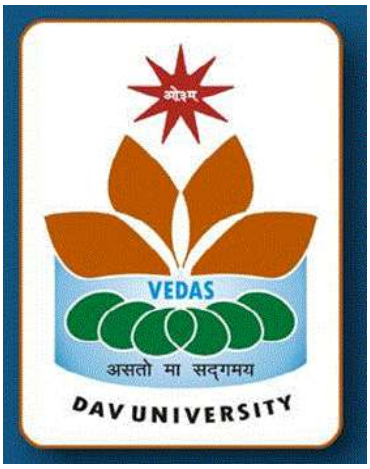
DAV UNIVERSITY JALANDHAR

FACULTY OF SCIENCE



Course Scheme and Syllabus
for

Master of Science in Computer Science
(Two Years Degree Course)
1st to 4th Semester

(As per Choice Based Credit System)

Syllabi Applicable for 2024 Batch& Onwards

Duration: 2 years (4 Semesters)

Eligibility: B.Tech/BE in relevant subject/BCA/B.Sc. (CS)/B.Sc. (IT)/BIT or equivalent from any recognized university with at least 50% aggregate marks (45% in case of candidate belonging to SC/ST) or a bachelor's degree with Computers/Mathematics/ Statistics/Business Mathematics /Business Statistics/Quantitative Techniques as compulsory/elective/optional/additional subject with at least 50% aggregate marks (45% in case of candidate belonging to SC/ST).

Semester 1

S.No	Paper Code	Course Title	Course Type	L	T	P	Cr
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	CSA540	Software Engineering and Testing	Core	4	0	0	4
5	CSA521	Python Programming	Core	4	0	0	4
6	CSA522	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
				20	**0**	**12**	**26**

Semester 2

S.No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	CSA510	Computer Networks and Data Communication	Core	4	0	0	4
2	CSA577	Design and Analysis of Algorithms	Core	4	0	0	4
3	CSA578	Computer Based Optimization Techniques	Core	4	0	0	4
4	CSA579	Interactive Computer Graphics	Core	4	0	0	4
5	CSA580	Theory of Computer Science	Core	4	0	0	4
6	CSA516	Computer Networks and Data Communication Laboratory	Core	0	0	4	2
7	CSA581	Design and Analysis of Algorithms Laboratory	Core	0	0	4	2
8	CSA582	Interactive Computer Graphics Laboratory	Core	0	0	4	2
				20	**0**	**12**	**26**

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	CSA605	Data Mining and Data Warehousing	DSE	4	0	0	4
2	CSA654	Web Technology	Core	4	0	0	4
3	CSA627	Research Methodology	Core	4	0	0	4
4	CSA541	Advanced Operating System	Core	4	0	0	4
5	CSA542	AI & Machine Learning	Core	4	0	0	4
6	CSA655	Web Technology Laboratory	Core	0	0	4	2
7	CSA543	AI & Machine Learning Laboratory	Core	0	0	4	2
8	CEC103	Community Engagement Course	Core	1	0	2	2
9.	CSA544	Advanced Operating System Laboratory	Core	0	0	4	2
				21	**0**	**12**	**28**

Semester 3

Semester 4

S. No	Course Title		Course Type	L	T	P	Cr
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-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	12	6
				12	**0**	**20**	**26**

Discipline Elective-I	
CSA607	Emerging Trends in Information Technology
CSA608	Distributed and Parallel Processing
CSA609	Information Systems
CSA616	System Simulation and Modelling
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
CSA671	Microprocessor and Its Applications
CSA678	Digital Image Processing
CSA682	Soft Computing
CSA683	System Software
CSA691	Natural Language Processing
CSA694	Blockchain Technology
CSA695	Cloud Computing
CSA692	Digitizing Industry knowledge for Software Development
Option to adopt MOOC course having 4 Credits.	
Discipline Elective-II	
CSA639	Big Data Analytics Laboratory
CSA641	Internet of Things Laboratory
CSA642	R Programming Laboratory
CSA643	Mobile Application Development Laboratory
CSA644	Scientific Computing using MATLAB Laboratory
CSA680	Digital Image Processing Laboratory
CSA693	Cyber Security
CSA696	Blockchain Technology laboratory
CSA697	Cloud Computing Laboratory

Option to adopt MOOC course having 2 Credits.

Note: 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.

L	T	P	Credits	Marks
4	0	0	4	100

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:

CO-1	Understand the set theory, Relation and Functions.
CO-2	Understand Group Theory and Recurrence relations
CO-3	Apply the operations of simple and multi graphs, directed and undirected graphs, Eulerian and Hamiltonian Graphs, Shortest path algorithms
CO-4	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**

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. Kolman, Busby, Ross : Discrete Mathematical Structure, PEARSON Education, 5th Edition.
2. C. L. Liu, Elements of Discrete Mathematics, Mcgraw-Hill College,
3. Rajaraman, V., Computer Oriented Numerical Methods, Prentice Hall of India.
4. SeymorLipschutz, Marc Lipson, Discrete Mathematics, McGraw Hill Professional,
5. J. P. Tremblay & R. Manohar. , Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill, Inc.
6. K.E. Atkinson, W. Han, Elementary Numerical Analysis, 3rd Edition, Wiley
7. Rosen, K. H.,*Discrete Mathematics and its Applications*, 6th Edition, McGraw Hill, 2007.

Master of Science in Computer Science
Syllabus 2024-26

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

L	T	P	Credits	Ms
4	0	0	4	

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:

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

UNIT– A **10Hours**

Data Base Concepts

- Data base vs. file oriented approach, Data Independence, Database models, General Architecture of a Data Base Management Software
- Advantages and Disadvantages of DBMS

Introduction to Data Models

- Entity Relationship model, hierarchical modelfrom network to hierarchical, relational model,object oriented database, object relational database,

Data Base Design

- Entities, Attributes, ER Diagrams, 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
- 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., 1993: An Introduction to Database Systems, Galgotia Publ. Private Ltd.
2. Date, C.J.: Data Base Systems, Vols. I & II, Narosa Publications.
3. Ivan Bayross : PL/SQL The Programming Language of ORACLE, (BPB Publication)
4. Mukhi, Vijay 1992: Mastering Oracle 6.0, BPB Publications.
5. Database system concepts :Korth
6. Principles of Database Management: James Martin
7. Computer Database organization : James Martin
8. Fundamentals of Database Systems: ElmasriNavathe

L	T	P	Credits	Mas
4	0	0	4	10

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

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:

CO-1	Ability to analyse algorithms and algorithm complexity.
CO-2	To extend the knowledge of summarize searching and sorting techniques
CO-3	Ability to describe stack, queue and linked list operation
CO-4	Ability to have knowledge of tree and graphs
CO-5	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, timespace tradeoff between algorithms
- Complexity of Algorithms, Records and Pointers.

Arrays

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

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**

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. Kanetkar ,Yashavant, 2021, Let Us C, BPB Publications.
2. Cooper, Mullish, 1998: The Spirit of C, An Introduction to Modern Programming, JaicoPubl. House, New Delhi.
3. Kerninghan, B.W. &Ritchie, D.M.: The C Programming Language, Prentice Hall of International, 2015.
4. Gottfried, B.: Theory and Problems of Programming in C, Schaum Series,1996.
5. Horwitz, E., and Sahni, S., 2008: Fundamentals of data structures in C, Computer Science Press.
6. Aho, A. V., Hopcroft, and Ullman, J.E., 2002: Data structures and algorithms, Addison Wesley.
7. Tanenbaum, A. M. and Augenstein, M.J., 2019: Data structures using C, Prentice Hall

8. Lipschutz, Seymour, 2014: Theory & problems of data structures, Schaum Series.
9. Deshpanday: C and data structures, Wiley India Pvt. Ltd,2003.

Master of Science in Computer Science
Syllabus 2024-26

Course Title: Software Engineering and Testing
Course Code: CSA540
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:

CO-1	Understand lifecycle processes and agile approaches of software Development.
CO-2	Apply novel software models and techniques to bring out innovative and solutions for the growth of the society.
CO-3	Model and Analyze structure and behavior of a software system.
CO-4	Design a solution to a given problem and evaluate the same in various scenarios.
CO-5	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: Software Process, Generic Process Model – Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models – Extreme Programming (XP), Adaptive SoftwareDevelopment, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering.

UNIT-B **10 HOURS**

Software Requirements:

- Functional and Non-Functional Requirements; ElicitingRequirements, Developing Use Cases, Requirement Analysis and Modelling
- RequirementsReview, Software Requirement and Specification (SRS) Document.

Software Design:

- Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling
- Object-OrientedDesign, Data Design, Architectural Design, User Interface Design, Component LevelDesign.

UNIT-C **10 HOURS**

Software Quality:

- McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management(RMMM).

Estimation and Scheduling of Software Projects:

- Software Sizing, LOC and FP based
- Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model(COCOMO)
- Project Scheduling and Staffing; Time-line Charts.

UNIT-D **10 Hours**

Software Testing:

- Verification and Validation; Error, Fault, Bug and Failure;UnitandIntegration Testing; White-box and Black-box Testing; Basis Path Testing, Control StructureTesting, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, PerformanceTesting, Stress Testing.
- Software Configuration Management: Change Control and Version Control; SoftwareReuse, Software Re-engineering, Reverse Engineering.

Reference Books:

1. Lewis, T.G., *Software Engineering*, New Delhi: McGraw Hill, 1982.
2. Ochoa Sergio and RomanGruia-Catalin, *Advanced Software Engineering,* Spinger, 2006.
3. Meyers, G., *The Art of Software Testing*, NJ: Wiley-Inter-Science, 2004.
4. Pressman: Software Engineering, Tata McGraw Hill.
5. Sommerville, I.: Software Engineering, Narosa Publ. House.
6. Mall ,Rajib, : Fundamentals of Software Engineering.
7. Fairley, R.E.: Software Engineering Concepts, McGraw Hill.
8. Walker Royce: Pearson Education: Software Project Management.
9. Joel Henry, Pearson Education: Software Project Management.

Course Title: Python Programming
Course Code: CSA521
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

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:

CO-1	Familiar with Python environment, data types, operators used in Python. Compare and contrast Python with other Programming languages.
CO-2	Learn the use of control structures and numerous data types with their methods.
CO-3	Design and define functions, modules, packages and exception handling methods.
CO-4	Create and handle files in Python and learn Object oriented programming Concepts.
CO-5	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

- 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

Algorithm Sorting and Searching

- Searching and Sorting Techniques, Efficiency of Algortihms.

Reference Books:

1. Fabrizio Romano; Learn Web Development with Python: Get hands-on with Python Programming and Django web development; Packt Publishing Ltd.
2. William S Vincent; Django for Beginners: Build Websites with Python and Django; Welcometocode.
3. Martin C. Brown Python: The Complete Reference, TMH Publisher.
4. M. C. Brown, *The Complete Reference Python*, Osborne/McGraw-Hill, 2018.
5. S. Maruch, A. Maruch, *Python for Dummies*, John Wiley & Sons, 2011.
6. A. B. Downey, *Think Python*, O'Reilly Media Inc., 2012.
7. J. M. Zelle, *Python Programming: An Introduction to Computer Science*, Franklin, Beedle & Associates, Inc., 2004.

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

L	T	P	Credits
0	0	4	2

Course Outcomes:

CO-1	Implementation of SQL: DDL, DML, DCL, TCL.
CO-2	Implementation of Nested Queries, Join Queries, Cursors, Procedures and Functions.
CO-3	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
CO-4	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	M
0	0	4	2	

Course Outcomes:

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

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

Course Title: Python Programming Laboratory
Course Code: CSA524

L	T	P	Credits	Marks
0	0	4	2	50

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

Course Outcomes:

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

Course Title: Computer Networks and Data Communication
Course Code: CSA510
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:

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

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

- 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., 2009: Computer Networks (5th Edition), PHI.
2. Forouzan, B. A., 2009: Data Communications and Networking, Fourth Edition, Tata McGraw Hill.
3. Atul Kahate, Cryptography and Network Security (2nd Edition), Tata McGraw Hill.
4. William Stalling: Cryptography and Network Security, Principles and Practise, 7th Edition, Pearson.
5. Forouzan: Cryptography and Network Security, (3rd Edition), Tata McGraw Hill.

Course Title: Design and Analysis of Algorithms
Course Code: CSA577
Course Duration: 45-60 Hours

L	T	P	Credits	Mark
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:

CO-1	To develop proficiency in problem solving and Analysis of various Algorithms for mainly Time and Space Complexity.
CO-2	To understand the String processing and Greedy techniques.
CO-3	To get a good understanding of dynamic programming and back tracking techniques
CO-4	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, Θ and Ω) 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
- 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, 3rd Edition, 2012.
6. Michael T Goodrich and Roberto Tamassia : Algorithm Design, Wiley India, 2002.
7. Brassad, Gilles and Bartley, Paul 1996: Fundamentals of Algorithms, Prentice Hall of India.
8. Mark Allen Weiss: Data Structure and Algorithms Analysis in C++, Pearson Education.

L	T	P	Credits
4	0	0	4

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

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

Course Outcomes:

CO-1	Acquainted with various quantitative techniques which are of great importance for quantitative decision-making.
CO-2	Acquainted with the application of statistical techniques in business decision making.
CO-3	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.
CO-4	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**

Integer & Dynamic Programming

- Integer programming problem

1. Branch and Bound Techniques
- Characteristics
2. 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*, 10th Ed. London Holden Day Inc., 2017.
2. Tara, H.A., *Operations Research*, 8thEdn., 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.

Course Title: Interactive Computer Graphics

Course Code: CSA579
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

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

Course Outcomes:

CO-1	Introduction to computer graphics and various display devices.
CO-2	To provide knowledge of various line drawing and circle drawing algorithms.
CO-3	To provide knowledge of various types of transformations and clipping algorithms.
CO-4	To provide knowledge of Hidden surface elimination algorithms and various types of illumination models.

UNIT – A **15 Hours**

Display Devices

- Line and point plotting systems
- Raster, vector, pixel and point plotters
- Continual Refresh and storage displays
- Digital frame buffer
- Plasma panel displays, Display processors
- Character generators
- Color-display techniques : shadow mask and penetration CRT, Color look-up tables

Elementary Drawing Algorithms

- Line drawing using direct method, simple DDA, integer DDA
- Incremental method, and Bresenham's algorithm
- Circle drawing using incremental method,Bresenham's and MidPoint algorithm
- drawing arcs, sectors
- Flood Fill Algorithms, Boundary Fill Algorithms

UNIT – B **15 Hours**

Geometric Transformations.

- Two Dimensional Translation, rotation, scaling, reflection and shear
- Concept of homogenous coordinates
- Building composite transformations

Viewing Transformations

- Concept of Windows & Viewport
- Window-To-Viewport Mapping
- Clipping Operations - Point Clipping
- Line Clipping Algorithms (Cohen - Sutherland, Mid-Point, Subdivision, Cyrus - Beck),

- Sutherland - Hodgeman Polygon Clipping Algorithm

UNIT – C **15 Hours**

Three-dimensional concepts

- 3-D representations and transformations
- perspective and parallel projections
- spline curves and surfaces
- Quadtree and Octree data structures

Hidden line/surface Removal

- Back Face Removal
- Z-Buffer Algorithm
- Painters (Depth Sort) Algorithm
- Subdivision Algorithms - Warnock's Algorithm
- Scan Line Algorithms - Scan Line

UNIT – D **15 Hours**

Rendering

- Introduction, a simple illumination model
- Shading - Gouraud shading &Phong Shading
- Ray Tracing, Shadows, Textures

Open GL

- Primitives of the language and interface with C/C++

Reference Books:

1. Giloi, W.K., 1978: Interactive Computer Graphics, Prentice-Hall.
2. Newman, W., Sproul, R.F., 1980: Principles of Interactive Computer Graphics, McGraw-Hill.
3. Rogers, D.F., 1985: Procedural Elements for Computer Graphics, McGraw-Hill.
4. Harrington, S., 1983: Computer Graphics: A Programming Approach, Tata McGraw-Hill.
5. Foley, J.D., Van Dam A., 1982: Fundamentals of Interactive Computer Graphics, AddisonWesley.
6. Hearn, D., Baker, P.M., 1986: Computer Graphics, Prentice-Hall.
7. Tosijasu, L.K., 1983: Computer Graphics, Springer-Verlag.
8. Kelley Bootle: Mastering Turbo C. Galgotia.
9. Plastock, Roy, 1986: Theory & Problems of Computer Graphics, Schaum Series, Tata McGraw Hill.
10. Foley, Vandam, Feiner, Huges, *Computer Graphics: Principles & Practice*, Pearson Education, second edition 2013.

Course Title: Theory of Computer Science
Course Code: CSA580
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

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

Course Outcomes:

CO-1	Understanding of regular language, various types of finite automata along with minimization of automata.
CO-2	Ability to develop the finite automata for various regular languages.
CO-3	Understanding of context free language and grammar, ambiguity in grammar and simplification of context free grammar.
CO-4	Understanding of push down automata and ability to develop the push down automata for various context free languages.
CO-5	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.

15 Hours

UNIT – A

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)
- 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. Reevsz, *Introduction to Formal Languages*, New Delhi: McGraw Hill 1983.
2. Lewis H.R., Papadimitriou C.H., *Elements of the Theory of Computation* (2nd ed.), NJ:Prentice-Hall,1997.
3. Anderson J.A., *Automata Theory with Modern Applications*, New York: Cambridge UniversityPress, 2006.
4. Lewis, Harry R. and Papadimitriou, Christos H.: Theory of Computation, Prentice Hall of India, 1996.
5. Hopcroft, John E. and Ullman, Jefrey D.: Introduction to Automata Theory, Languages and Computation, Addison-Wesley Publishing Company Inc
6. Brady, J.M.: Theory of Computer Science, Wiley.
7. Dewire, Dawna Tranis: Client Server Computing, McGraw Hill.
8. Aho,Lam,Sethi and Ullman : Compilers Principles, Techniques and Tools, Publisher Pearson.

Course Title: Computer Network and Data Communication Laboratory
Course Code: CSA516

L	T	P	Credits	Marks
0	0	4	2	50

Course Outcomes:

CO-1	Interaction with different hardware devices present in computer networks and discuss various network models.
CO-2	Interaction with data link layer and its protocols.
CO-3	Interaction various Routing algorithms. In addition to that functionality of network layer.
CO-4	Functionality of Transport layer.
CO-5	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)

Course Title: Design and Analysis of Algorithms Laboratory

L	T	P	Credits	Marks
0	0	4	2	50

Course Code: CSA581

Implementation of various algorithms divide and conquer, string processing, greedy methods, dynamic programming, etc.

Course Outcomes:

CO-1	Implementation of various algorithms of sorting and searching.
CO-2	Implementation of various algorithms divide and conquer, string processing, greedy methods, dynamic programming, etc.

Course Title: Interactive Computer Graphics Laboratory
Course Code: CSA582

L	T	P	Credits	Marks
0	0	4	2	50

Implementation of various algorithms of drawing line, circle, ellipse, etc. and2D transformations

Course Outcomes:

CO-1	Introduction to computer graphics and various display devices.
CO-2	Implementation various line drawing and circle drawing algorithms.
CO-3	Implementation of color filling algorithms.
CO-4	Implementation of various types of transformations
CO-5	Implementation of various character generation techniques

Course Title: Web Technology
Course Code: CSA654
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective:

- Creating web based applications using React JS
- To build Web services and creating files for writing and reading data through MongoDB

Course Outcomes:

CO-1	Working with React Modules, importing and exporting the modules.
CO-2	Learn what is JSX and how it works behind the scenes.
CO-3	Creating dynamic websites with help of re-usable components.
CO-4	Build web applications using React JS with MongoDB

Unit –A **10 Hours**

- Introduction to React, Original DOM vs Virtual DOM, React Components, React Components with JSX, React Components with ES6.
- Basics of Node and Installation, Introduction to Npm, Adding and removing modules

Unit-B **12 Hours**

- Creating an application using Create React App, Life Cycle, Debugging, Default values, SetState in depth, Creating Forms, Creating Table, Handling Events, Applying Filters, JSX in depth, Validations, Applying Styles, Backend calls.

Unit-C **13 Hours**

- Stateful Components, Stateless Components, Local Storage, Routing, Basic Routing and Passing Params, Hyperlinks, Master Pages, Reconciliation, Creating Reusable Components, React.Component vs React.pure Component, Composition vs Inheritance, Code Reusability and Optimization, Fragments, Bundling, Deploying.

Unit-D **10 Hours**

- MongoDB: Introduction: What is MongoDB? Why Mongo DB? (using JSON, Creating or generating a unique key, Support for Dynamic Queries, Storing Binary Data, Replication, Shading, Updating information in –place), Terms used in RDBMS and Mongo DB, Data types in Mongo DB, MongoDB Query Language.

References:

1) Kyle Banker,Peter Bakkum,Shaun Verch,Douglas Garrett,Tim Hawkins,"MongoDB in Action", DreamTech Press, 2nd Edition ,2016.
2) MongoDB: The definitive guide by Kristina Chodorow
3) MongoDB Complete guide by Manu Sharma

4) React JS for beginners by Mayur Patil
5) The road to learn React: your journey to master plain yet pragmatic React.jS by Robin Wieruch.
6) React.js: Easy learning by Sandeep Bisht

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

L	T	P	Credits	Marks
4	0	0	4	100

Objectives: 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:

CO-1	Student must be able to understand Scientific Research, Methods of research, Scope of research and Reviewing the literature.
CO-2	Student must be able to learn Statistical Analysis and Regression & Correlation Analysis.
CO-3	Student must be able to understand Hypothesis testing.
CO-4	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.
- 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.

Course Title: Advanced Operating System
Course Code: CSA541
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of this course is to acquaint the students with the basic concepts inOperating Systems viz. process scheduling, memory management, virtual memory, file and input/output systems 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:

CO-1	Understand the basics, process management and deadlock handling in operating system.
CO-2	Understand Memory management.
CO-3	Understand file and input/output systems, security and virtual machines.
CO-4	Application of concepts in various operating systems like Linux, Windows, etc.

Unit A **13 Hours**

Basics of Operating Systems:
Operating System Structure, Operations and Services.
System Calls, Operating-System Design and Implementation; System Boot.
Process Management:
Process Scheduling and Operations.
Interprocess Communication, Communication in Client–Server Systems.
Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization.
Threads:
Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.
CPU Scheduling:
Scheduling Criteria and Algorithms.
Thread Scheduling, Multiple Processor Scheduling, Real-Time CPU Scheduling.

Deadlocks:
Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

UNIT – B **13 Hours**

Memory Management:
Contiguous Memory Allocation, Swapping, Paging, Segmentation.
Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.
Storage Management:
Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structure.

UNIT – C **10 Hours**

File and Input/Output Systems:
Access Methods, Directory and Disk Structure.
File System Mounting, File Sharing, File-System Structure and Implementation.
Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.
Recovery, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.
Security:
Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats.
Cryptography as a Security Tool, User Authentication, Implementing Security Defences.
Virtual Machines:
Types of Virtual Machines and Implementations; Virtualization.

UNIT – D **10 Hours**

Linux Operating Systems:
Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output; Inter process Communication, Network Structure.
Windows Operating Systems:
Design Principles, System Components, Terminal Services and Fast User Switching; File System, Networking.
Distributed Systems:
Types of Networks based Operating Systems, Network Structure, Communication Structure and Protocols; Robustness, Design Issues, Distributed File Systems.

Reference Books

1. Operating System Principles, Abraham Silberchatz, Peter B.Galvin,Greg Gagne,8th Edition, Wiley
Student Edition
2. Operating System-Internals and Design Principles, W.Stallings, 6th Edition, Pearson.
3.Modern Operating System, Andrew s Tanenbaum, 3rd Edition, PHI
4. Operating System A concept-based Approach, 2nd Edition, D.M.Dhamdhere, TMH.

Title: AI & ML
Course Code: CSA542
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Outcomes:

CO-1	Learn the fundamentals of Artificial Intelligence, intelligent agents, searching algorithms, and logical reasoning techniques.
CO-2	Implement supervised and unsupervised learning algorithms to solve classification, regression, and clustering problems.
CO-3	Use ensemble models and evaluation metrics to enhance and assess machine learning models.
CO-4	Understand and apply neural networks like CNNs, RNNs, and LSTMs for advanced problem-solving.

Unit A **10 Hours**

Artificial Intelligence: Definition, Current AI Systems, Intelligent Agents, Different types of Agents, Searching Algorithms: Heuristic Search, Breadth First Search, Depth First Search, A* Search, Introduction to Expert Systems, Logic and Inferences: Propositional Logic, First Order Logic (FOL), Forward and Backward Chaining

Unit B **12 Hours**

Introduction: Introduction to Machine Learning, Applications, Types: Supervised Learning, unsupervised Learning, semi-supervised learning and reinforcement learning.
Supervised Learning Algorithms: Naïve Baves, Decision Tree, KNN, SVM, Bayesian Network, Multilayer perceptron or back propagation neural network, linear regression, logistic regression.

Unit C **12 Hours**

Unsupervised Learning Algorithms: K-means Clustering, Hierarchical clustering
Ensemble Machine Learning models: Ensemble Machine Learning techniques such as Bagging, Boosting and Voting

Model Selection: Metrics, Feature Selection, Principal Component Analysis, Confusion Matrix, Overfitting, Underfitting, Bias- Variance Trade-off.

Unit D **12 Hours**

Deep Learning: Basics of Deep Learning, Need of deep learning, Difference between machine learning and deep learning, Classification of Deep Learning Approaches
Types: Recursive Neural Networks (RNN), Convolutional Neural Network, Recurrent Neural Network: LSTM

References

- Norvig, P., & Russell, S. J. (2020). *Artificial intelligence: A modern approach* (4th ed.). Pearson.
- Raschka, S., & Mirjalili, V. (2022). *Python machine learning* (4th ed.). Packt Publishing.
- Sipser, M. (2012). *Introduction to the theory of computation* (3rd ed.). Cengage Learning.
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press.
- Mitchell, T. M. (2020). *Machine learning* (Reissue edition). McGraw-Hill.

Course Title: Advanced Web Technology Laboratory
Course Code: CSA655

L	T	P	Credits	Mar
0	0	4	2	5(

- Implementation of Stateful and Stateless Components
- Implementation of Validations controls
- Working web forms and event handling
- React component lifecycle and different lifecycle methods
- Learn to Use MongoDB Atlas (The Cloud Version of MongoDB) and Install and configure MongoDB

Course Outcomes:

CO-1	Working with React Modules, importing and exporting the modules.
CO-2	Learn what is JSX and how it works behind the scenes.
CO-3	Creating dynamic websites with help of re-usable components.
CO-4	Build web applications using React JS with MongoDB

L	T	P	Credits	Mar s

0	0	4	2	50

Course Title: AI & ML Laboratory
Course Code: CSA543

- Implement BFS and DFS algorithms.
- Apply A* Search to solve pathfinding problems.
- Create a simple Propositional Logic solver.
- Use Forward and Backward Chaining for rule-based reasoning.
- Build an expert system for decision-making.
- Clean and visualize data using Python.
- Implement Naïve Bayes, Decision Tree, KNN, and SVM for classification.
- Create linear and logistic regression models for prediction.
- Train and test a Multilayer Perceptron (MLP).
- Perform K-means and Hierarchical clustering on datasets.
- Apply bagging, boosting, and voting techniques for model improvement.
- Evaluate models using confusion matrix and metrics like precision and recall.
- Use PCA for dimensionality reduction.
- Build a basic neural network for binary classification.
- Implement a CNN for image classification.
- Train an RNN or LSTM for sequential data.
- Compare deep learning and traditional machine learning models.

Course Title: Advanced Operating System Laboratory

Course Code: CSA544

L	T	P	Credits	Marks
0	0	4	2	50

- Installation: Linux introduction and file system – Basic features, advantages, installing requirement, Basic architectureof UNIX/Linux system, Kernel, Shell.
- Commands for file handling: creating and viewing files, file comparisons.
- Disk related commands, checking disk free spaces.
- Processes in linux – process fundamentals, connecting processes with pipes,Redirecting input output, Background processing, managing multiple processes, changing process priority, scheduling of processesat command, batch commands, Printing commands, Regular expressions
- Mathematical commands.
- Vi editor.
- Shell programming.
- Implementation of Interprocess communication and semaphores.

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L	T	P	Credits	Ms
4	0	0	4	10

Course Title: Data Mining and Data Warehousing
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:

CO-1	To understand Basic Systems Concepts and Data Warehouse Design Process.
CO-2	To understand Data Mart in detail.
CO-3	Student must be able to understand Data Preprocessing and Outlier detection.
CO-4	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**

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. RomezElmasri, Shamkant B., Navathe, *Fundamentals of Database Systems,* New Delhi:Pearson Education, 2009.
3. Han, Kamber, Morgan Kaufmann, *Data Mining: Concepts and Techniques*, 2nd Edition, Elsevier, 2012.
4. Inmon, W.H., C. L. Gassey,*Managing the Data Warehouse*, New York:John Wiley 1999.
5. Fayyad, Usama M., *Advances in Knowledge Discovery and Data Mining*, MIT Press, 1996.
6. Charu C. Aggarwal, *Data Mining: The Textbook*, Springer, 2015.
7. Hongbo Du, *Data Mining Techniques and Applications: An Introduction*, Cengage India, 2010.
8. Tan, Steinbach, Kumar, *Introduction to Data Mining*, Pearson India. 2016.
9. Alex Berson, Stephen Smith, *DATA WAREHOUSING, DATA MINING, & OLAP*, McGraw Hill Education, 1997.
10. Prasad R.N., *Fundamentals of Business Analytics*, Wiley India, Second Edition, 2016

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

L	T	P	Credits	Ms
4	0	0	4	1

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:

CO-1	To understand basic concepts System and Information Concepts and Management Information System.
CO-2	To understand Decision Support Systems.
CO-3	Student must be able to Expert System and Executive Information and Support Systems.
CO-4	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

- 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. MurdickRobert, Joel E. Ross, *Information Systems for Modern Management*, New Delhi: PHI, 3rd Ed, 1971.
2. TurbanEfraim,*Decision Support Systems& Intelligent Systems*, New Delhi: Pearson Education, 2004.
3. Laudon C. Kenneth &Laudon P. Janes, *Management Information Systems*, Pearson Education, 2018.
4. BellavistaPaolo and CorradiAntonio (Eds.), *Handbook of Mobile Middleware*, Auerbach Publication, 2006.
5. Steven Alter, *Information Systems* , 4th Edition, Pearson Education, 2003.
6. McNurlinC.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.

L	T	P	Credits	Marks
4	0	0	4	100

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

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:

CO-1	To understand basic concepts in the Systems and environment and System simulation.
CO-2	To understand Continuous-time and Discrete time Systems.
CO-3	Student must be able to understand Random Numbers.
CO-4	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
- 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. GordanG., *System Simulation*, New Delhi: Pearson Education, 2nd Ed. 2015
3. DeoNarsingh, *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, 4th 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

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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:

CO-1	Understand lifecycle processes and agile approaches of software Development.
CO-2	Apply novel software models and techniques to bring out innovative and solutions for the growth of the society.
CO-3	Model and Analyze structure and behavior of a software system.
CO-4	Design a solution to a given problem and evaluate the same in various scenarios.
CO-5	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

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
- UNITTest, 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 RomanGruia-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, 9th Ed, 2010.

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:

CO-1	Student must be Able to understand the building blocks of Big Data.
CO-2	Student must be able to articulate the Mining Data Streams.
CO-3	Student must be able to represent the analytical aspects of Big Data using Hadoop.
CO-4	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
- Job Scheduling-Shuffle and Sort, Task execution
- Map Reduce Types and Formats, Map Reduce Features

UNIT – D **10 Hours**

Frameworks

3. Applications on Big Data Using Pig and Hive
4. Data processing operators in Pig
5. Hive services, HiveQL, Querying Data in Hive
6. Fundamentals of HBase and ZooKeeper
7. Visualizations
    - Visual data analysis techniques, interaction techniques
8. 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.

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:

CO-1	Introduction to machine learning.
CO-2	Understand the Linear machines and Learning decision trees.
CO-3	Understand the concepts of Instance-based Learning and Machine learning concepts and limitations.
CO-4	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

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 perceptron 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

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:

CO-1	Learn and usage of the term "internet of things" in different contexts.
CO-2	Understand the key components that make up an IoT system.
CO-3	Understand the concepts of Data Acquiring and Business Models for Business Processes.
CO-4	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 IoTs Sources of the IoTs, M2M Communication, Examples of IoTs,
- Applications of IoT domains and recent deployment trends.
- Design Principles for Connected Devices, Internet Connectivity Principles.
- Business Models for Business Processes in the Internet of Things, IoT/M2Msystems.
- Overview of AI technologies and their applications in IoT domains.
- IoT architecture and its different layers. How different layers are connected to

:

UNIT-B **10 Hours**

- IoT Protocol stack and how it differs from IP Stack, Application layer protocols CoAP, MQTT, HTTP etc. RPL routing protocol for constrained devices.
- Wireless Communication Technologies like ZigBee, 6LowPAN etc. For IoT, 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 (WIFI, Cellular, LTE, 5G, LPWAN etc.), Web Connectivity for connected-Devices.

UNIT – C **10 Hours**

- Introduction to IoT Security and Privacy, Threats to IoT security based on its layers, security requirements and good security practices.
- 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.

- Introduction to Cloud Platform services for IoT.

UNIT – D **10 Hours**

- Introduction to Wireless sensor networks, challenges of wireless sensor networks, sensor constraints like low computational power, battery powered etc. Different Topologies in WSN and design principles of WSN.
- Introduction to IoT prototyping and designing, embedded devices for IoT prototype, IoT firmware, Arduino IDE introduction for prototyping, cloud integration etc.

Reference Books:

1. Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Higher Education, 2017.
2. Bahgya and V. Madisetti, Internet of Things, University Press, 2015.
3. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 2013.
4. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly, 2011.
5. F. John Dian, Fundamentals of Internet of Things, Wiley-IEEE Press, 2022.
6. Sudhir Kumar, Fundamentals of Internet of Things, Routledge, 2022.
7. Raj Kamal, Internet of Things (2nd Edition), McGraw Hill Education, 2022.

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:

CO-1	Introduction to R Programming.
CO-2	To learn about Matrices, Arrays and Lists.
CO-3	Understand the concepts of Data Frames.
CO-4	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

- 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 **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

- 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 Visualisatio*n, Statistical Analysis and Programming in R, Amazon Digital South Asia Services Inc, 2013.

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:

CO-1	Learn the history of microprocessors, Microcomputer structure and Architecture of 8085/ 8086 Microprocessor
CO-2	Understand the Memory Interface.
CO-3	Understand the Interrupts and Direct Memory Access (DMA).
CO-4	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

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*, 8th 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.

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

L	T	P	Credits	Mas
0	0	4	2	5

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:

CO-1	To understand basic concepts distributed systems and Inter-process Communication
CO-2	To understand Distributed Operating Systems and Parallel Processing.
CO-3	Student must be able to understand Parallel Processing Architectures, Data Dependency Analysis and Thread Based Implementation.
CO-4	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, 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**

Parallel Processing Architectures

- Parallelismin 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

- ThreadManagement, 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 (2nd Ed), 2014.
2. CoulourisGeorge, DollimoreJean, KindbergTim, *Distributed Systems: Concepts and Design*, New Delhi: Pearson Education 5th edition, 2011.
3. Madnick and Donovan, *Operating System*, New delhi: McGraw Hill, 1997
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. Rajaraman V., *Elements of Parallel Computing*, New Delhi:PHI, 1990
7. A.S. Tenenbaum, *Operating System: Design and Implementation*,NewDelhi:PHI, 2006.

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, sptial and frequency domain, linear programming, color image processing, image compression, etc.

Course Outcomes:

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

UNIT – A **15 Hours**

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 **10 Hours**

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.

UNIT – C **10 Hours**

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
- 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 ofIndia, 2002.
2. Pratt William K., *Digital Image Processing: PIKS Inside*(3rd ed.), New Jersy: John Wiley & Sons, Inc., 2001.
3. Bernd Jahne, *Digital Image Processing*, (5th revised and extended edition), Springer, 2002
4. AnnaduraiS. and ShanmugalakshmiR., *Fundamentals of Digital Image Processing*, New Delhi: Pearson Education, 2007
5. Joshi M.A., *Digital Image Processing: An Algorithmic Approach*, New Delhi: Prentice-Hall ofIndia, 2006
6. Sridhar ,*Digital Image Processing* 2ed, Oxford University Press.

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:

CO-1	Learn soft computing techniques genetic algorithm concepts.
CO-2	Analyze various neural network architectures.
CO-3	Understand Fuzzy Systems and Applications.
CO-4	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
- Backpropogation 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
- Learning Vector Quantization, Counter Propogation 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. SivanandamS N and DeepaS N, *Principles of Soft Computing*, New Delhi: Wiley India (2nd 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 Jersy: Wiley (3rd Ed), 2011.
7. RajasekaranS. andPaiG.A.V., *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI, 2013.
8. Goldberg Davis E., *Genetic Alorithms, 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.

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:

CO-1	Learn and classify different methodologies, concepts and approaches to System Software Programming.
CO-2	Understand the Loaders & Linkage Editors, and Compilers.
CO-3	Understand the Compilers and its construction tools.
CO-4	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

Loaders & Linkage Editors **15 Hours**
- Loading, Linking & Relocation
- Program Relocatibility
- 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
- 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.

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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:

CO-1	Explain NLP evolution from **rule-based to LLMs**
CO-2	Implement **classical and statistical NLP techniques**
CO-3	Apply **neural & transformer models** for NLP tasks
CO-4	Build **real-world NLP applications** using modern tools

UNIT – A **15 Hours**

Foundations of NLP & Linguistic

- **Introduction to NLP**
- Definition, scope, and challenges
- NLP vs Computational Linguistics
- Applications: MT, Chatbots, IR, Speech, Sign Language

- **History and Evolution of NLP**
  - Rule-based NLP
  - Statistical NLP
  - Neural NLP
  - Transformer & LLM era

- **Text Processing Basics**
  - Tokenization
  - Normalization
  - Stemming and Lemmatization
  - Stop-word handling

- **Regular Expression and Finite Automata**
  - Regex for text processing
  - Finite State Automata (FSA)
  - Finite State Transducers (FST)
  - Morphological analysis

UNIT-B
Syntax & Classical NLP Techniques **15 Hours**

- **Word Classes and POS Tagging**
  - Parts of Speech
  - Rule-based POS tagging
  - Statistical POS tagging
  - Evaluation metrics

- **Syntax & Grammers**
  - Phrase structure
  - Constituency vs Dependency grammar
  - Context-Free Grammars (CFG)
  - Parse trees

- **Parsing Techniques**
  - Top-down parsing
  - Bottom-up parsing
  - CYK algorithm
  - Dependency parsing (intro)

UNIT – C **15 Hours**

Semantics, WSD & Traditional ML NLP

- **Lexical Semantics**
  - Word meaning
  - Synonymy, Polysemy, Homonymy
  - Lexical resources (WordNet)

- **Word Sense Disambiguation (WSD)**
  - Knowledge-based approaches
  - Selectional restriction
  - Dictionary-based methods
  - Unsupervised WSD
  - Supervised ML-based WSD

- **Feature-Based NLP**
  - Bag of Words (BoW)
  - TF-IDF
  - N-grams
  - Feature engineering

- **Classical ML for NLP**
  - Naive Bayes
  - Support Vector Machines
  - Conditional Random Fields (CRF)
  - Applications: NER, text classification

UNIT – D **15 Hours**

Statistical and Neural NLP

- **Statistical NLP**
  - Probability basics
  - Language Modeling
  - N-gram models
  - Smoothing techniques

- **Sequence Models**
  - Hidden Markov Models (HMM)
  - POS tagging using HMM
  - CRF vs HMM

- **Word Embeddings**
  - Distributional hypothesis
  - Word2Vec (CBOW, Skip-Gram)
  - GloVe
  - FastText
  - Limitations of static embeddings

Reference & Text Books:

1. Grosz, B.J., Sparck Jones, K. & Webber, B.L. (eds)., *Readings in natural language processing*, Los Altos, CA. Morgan Kaufmann, 1986.
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.
5. Jurafsky, D. & Martin, J. H. (2026). *Speech and Language Processing* (3rd ed., online draft). Available from Stanford University (online).

Course Title: Elective-II Laboratory
Course Code: CSAXXX

L	T	P	Credits	Marks
0	0	4	2	50

Implementation of the concepts ofthe course chosen from Elective-I

Course Title: Digitizing Industry Knowledge for Software Development

Course Code: CSA692

Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To provide the basic knowledge about Knowledge Driven Development (KDD) and the problem faced by software developer in completing the project.

Course Outcomes:

CO -1	Understand lifecycle processes and agile approaches of software Development.
CO -2	Apply novel software models and techniques to bring out innovative and solutions for the growth of the society.
CO -3	Model and Analyse structure and behaviour of a software system.
CO -4	Design a solution to a given problem and evaluate the same in various scenarios.

UNIT – A **15 Hours**

Problem Space Understanding

- Importance, Problem Space Understanding in Enterprise Systems,
- Information Technology: Overview and its role in industry

UNIT-B

Knowledge Management System **13 Hours**

- Current Challenges, Knowledge Life cycle and levels of Knowledge, Knowledge Driven Development
- Domain Knowledge Framework: Structure Plus Content, Connecting statements together.

UNIT – C **12 Hours**

Knowledge about Finance

- Banking: Banking Domain Knowledge-Sprinkles, Administrative of Corporate Banking Products, Administration of Investment Banking Products, Insurance: Overview, Insurance Domain Knowledge-Sprinklers,
- Automobile: Overview, Automobile Domain Knowledge-Sprinkles

UNIT – D **15 Hours**

Knowledge about Models

- Atomic Knowledge Model - Delivering IT Projects reusing Industry Knowledge. Digital transformation and the role of Knowledge Driven Development

Text Book:

- Digitizing Industry Knowledge for Software Development by Manoj Kumar Lal Published by Notion Press.

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Course Title: Cybersecurity
Course Code: CSA693
Course Duration: 45-60 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To implement successful solutions to the security needs of a business through risk compliance, incident handling, integrated network solutions, and application development while maintaining an ethical profile.

CO-1	Student should understand cyber-attack
CO-2	Types of cybercrimes
CO-3	Cyber laws and also how to protect them self and ultimately society from such attacks

UNIT-A **15 Hours**

Introduction to Security: Need for security.

- Security approaches, principles of security, types of attacks.
- Digital Privacy, Online Tracking, Privacy Laws, Types ofComputer Security risks (Malware, Hacking, Pharming, Phishing, Ransomware, Adware and Spyware, Trojan, Virus, Worms, WIFI Eavesdropping, Scareware, Distributed Denial-Of-Service Attack, Rootkits, Juice Jacking),

UNIT-B **12 Hours**

- Antivirus and Other Security solution, Password, Secure online browsing, Email Security, Social Engineering, Secure WIFI settings, Track yourself online, Cloud storage security, IOT security, Physical Security Threads.
- Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit.

UNIT-C **10 Hours**

- Networks Vulnerability Scanning - Netcat, Socat,, Understanding port and services tools-Datapipe, Fpipe, WinRelay, Network Reconnaissance-Nmap.
- Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding the basis of Virtual Private Networks, Linux Firewall, Window Firewall, Snort: Introduction Detection System

UNIT-D **8 Hours**

- Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with

Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world.

Reference Books:

1. Cryptography and Network Security: Behrouz A. Forauzan 2/e
2. Cryptography and Network Security: William Stallings 4/e
3. nAnti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
4. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley.

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Course Title: Blockchain Technology
Course Code: CSA694
Course Duration: 45-60 Hours

Course Objective: To give students the understanding of emerging abstract models for Blockchain Technology and to familiarise with the functional/operational aspects of cryptocurrency eco-system.

Course Outcomes:

CO-1	Understand the applications of blockchain in different domains.
CO-2	Understand basic technologies like cryptographic hash functions, blocks, Merkle trees, elliptic curve cryptography and digital signatures.
CO-3	To Have knowledge of decentralized consensus algorithms like Proof of Work, Proof of Stake, Proof of Capacity etc.
CO-4	To Learn how to record transactions in blockchain, computing Bitcoin addresses etc.

UNIT – A **15 Hours**

Introduction

- History, Digital currencies, Ledgers, Cryptography, Centralized and decentralized systems, Peer-to-peer systems, Purpose of Blockchain, Types of blockchain (public, private, semi-private), Applications of blockchain (in government, healthcare, real estate, voting, insurance, NFTs, metaverse, Web 3.0).

UNIT-B

Cryptocurrency & Design **13 Hours**

- Concept of cryptocurrency, History of Bitcoin, Mining concept, Challenges of blockchain/Bitcoin design (performance, scalability, efficiency, security, governance, public policy and legal framework).

UNIT – C **12 Hours**

Blockchain Technology

- Properties of hash functions, Cryptographic hash functions, Hashes, Blocks, Block headers, Merkle trees, Chain forks, Asymmetric cryptography, Digital signatures

Decentralized Network Consensus.

- Introduction to decentralized networks, Native currency, Consensus, Proof of Work (PoW), Proof of Stake (PoS), Proof of Capacity (PoC), Proof of Burn (PoB), PBFT, Proof of Elapsed Time (PoET).

UNIT – D **15 Hours**

Permissioned and Permissionless Blockchain

Blockchain systems vs traditional databases, Permissioned and permissionless blockchains, Applications,

Advantages and disadvantages, Solidity.

Blockchain and Money Transactions

Satoshi and Bitcoin, Recording of transactions in blockchain, Transaction inputs, outputs and format,
Bitcoin addresses.

Text Book:

1. Imran Bashir Mastering blockchain Distributed ledger technology, decentralization, and smart contracts explained, 2nd edition, Packt Publication, 2018.
2. Lorne Lantz and Daniel Cawrey Mastering Blockchain Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, 1st edition, O'Reilly Publication, 2020.
3. Chris Dannen Introducing Ethereum and Solidity Foundations of Cryptocurrency and Blockchain Programming for Beginners, 1st edition, Apress Publication, 2017.

Course Title: Blockchain Technology Laboratory

Course Code: CSA696

L	T	P	Credits	Marks
0	0	2	1	50

Hands-on related to Blockchain (Creation of Block, blockchain implementation, mining in blockchain)

Use any programming language to implement the following:

1. Using SHA256, obtain the message digest of string “Blockchain Developer”
2. Write a program to encrypt and decrypt the message “Hello World” using SHA256.
3. Implement RSA cryptographic algorithm.
4. Create a simple blockchain using Proof of Work (PoW).
5. Demonstrate sending of a digitally signed document.
6. Create a blockchain block containing block hash, transaction history, time of creation.
7. Create a blockchain having 5 nodes and print the hash values of each block.
8. Create a blockchain having 5 nodes and check its validity.
9. Implement a smart contract using solidity programming language.
10. Create a simple permissioned blockchain using Hyperledger Fabric.