw Hill, 2002.
5. Meyers, G., *The Art of Software Testing*, NJ: Wiley-Inter-Science, 2004.
6. Sommerville, Ian, *Software Engineering*, Addison Wesley, 9<sup>th</sup> Ed, 2010.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Compiler Design**  
**Course Code: CSA620**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** This course provides a comprehensive understanding of phases of compiler, finite automata, regular expressions, syntax-directed translation & implementation, code generation and run time environment.

**Course Outcomes:**

<b>CO-1</b>	Student must be able to understand Structure of A Compiler and Syntax Analysis.
<b>CO-2</b>	Student must be able to learn Syntax Directed Translation.
<b>CO-3</b>	Student must be able to understand Run Time Environment.
<b>CO-4</b>	Student must know Code Generation & Code Optimization.

**UNIT-A**

**13 Hours**

**The Structure of A Compiler**

- Phase of a Compiler, Compiler Tools, Finite Automata, Regular Expressions
- Conversion From Regular Expression To Finite Automata

**Syntax Analysis**

- Context Free Grammars, Top Down & Bottom Up Parsing Techniques
- Parsing Table Construction, LR, SLR & LALR Parsers.

**UNIT-B**

**12 Hours**

**Syntax Directed Translation**

- Syntax-directed translation & implementation, Intermediate Code, Postfix translation
- Parse Trees, Syntax Trees

**UNIT-C**

**Run Time Environment**

**10 Hours**

- Storage Organization Allocation Strategies, Parameter Passing
- Symbol Tables, Code Generation, Problem In Code Generation

**UNIT-D**

**Code Generation & Code Optimization**

**10 Hours**

- Principle Sources, Loop Optimization, DAG Representation

**Master of Computer Applications  
Syllabus 2022-24**

**Reference Books:**

1. Aho, Alfred V. and Ullman Jeffery D., *Principles of Compiler Design*, Addison-Wesley, 1977.
2. Barrett, *Compiler Construction*, Prentice Hall
3. Trembley, Jean-Paul & Paul G. Sorenson, *The Theory and Practice of Compiler Writing*, New York: McGraw Hill, 1985.
4. Keith Cooper and Linda Torczon, *Engineering a Compiler*, Morgan Kaufmann Publishers, 2011
5. Dhamdhare D.M, *Compiler Construction—Principles and Practice*, Macmillan India, 2008
6. Gaddis. David, *Starting out with Modern Compiler Design*, New Delhi: Wiley India Pvt. Ltd, 2005.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Research Methodology**  
**Course Code: CSA627**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** The objective of the study is to let students understand basics of Research design and activities. The focus will be on data analysis and their effective presentation.

**Course Outcomes:**

<b>CO-1</b>	Student must be able to understand Scientific Research, Methods of research, Scope of research and Reviewing the literature.
<b>CO-2</b>	Student must be able to learn Statistical Analysis and Regression & Correlation Analysis.
<b>CO-3</b>	Student must be able to understand Hypothesis testing.
<b>CO-4</b>	Student must be knowing dissertation design and report writing.

**UNIT – A**

**10 Hours**

- Scientific Research: Nature and Objectives of research;
- Methods of research: historical, descriptive and experimental. Motivation in Research, Study and formulation of research problem.
- Scope of research and formulation of hypothesis; Feasibility, preparation and presentation of research proposal.
- Reviewing the literature, Reviews, Meta-analysis, differences between uses of internet networks in research activities in searching material, paper downloading, submission of papers, relevant websites for journals and related research work.

**UNIT-B**

**12 Hours**

- Statistical Analysis: Introduction to statistical analysis: Measures of central tendency and dispersion; mean, median, mode, range, mean deviation and standard deviation.
- Regression and Correlation Analysis, Random Variables and Probability Distribution

**UNIT – C**

**12 Hours**

- Test of Hypothesis: Test of Hypothesis: Basic ideas of testing of hypothesis; Tests of significance based on normal, t and Chi-square distributions. Analysis of variance technique. Design of Experiments: Basic principles, study of completely randomized and randomized block designs.

**UNIT – D**

**11 Hours**

- Introduction to dissertation design and report writing
- Presentation: Tabular and graphical representation of results, quoting of references and preparing bibliography.

**Master of Computer Applications**  
**Syllabus 2022-24**

- Plagiarism: Introduction, types of plagiarism, plagiarism detection tools.

**Reference Books:**

1. Hogg, R.V. & Craig, A. T, *Introduction to Mathematical Statistics*, MacMillan, 1965.
2. Goon, A. M., Gupta, M. K. & Dasgupta, *Fundamentals of Statistics*, Vol. I, World Press, 1975.
3. Gupta, S.C. & Kapoor, V. K, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 1994.
4. Dowdy, S., Wearden, S. and Chilko, D., *Statistics for Research*, Wiley Series (2004)
5. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., *Probability and Statistics for Engineers and Scientists*, Pearson Education (2002).
6. Borth, Wayne C, et. Al. *The Craft of Research Chicago Guides to Writing Edition and Publishing*.
7. Johnson, R.A., *Probability and Statistics*, PHI, New Delhi, 1994.
8. Meyer, P. L, *Introduction to Probability & Statistical Applications*, Oxford, IBH, 1986.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Big Data Analytics**  
**Course Code: CSA632**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:**

- To explore the fundamentals concepts of big data analytics.
- To learn and understand the concept of big data intelligent techniques, various search methods and visualization techniques.

**Course Outcomes:**

<b>CO-1</b>	Student must be Able to understand the building blocks of Big Data.
<b>CO-2</b>	Student must be able to articulate the Mining Data Streams.
<b>CO-3</b>	Student must be able to represent the analytical aspects of Big Data using Hadoop.
<b>CO-4</b>	Student must be know the different Frameworks.

**UNIT – A**

**10 Hours**

**Introduction to Big Data**

- Overview of Big Data, Stages of analytical evolution.
- Challenges of Conventional Systems
- Intelligent data analysis, Nature of Data
- Analytic Processes and Tools
- Analysis vs Reporting, Modern Data Analytic Tools
- Statistical Concepts:
  - Sampling Distributions - Re-Sampling
- Statistical Inference - Prediction Error

**UNIT-B**

**10 Hours**

**Mining Data Streams**

- Introduction To Streams Concepts, Stream Data Model and Architecture
- Stream Computing, Sampling Data in a Stream
- Filtering Streams, Counting Distinct Elements in a Stream
- Estimating Moments, Counting Oneness in a Window, Decaying Window
- Real time Analytics Platform(RTAP) Applications

**UNIT – C**

**15 Hours**

**Hadoop**

- History of Hadoop, The Hadoop Distributed File System
- Components of Hadoop, Analyzing the Data with Hadoop
- Scaling Out- Hadoop Streaming, Design of HDFS-Java interfaces to HDFSBasics
- Developing a Map Reduce Application
- How Map Reduce Works
- Anatomy of a Map Reduce Job run-Failures

**Master of Computer Applications  
Syllabus 2022-24**

- Job Scheduling-Shuffle and Sort, Task execution
- Map Reduce Types and Formats, Map Reduce Features

**UNIT – D**

**10 Hours**

**Frameworks**

- Applications on Big Data Using Pig and Hive
- Data processing operators in Pig
- Hive services, HiveQL, Querying Data in Hive
- Fundamentals of HBase and ZooKeeper
- Visualizations
  - Visual data analysis techniques, interaction techniques
- Systems and applications

**Reference Books:**

1. Michael Berthold, David J. Hand, *Intelligent Data Analysis*, Springer, 2007.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, 2012.
3. Tom White, *Hadoop: The Definitive Guide* Third Edition, O’reilly Media, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, *Mining of Massive Datasets*, Cambridge University Press, 2012.
5. Bill Franks, *Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics*, JohnWiley& sons, 2012.
6. Michael Minelli (Author), Michele Chambers (Author), Ambiga Dhiraj (Author), *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*, Wiley Publications, 2013.
7. Jiawei Han, Micheline Kamber, *Data Mining Concepts and Techniques*, Second Edition, Elsevier, Reprinted 2008.
8. Thomas Erl, Wajid Khattak, Paul Buhler, *Big Data Fundamentals: Concepts, Drivers & Techniques*, Pearson India, 2016.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Machine Learning**  
**Course Code: CSA633**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** The main objective of this course is to acquaint students with an in-depth introduction to two main areas of Machine Learning and analyze a given problem in the language/framework of different AI methods (e.g., standard search algorithms or dynamic programming). Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports

**Course Outcomes:**

<b>CO-1</b>	Introduction to machine learning.
<b>CO-2</b>	Understand the Linear machines and Learning decision trees.
<b>CO-3</b>	Understand the concepts of Instance-based Learning and Machine learning concepts and limitations.
<b>CO-4</b>	To learn about Machine learning assessment and Improvement and Support Vector Machines.

**UNIT – A**

**10 Hours**

**Introduction**

- Machine intelligence and applications
- Pattern recognition concepts classification, regression, feature selection
- Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning
- Supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

**UNIT-B**

**10 Hours**

**Linear machines**

- General and linear discriminants, decision regions
- Single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm, backpropagation learning, on-line, off-line error surface, important parameters.

**Learning decision trees**

- Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data

**UNIT – C**

**15 Hours**

**Instance-based Learning**

- Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability



**Master of Computer Applications  
Syllabus 2022-24**

**Machine learning concepts and limitations**

- Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension
- Fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

**UNIT – D**

**10 Hours**

**Machine learning assessment and Improvement**

- Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

**Support Vector Machines**

- Margin of a classifier, dual perceptron algorithm, learning nonlinear hypotheses with percept kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

**Reference Books:**

1. E. Alpaydin, *Introduction to Machine Learning*, Prentice Hall of India, 2015.
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online).
3. C. M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006.
4. Kevin Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012.
5. T. M. Mitchell, *Machine Learning*, McGraw-Hill, 2017.
6. Willi Richert, Luis Pedro Coelho, *Building Machine Learning Systems with Python*, Packt Publishing, 2013.
7. Toby Segaran. *Programming Collective Intelligence: Building Smart Web 2.0 Applications*, 2007

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Internet of Things**  
**Course Code: CSA634**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

**Course Outcomes:**

<b>CO-1</b>	Learn and usage of the term “internet of things” in different contexts.
<b>CO-2</b>	Understand the key components that make up an IoT system.
<b>CO-3</b>	Understand the concepts of Data Acquiring and Business Models for Business Processes.
<b>CO-4</b>	To learn about Data Collection and IOT cloud-based services.

**UNIT – A**

**15 Hours**

- An Overview of Internet of things, Internet of Things Technology.
- Behind Io Ts Sources of the Io Ts, M2M Communication, Examples of IoTs,
- Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity
- Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.
- Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities

**UNIT-B**

**10 Hours**

- Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability
- Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices

**UNIT – C**

**10 Hours**

- Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage
- Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

**UNIT – D**

**10 Hours**

- Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models
- IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio

**Master of Computer Applications**  
**Syllabus 2022-24**

Frequency Identification, and Wireless, Sensor Network Technology,  
Sensors Technology ,Sensing the World.

**Reference Books:**

1. Rajkamal, *Internet of Things: Architecture, Design Principles And Applications*, McGraw Hill Higher Education, 2017.
2. A.Bahgya and V.Madisetti, *Internet of Things*, Univesity Press, 2015
3. Adrian McEwen and Hakim Cassimally, *Designing the Internet of Things*, Wiley, 2013.
4. CunoPfister, *Getting Started with the Internet of Things*, Oreilly, 2011.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: R Programming**  
**Course Code: CSA635**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** Understand the basics in R programming in terms of constructs, control statements, string functions and the use of R for Big Data analytics. Students explore that how to apply R programming for text processing, able to appreciate and apply the R programming from a statistical perspective.

**Course Outcomes:**

<b>CO-1</b>	Introduction to R Programming.
<b>CO-2</b>	To learn about Matrices, Arrays and Lists.
<b>CO-3</b>	Understand the concepts of Data Frames.
<b>CO-4</b>	To learn about OOP and Interfacing of R with other languages.

**UNIT – A**

**10 Hours**

**Introduction**

- Introducing to R , R Data Structures
- Help functions in R, Vectors, Scalars, Declarations
- Recycling, Common Vector operations,
- Using all and any Vectorized operations, NA and NULL values
- Filtering, Vectorized if-then else, Vector Equality, Vector Element

**UNIT - B**

**10 Hours**

**Matrices, Arrays and Lists**

- Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists

**UNIT – C**

**10 Hours**

**Data Frames**

- Creation of data frames, significance of data frames in R language, accessing data element of a frame, printing data frames, getting structure of data frames, summary of data frames, extracting rows and column of the data frames, appending data frames.

**UNIT – D**

**15 Hours**

**OOP**

- S3 Classes, S4 Classes, Managing your objects, Input/Output – accessing keyboard and monitor, reading and writing files, accessing the internet, String Manipulation, Graphics, Creating Graphs, Customizing Graphs, Saving graphs to files, Creating three-dimensional plots

**Interfacing**

## **Master of Computer Applications Syllabus 2022-24**

- Interfacing R to other languages , Parallel R, Basic Statistics , Linear Model, Generalized Linear models, Non-linear models, Time Series and Auto-correlation, Clustering

### **Reference Books:**

1. Norman Matloff, *The Art of R Programming: A Tour of Statistical Software Design*, McGraw No Starch Press, 2011.
2. Jared P. Lander, *R for Everyone: Advanced Analytics and Graphics*, Addison-Wesley Data & Analytics Series, 2013.
3. Mark Gardener, *Beginning R – The Statistical Programming Language*, Wiley, 2013.
4. Robert Knell, *Introductory R: A Beginner's Guide to Data Visualisation*, Statistical Analysis and Programming in R, Amazon Digital South Asia Services Inc, 2013.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Mobile Application Development**  
**Course Code: CSA636**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:**

- To facilitate students to develop mobile applications
- To help students to gain a basic understanding of Android application development.
- The students will understand Android Studio development.

**Course Outcomes:**

<b>CO-1</b>	Acquired the Introduction to Mobile Computing and Android
<b>CO-2</b>	To learn about Android Application Design Essentials and Android User Interface Design Essentials.
<b>CO-3</b>	Understand the concepts of Files, Content Providers, and Databases.
<b>CO-4</b>	To learn the use of Common Android APIs.

**UNIT – A**

**10 Hours**

**Introduction**

- Introduction to Mobile Computing
- Introduction to iOS Android Development Environment
- Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User

**Introduction to Android**

- The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file

**UNIT-B**

**15 Hours**

**Android Application Design Essentials**

- Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

**Android User Interface Design Essentials**

- User Interface Screen elements, Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool, Gallery, ImageSwitcher, GridView, and ImageView views to display images, Creating Animation

**UNIT – C**

**10 Hours**

**Files, Content Providers, and Databases**

- Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers
- Testing Android applications, Publishing Android application, Using

**Master of Computer Applications  
Syllabus 2022-24**

Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

**10 Hours**

**UNIT – D**

**Using Common Android APIs**

- Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

**Reference Books:**

1. Lauren Darcey and Shane Conder, *Android Wireless Application Development*, Pearson Education, 2nd ed. (2011)
2. Reto Meier, *Professional Android 2 Application Development*, Wiley India Pvt Ltd
3. Mark L Murphy, *Beginning Android*, Wiley India Pvt Ltd, 2011.
4. Barry Burd, *Android Application Development All in one, For Dummies*, 2015.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Scientific Computing using MATLAB**

**Course Code: CSA637**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:**

- Programming in MATLAB includes input and output of data, algebraic and logical expressions and operators, all data types including complex numbers and strings, structured and cell arrays, etc
- MATLAB functions for graphics modifications, interactive figure modifications, Applications of MATLAB to scientific problems such as numerical integration, differentiation, etc.

**Course Outcomes:**

<b>CO-1</b>	Acquired the basic of matlab nd Linear Systems
<b>CO-2</b>	To provide knowledge of Matrices.
<b>CO-3</b>	To provide knowledge of Eigenvalues, Eigenvectors and Complex Numbers and Polynomials and Interpolation.
<b>CO-4</b>	To provide knowledge of Numerical Differentiation and Optimization.

**UNIT – A**

**15 Hours**

**Introduction**

- Introduction to Matlab
- Scripts and Arrays, Data Types and Cell Arrays, Flow Control and Matrix Algebra, Functions and Vectorization, Two-Dimensional Graphics, Monte-Carlo Methods

**Linear Systems**

- Matrix representation of Linear Systems, Echelon Forms, Rank, Consistent Systems, Homogeneous Linear Systems
- Applications of Linear Systems

**UNIT-B**

**10 Hours**

**Matrices**

- Matrix Algebra, Inverses
- LU Factorization, Applications of Matrices, Determinants
- Least squares approximations, QR factorization

**UNIT – C**

**10 Hours**

**Eigenvalues and Eigenvectors and Complex Numbers**

- omit eigenspaces, Diagonalization, Applied Eigenvalue Problems: Predator-Prey Model, Car Rental.
- Algebraic Theory, Geometric Theory, Polar Form

**Polynomials and Interpolation.**

- Polynomials, Curve-Fitting, MATLAB Commands for Polynomials
- Linear Interpolation

**UNIT – D**

**10 Hours**

**Numerical Differentiation**

- Derivatives of Interpolation Polynomials, Difference Approximations, Taylor Expansion Method, Differentiation

**Optimization**



**Master of Computer Applications**  
**Syllabus 2022-24**

- Zero-Finding, Roots of Nonlinear Equations: Graphical Method, Bisection Method, Newton Iteration Method

**Reference Books:**

1. Duane C. Hanselman, Bruce L. Littlefield, *Mastering MATLAB*, Prentice Hall (Pearson), 2012.
2. Kenneth Hardy, *Linear Algebra for Engineers and Scientists Using Matlab*, Prentice Hall (Pearson), 2005.
3. Shoichiro Nakamura, *Numerical Analysis and Graphic Visualization with MATLAB*, 2/E, Prentice Hall (Pearson), 2002.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Graphics and Multimedia**

**Course Code: CSA638**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:**

- To study the graphics algorithms and techniques
- To learn multimedia concepts and I/O techniques

**Course Outcomes:**

<b>CO-1</b>	To learn the Output primitives and Three-Dimensional Concepts..
<b>CO-2</b>	To provide knowledge of Multimedia Systems Design.
<b>CO-3</b>	To provide knowledge of Multimedia File Handling..
<b>CO-4</b>	To provide knowledge of Hypermedia.

**UNIT – A**

**15 Hours**

**Output primitives**

- Introduction to Line, Curves and Algorithms
- Two-Dimensional Geometric Transformations, Two-Dimensional Viewing, clipping operations, point, line, and polygon clipping algorithms.

**Three-Dimensional Concepts**

- Three-Dimensional Object Representations
- Three-Dimensional Geometric and Modelling Transformations
- Three-Dimensional Viewing, Colormodels and Animation
- Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

**UNIT-B**

**10 Hours**

**Multimedia Systems Design**

- An Introduction – Multimedia applications,
- Multimedia System Architecture, Evolving technologies for Multimedia, Defining objects for Multimedia systems,
- Multimedia Data interface standards
- Multimedia Databases.

**UNIT – C**

**10 Hours**

**Multimedia File Handling**

- Compression & Decompression
- Data & File Format standards, Multimedia I/O technologies
- Digital voice and audio, video image and animation
- Full motion video, Storage and retrieval Technologies.

**UNIT – D**

**10 Hours**

**Hypermedia**

- Multimedia Authoring & User Interface
- Hypermedia messaging, Mobile Messaging
- Hypermedia message component, creating Hypermedia message,

**Master of Computer Applications**  
**Syllabus 2022-24**

integrated multimedia message standards, Integrated Document management, Distributed Multimedia Systems.

**Reference Books:**

1. Donald Hearn and M.Pauline Baker, *Computer Graphics C Version*, Pearson Education, 2003.
2. Prabat K Andleighand KiranThakrar, *Multimedia Systems and Design*, PHI, 2003.
3. Judith Jeffcoate, *Multimedia in practice technology and Applications*, PHI,1998.
4. Foley, Vandam, Feiner, Huges, *Computer Graphics: Principles & Practice*, Pearson Education, second edition 2013.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Microprocessors and Its Applications**

**Course Code: CSA671**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** The purpose of this course is to teach students the fundamentals of microprocessor and to introduce students to features and technology of microprocessor systems. The students studying the subject are supposed to learn the architecture of a typical microprocessor and also get general information about microprocessor based control systems.

**Course Outcomes:**

<b>CO-1</b>	Learn the history of microprocessors, Microcomputer structure and Architecture of 8085/8086 Microprocessor
<b>CO-2</b>	Understand the Memory Interface.
<b>CO-3</b>	Understand the Interrupts and Direct Memory Access (DMA).
<b>CO-4</b>	Acquired the knowledge about Bus Interface and Assembly Language Programming.

**UNIT – A**

**15 Hours**

**Introduction**

- Introduction to Microprocessor
- Microcontroller and Microcomputer

**Microcomputer structure**

- Processor, memory and I/O; Bit slices and 8/16/32-bit microprocessors
- Microprocessor architecture (registers, index and stack pointers, addressing modes)
- I/O interface adapters (parallel and serial) interface devices, system clock, clock phase and bit rates

**Architecture of 8085/ 8086 Microprocessor**

- Description of various pins
- Configuring the 8086/8088 microprocessor for minimum and maximum mode systems description of system mode interfaces
- Internal architecture of the 8086 / 8088 microprocessor, system clock, Bus cycle, instruction execution sequence.

**UNIT – B**

**15 Hours**

**Memory Interface**

- Memory Devices
- Address Decoding, 8-bit, 16-bit, 32-bit and 64-bit memory interfaces
- Dynamic RAM

**Basic I/O Interface**

- I/O Port Address Decoding
- Programmable Peripheral Interface
- 8279 Programmable Keyboard/Display Interface
- 8254 Programmable Interval Timer
- 16550 Programmable Communication Interface

**Master of Computer Applications  
Syllabus 2022-24**

**UNIT – C**

**15 hours**

**Interrupts**

- Basic Interrupt Processing
- Hardware Interrupts
- Expanding the Interrupt Structure
- 8259A Programmable Interrupt Controller

**Direct Memory Access (DMA)**

- Basic DMA Operations
- 8237 DMA Controller
- Shared Bus Operations

**UNIT – D**

**15 Hours**

**Bus Interface**

- ISA, EISA
- VESA Buses, PCI, USB Bus

**Assembly Language Programming**

- Addition, Subtraction, Complement First and Second, Shifting of 8 and 16-bit number by one and two bits.

**Reference Books:**

1. Barry B. Brey, *The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processors, Pentium II, Pentium III, Pentium 4 and Core2 with 64-bit Extensions: Architecture, Programming and Interfacing*, 8<sup>th</sup> Edition, New Delhi: Pearson Education-2009.
2. Khambata J., *Microprocessor and Microcomputer*, New York: John Wiley and Sons, 1987.
3. Liu, Y., Gibson, and G.A., *Microcomputer Systems: The 8086/8088 Family*, New Delhi: Prentice Hall, 2nd Edition, 1986.
4. Tribel Walter, *The 80386, 80486, and Pentium Processors: Hardware, Software, and Interfacing*, New Delhi: Prentice Hall, ISBN #0-13-533225-7, 1998.
5. Douglas V. Hall, *Microprocessors and Interfacing - Programming and Hardware*, New Delhi :TataMcGraw Hill Publishing Company Ltd, 2006.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Digital Image Processing**

**Course Code: CSA678**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** To introduce basic image processing techniques, spatial and frequency domain, linear programming, color image processing, image compression, etc.

**Course Outcomes:**

<b>CO-1</b>	Fundamentals of image processing, basic filters and image processing operations
<b>CO-2</b>	Image Enhancement operations in Spatial and Frequency domain
<b>CO-3</b>	Color and Morphological Image Processing and applications of image processing
<b>CO-4</b>	Image Compression and its methods

**15 Hours**

**UNIT – A**

**Introduction**

- Fundamental Steps in Image Processing
- Element of Visual Perception
- A simple image model, sampling and quantization
- Some Basic Relationships Between Pixel
- Image Geometry in 2D

**Image Processing Techniques**

- Basic Intensity Transformation Functions
- Image Restoration
- Histogram Processing: Histogram Equalization, Histogram matching, Local Histogram Processing, Using Histogram Statistics for Image Enhancement
- Image Subtraction, Image Averaging
- Filtering: Smoothing Spatial Filters, Sharpening Spatial Filters

**UNIT – B**

**Introduction to the Fourier Transformation**

- Discrete Fourier Transformation
- Fast Fourier Transformation
- Image Smoothing Using Frequency Domain Filters: Ideal Lowpass Filters, Butterworth low pass filters, Gaussian Lowpass Filters
- Image Sharpening Using Frequency Domain Filters: Ideal Highpass Filters, Butterworth High pass filters, Gaussian High pass Filters, Unsharp Masking, Highboost Filtering and High Frequency-Emphasis filtering.

**10 Hours**

**UNIT – C**

**Techniques of Color Image Processing**

- Color image signal representation
- Color System Transformations
- Extension of Processing Techniques to Color Domain

**Morphological Image Processing**

- Erosion and Dilation

**10 Hours**

**Master of Computer Applications  
Syllabus 2022-24**

- Opening and Closing
- Hit – or- miss Transformations

**Applications of Image Processing**

- Picture Data Archival
- Machine Vision
  
- Medical Image Processing

**UNIT-D**

**10 Hours**

**Introduction to Image Compression**

- Coding Redundancy
- Spatial and Temporal Redundancy
- Irrelevant Information
- Measuring Image Information

**Basic Compression Methods**

- Huffman Coding
- LZW Coding
- Run Length Coding
- Wavelet Coding

**Reference Books:**

1. Gonzalez Rafael C. and Woods Richard E., *Digital Image Processing*, New Delhi: Prentice–Hall of India, 2002.
2. Pratt William K., *Digital Image Processing: PIKS Inside*(3rd ed.), New Jersey: John Wiley & Sons, Inc., 2001.
3. Bernd Jahne, *Digital Image Processing*, (5th revised and extended edition), Springer, 2002
4. Annadurai S. and Shanmugalakshmi R., *Fundamentals of Digital Image Processing*, New Delhi: Pearson Education, 2007
5. Joshi M.A., *Digital Image Processing: An Algorithmic Approach*, New Delhi: Prentice-Hall of India, 2006
6. Sridhar ,*Digital Image Processing 2ed*, Oxford University Press.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Soft Computing**  
**Course Code: CSA682**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** To introduce the concepts of artificial neural networks, fuzzy sets, fuzzy logics, various search techniques, genetic algorithms, supervised and unsupervised learning, neuro-fuzzy systems and their applications.

**Course Outcomes:**

<b>CO-1</b>	Learn soft computing techniques genetic algorithm concepts.
<b>CO-2</b>	Analyze various neural network architectures.
<b>CO-3</b>	Understand Fuzzy Systems and Applications.
<b>CO-4</b>	Learn soft computing applications

**UNIT-A**

**15 Hours**

**Introduction**

- Introduction to soft computing; introduction to biological and artificial neural network, genetic algorithm
- Introduction to fuzzy sets and fuzzy logic systems

**Genetic Algorithm and Genetic Programming**

- Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues.
- Genetic Programming: Characteristics of genetic programming: Human, Competitive, High-Return, Routine, Machine Intelligence; Data Representation: Crossing Programs, Mutating Programs, The Fitness Function.
- Advantages and Limitations of Genetic Algorithm.
- Applications of Genetic Algorithm.

**UNIT-B**

**15 Hours**

**Artificial Neural Networks and Applications**

- Introduction, Basic models of ANN, Important terminologies, Supervised Learning Networks, Perception Networks, Adaptive Linear Neuron
- Backpropagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks
- Neural network applications in control systems. Neural Nets and applications of Neural Network.

**Unsupervised Learning Network**

- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps



**Master of Computer Applications  
Syllabus 2022-24**

- Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks

**UNIT-C**

**15 Hours**

**Fuzzy Systems and Applications**

- Introduction to Classical Sets ( crisp Sets)and Fuzzy Sets- operations and Fuzzy sets
- Fuzzy reasoning; fuzzy inference systems; fuzzy control; fuzzy clustering
- Membership functions- Features, Fuzzification, membership value assignments, Defuzzification, applications of fuzzy systems
- Neuro-fuzzy systems : neuro-fuzzy modeling; neuro-fuzzy control

**UNIT-D**

**15 Hours**

**Applications**

- Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design
- Robotics and Sensors, Information Retrieval System, Share Market Analysis, Natural Language Processing

**Reference Books:**

1. Sivanandam S N and Deepa S N, *Principles of Soft Computing*, New Delhi: Wiley India (2<sup>nd</sup> Ed), 2011.
2. KarrayFakhreddineO,Silva Clarence D, *Soft Computing and Intelligent System Design*, New Delhi: Pearson Edition, 2009.
3. Mitchell M., *An Introduction to Genetic Algorithms*, New Delhi: Prentice-Hall, 2000.
4. Jang J.S.R., Sun C.T. and MizutaniE.,*Neuro-Fuzzy and Soft Computing*, New Delhi: PHI, Pearson Education, 2004.
5. Rich Elaine andKnight Kevin, *Artificial Intelligence*, New Delhi: TMH, 2008
6. Ross Timothy J., *Fuzzy Logic with Engineering Applications*, New Jersey: Wiley (3<sup>rd</sup> Ed), 2011.
7. Rajasekaran S. and Pai G.A.V., *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI, 2013.
8. Goldberg Davis E., *Genetic Algorithms, Search, Optimization and Machine Learning*, Addison Wesley, 1989.
9. Jang J.S.R., Sun C.T., MizutaniE, *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence*, Prentice Hall, 1997.
10. Melanie Mitchell, *An Introduction to Genetic Algorithms*, London: MIT press, 1999.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: System Software**  
**Course Code: CSA683**  
**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** This course demonstrates an in-depth understanding system software loader, linker, assembler, compiler, and parsing techniques.

**Course Outcomes:**

<b>CO-1</b>	Learn and classify different methodologies, concepts and approaches to System Software Programming.
<b>CO-2</b>	Understand the Loaders & Linkage Editors, and Compilers.
<b>CO-3</b>	Understand the Compilers and its construction tools.
<b>CO-4</b>	Acquired the knowledge about parsing techniques.

**UNIT – A**

**15 Hours**

**System Software**

- Definition, Evolution of System Software

**Assemblers**

- Elements of Assembly Language Programming
- Overview of Assembly Process
- Design Options- One Pass Assembler & Multi Pass Assembler
- Macro Processors: Basic Functions
- Design Options-Recursive Macro Expansion
- General Purpose Macro Processors
- Macro Processing Within Language Translators

**UNIT-B**

**15 Hours**

**Loaders & Linkage Editors**

- Loading, Linking & Relocation
- Program Relocatability
- Overview of Linkage Editing
- linking for Program Overlays

**Compilers**

- Phases of Compilation Process
- Logical Analysis
- Parsing, Storage Management Optimisation
- Incremental Compilers
- Cross Compilers
- P Code Compilers

**UNIT – C**

**15 Hours**

**Compilers**

- Phases And Passes
- Analysis-Synthesis Model of Translation

**Compiler Construction Tools**

**Master of Computer Applications  
Syllabus 2022-24**

- Lexical Analysis
- Process of Lexical Analysis
- Finite State Automata, DFA And NFA
- Recognition of Regular Expressions, LEX

**UNIT – D**

**15 Hours**

**Parsing Techniques**

1. Top Down & Bottom-Up Parsing
  - Shift Reduce Parsing, Operator Precedence Parsing
  - Predictive Parsers Automatic Construction of Efficient Parsers
  - LR Parsers
  - The Canonical Collection of LR(0) Items
  - Constructing SLR Parsing Tables
  - Constructing Canonical LR Parsing Tables, Constructing LALR Parsing Tables

**Reference Books:**

1. Beck Leland L., *System Software, An introduction to system programming*, New Delhi: Addison Wesley, 2009.
2. Dhamdhere D.M., *Introduction to System Software*, New Delhi: Tata McGraw Hill, 1990.
3. Dhamdhere D.M., *System Software and Operating System*, New Delhi: Tata McGraw Hill, 1992
4. Alfred V Aho and Ullman Jeffery D, *Principles of Compiler Design*, New Delhi: Narosa/Addison Wesley, 1986.
5. Donovan J. John, *System Programming*, New Delhi: Tata McGraw Hill, 1999.

**Master of Computer Applications  
Syllabus 2022-24**

**Course Title: Natural Language Processing**

**Course Code: CSA691**

**Course Duration: 45-60 Hours**

L	T	P	Credits	Marks
4	0	0	4	100

**Course Objective:** To provide basic knowledge about Natural language processing viz. Morph, Part of speech tagging, syntactic analysis, semantic analysis etc.

**Course Outcomes:**

<b>CO-1</b>	Understand the basics of Natural Language Processing.
<b>CO-2</b>	Understand Syntax: Word Classes, Context Free Grammars and Parsing
<b>CO-3</b>	Understand the Word Sense Disambiguation.
<b>CO-4</b>	Acquired the knowledge about various statistical techniques used in NLP

**UNIT – A**

**15 Hours**

**Introduction to Natural Language Processing**

- Definition, History
- Applications, Goals
- Regular expressions and Automata
- Morphology and Finite State Transducers

**UNIT-B**

**Syntax**

**15 Hours**

- Word Classes and Part-of Speech Tagging
- Context Free Grammars for English
- Parsing with Context-Free Grammars.

**UNIT – C**

**15 Hours**

**Word Sense Disambiguation**

- Selection Restriction Based Disambiguation
- Robust WSD: Machine Learning, Supervised Learning Approaches, Bootstrapping Approaches, Unsupervised Methods, Dictionary Based Approaches.

**UNIT – D**

**15 Hours**

**Introduction to various statistical techniques used in NLP**

- Introduction to computational linguistic
- Hidden Markov Model
- Support Vector Machine
- CRF, N-Gram, HMMs

**Reference Books:**

1. Grosz, B.J., Sparck Jones, K. & Webber, B.L. (eds), *Readings in natural language processing*, Los Altos, CA. Morgan Kaufmann, 1986.

**Master of Computer Applications  
Syllabus 2022-24**

2. Allen, J., *Natural Language Understanding*, Redwood City, CA. Benjamin/Cummings, 1995.
3. Bharti, Akshar, Chaitanya Vineet, Sangal Rajeev, *Natural Language Processing*, Prentice Hall.
4. Jurafsky, D. & J. Martin, *Speech and Language Processing: An Introduction to Natural Language Processing Computational Linguistics, and Speech Recognition*, Prentice Hall, 2000.

**Course Title: Elective-II Laboratory**  
**Course Code: CSAXXX**

L	T	P	Credits	Marks
0	0	4	2	50

Implementation of the concepts of the course chosen from Elective-II