DAV UNIVERSITY JALANDHAR

FACULTY OF SCIENCE

Course Scheme and Syllabus
for

Master of Computer Applications
(Two Years Degree Program)

1st to 4th Semester

(NEP 2020)

Syllabi Applicable for 2025-27

Duration: 2 years (4 Semesters)

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

Or

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

Or

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO-1. Work productively as successful Computer professionals in diverse career paths including supportive and leadership roles on multidisciplinary teams or be active in higher studies.

PEO-2. Communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavors, and practice their profession with high regard to ethical responsibilities.

PEO-3. Engage in life-long learning and to remain current in their profession to foster personal and organizational growth.

PROGRAMME OUTCOMES (POS)

PO-1: Apply mathematics and computing fundamental and domain concepts to find out the solution of defined problems and requirements. (Computational Knowledge).

PO-2: Use fundamental principle of Mathematics and Computing to identify, formulate research literature for solving complex problems, reaching appropriate solutions. (Problem Analysis).

PO-3: Understand to design, analyze and develop solutions and evaluate system components or processes to meet specific need for local, regional and global public health, societal, cultural, and environmental systems. (Design/Development of Solutions).

PO-4: Use expertise research-based knowledge and methods including skills for analysis and development of information to reach valid conclusions. (Conduct Investigations of Complex Computing Problems).

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. (Modern tool usage).

PO-6: Exhibiting ethics for regulations, responsibilities and norms in professional computing practices. (Professional Ethics).

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development (Environment and sustainability).

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice (Ethics).

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (Individual and team work).

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (Communication).

PO-11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments (Project management and finance).

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (Life-long learning).

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO-1: Globally expertise the technological planning and development of software applications in the usage of the modern era.

PSO-2: Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design, cloud computing, Artificial Intelligence, Mobile applications.

PSO-3: Acquiring In-depth knowledge & sustained learning leading to innovation, permutation, modernization and research to fulfill global interest.

PSO-4: Know about computing principles and business practices employed as software solutions in industries.

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& Testing	Core	4	0	0	4
5	CSA521	Python Programming	Core	4	0	0	4
6	CSA522	Advanced Database Management Systems Laboratory	Core	0	0	4	2
7	CSA523	Data Structures and File Processing Laboratory	Core	0	0	4	2
8	CSA524	Python Programming Laboratory	Core	0	0	4	2
				20	**0**	**12**	**26**

Semester 2

S.No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	CSA525	JAVA & Network Programming	Core	4	0	0	4
2	CSA541	Advanced Operating System	Core	4	0	0	4
3	CSA542	AI & Machine Learning	Core	4	0	0	4
4	CSA577	Design and Analysis of Algorithms	Core	4	0	0	4
5	CSA578	Computer Based Optimization Techniques	Core	4	0	0	4
6	CSA528	JAVA & Network Programming Laboratory	Core	0	0	4	2
7	CSA543	AI & Machine Learning Laboratory	Core	0	0	4	2
8	CSA544	Advanced Operating System Laboratory	Core	0	0	4	2
				20	**0**	**12**	**26**

Semester 3

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	CSA612	Theory of Computer Science	Core	4	0	0	4
2	CSA628	Computer Networks and Data Communication	Core	4	0	0	4
3	CSA693	Cyber Security	Core	4	0	0	4
4	CSA654	Web Technology	Core	4	0	0	4
5	CSA627	Research Methodology	Core	4	0	0	4
6	CSA630	Computer Networks and Data Communication Laboratory	Core	0	0	4	2
7	CEC103	Community Engagement Course	Core	1	0	2	2
8	CSA655	Web Technology Laboratory	Core	0	0	4	2
				21	**0**	**10**	**26**

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
5	CSAXXX	Discipline Elective II	DSE	0	0	4	2
6	CSAXXX	Discipline Elective II	DSE	0	0	4	2
7	CSAXXX	Discipline Elective II	DSE	0	0	4	2
8	CSA689	Major Project	DSE	0	0	12	6
				16	**0**	**24**	**28**

Discipline Elective-I	
CSA605	Data Mining and Data Warehousing
CSA608	Distributed and Parallel Processing
CSA616	System Simulation and Modelling
CSA619	Advanced Software Engineering
CSA620	Compiler Design
CSA632	Big Data Analytics
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
CSA696	Blockchain Technology Laboratory
CSA697	Cloud Computing Laboratory
CSA698	Natural Language Processing Laboratory
Option to adopt MOOC course having 2 Credits.	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA 517**						
Course Title	**Discrete Mathematical Structures**						
Course Outcomes:	On the completion of the course the student will be able to: 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						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	**10%**	**10%**	**25%**	**-**	**50%**	**-**	**5%**
Syllabus							**CO Mapping**
Unit 1	**Set Theory (12 Hours)**						CO1
	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 2	**Group Theory(13 Hours)**						CO2
	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 3	**GRAPH (10 Hours)**	CO3
	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 4	**Vectors and Matrices (10 Hours)**	CO 4
	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 Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA518**						
Course Title	**Advanced Database Management System**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	**10%**	**10%**	**25%**	**-**	**50%**		5%
Syllabus							CO Mapping
Unit 1	**Introduction to Data Base and Data Models (10 Hours)**						CO1
	General Architecture of a Data Base Management Software, Advantages and Disadvantages of DBMS,						
	Entity Relationship model, hierarchical model from network to hierarchical, relational model, object oriented database, object relational database						
	Data Base Design						
	Functional dependencies; Normalization , Multivalued dependencies, decomposition, Relational algebra and calculus,						
	Need and types of query optimization procedures, phases of query optimization.						
Unit 2	**Data Base Protection (10 Hours)**						CO 2
	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 3	**Introduction to PL/SQL (10 Hours)**	CO3
	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 4	**Distributed Database Concepts. (15 Hours)**	CO 4
	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 Book/s	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, 4th Revised Edition (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: Elmasri Navathe*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA519**						
Course Title	**Data Structures and File Processing**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							CO Mapping
Unit 1	**Preliminaries (12 Hours)**						CO 1
	Introduction to Data Structures: Primitive and Composite, Various data structures.						
	Common operations on data structures, algorithm complexity.						
	Big O notation, timespacetradeoff between algorithms.						
	Complexity of Algorithms, Records and Pointers.						
	Arrays						
	Arrays defined, representing arrays in memory, various operations on linear arrays.						
	Multi-dimensional arrays, Matrices, Sparse Matrices.						
	Linear Search, Binary Search.						
	Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, Radix Sort						
Unit 2	**Linked Lists (13 Hours)**						CO 2
	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.						
	Quick sort technique to sort an array, parenthesis checker.						
	Queues: Implementation of queue using arrays and linked lists.						
	Dequeue, Priority Queues and their implementation, applications						

	of queues.	
Unit 3	**Trees (10 Hours)**	CO 3
	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. Heap sort technique to sort an array.	
Unit 4	**Graphs and Hash Tables (10 Hours)**	CO 4
	Representation of Graphs and Applications: Adjacency Matrix, Path Matrix, 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	
	Operations on files, Types of files. File Organizations: Sequential files, Indexed Sequential file, Directed files and multikey files, File performance criteria and terms.	
Reference Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA540**						
Course Title	**Software Engineering and Testing**						
Course Outcomes	On the completion of the course the student will be able to: 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 behaviour 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.						
Examination Mode	Theory+Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							CO Mapping
Unit 1	**Introduction (15 Hours)**						CO1
	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 Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering						
Unit 2	**(19 Hours)**						CO2
	Software Requirements						
	Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling						
	Requirements Review, Software Requirement and Specification (SRS) Document.						

	Software Design	
	Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling	
	Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.	
Unit 3	**Software Quality (10Hours)**	CO 3
	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 4	**Software Testing (10 Hours)**	CO 4
	Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.	
	Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.	
Reference Book/s	*1. Lewis, T.G., Software Engineering, New Delhi: McGraw Hill, 1982.* *2. Ochoa Sergio and Roman Gruia- 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, 5th Edition.* *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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA521**						
Course Title	**Python Programming**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to Python Language (15 Hours)**						CO1
	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 2	**Control Structures (15 Hours)**						CO2
	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 3	**Python Class and Objects (15 Hours)**	CO3
	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 4	GUI Programming in Python (15 Hours)	CO4
	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, List Box, Radio button, Message, Text, Spin box, etc.	
	Database connectivity in Python: Installing mysql connector, accessing connector module module, using connect, cursor, execute & close functions, reading single & multiple results of query execution.	
Reference Book/s	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.* *A. B. Downey, Think Python, O'Reilly Media Inc., 2012.* 6. *J. M. Zelle, Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates, Inc., 2004.* 7. *Dr. R. Nageswara Rao, Core Python Programming, 3rd Edition.*	

L	T	P	Credits	Marks
0	0	4	2	50

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

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

L	T	P	Credits	Marks
0	0	4	2	50

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

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

L	T	P	Credits	Marks
0	0	4	2	50

Course Title: Python Programming Laboratory
Course Code: CSA524

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.

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

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA525**						
Course Title	**JAVA and Network Programming**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Java Foundation Classes and Swings Components (10 Hours)**						CO1
	Review of Java Basic Features: JFC and Swing Components: Features, Components, Swing Vs AWT, Swing Containers, Controls, Using Dialogs, Sliders, Progress Bars, Tables, Creating User Interface using Swing						
	Event-Driven Programming in Java, Event- Handling Process, Event Handling Mechanism, The Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling						
Unit 2	**Java Database Connectivity (15 Hours)**						CO2
	Connectivity model, Java. SQL package, JDBC Exception Classes, Database connectivity, Data manipulation and navigation, Creating Database Application.						
	Java Networking and J2EE Network Programming in Java using the java.net package; Establishing two-way communication between Server and Client using TCP and UDP						
Unit 3	**Java Server Pages (10 Hours)**						CO3
	Introduction to JSP Technology; Architecture of JSP (Model – I and Model - II); Life Cycle of JSP Page; Working with basic JSP Basic Tags; JSP objects, developing Web Applications.						
Unit 4	**Spring MVC (10 Hours)**						CO4
	Spring Framework Architecture; Dependency Injection and Inversion of Control; AOP with Spring; Managing Transactions in Spring; Spring Form Tag Library; Spring's Web MVC Framework						

Reference Book/s	1. *Schildt, Herbert : The Complete Reference Java 2, , TMH.* 2. *Ivan Bayross : Web Enabled Commercial Application Development using Java 2.0, BPB.* 3. *Cornell, Gary and Horstmann Cay S. : Core Java, Vol I and Vol II, Sun Microsystems Press.* 4. *Keogh, James : J2EE : The Complete Reference. The Complete Reference, 10th Edition, by Herbert Schildt, McGraw-Hill.* 5. *Martin Bond, Debbie Law, Andy Longshaw, Dan Haywood, Peter Roxburgh: Sams: Teach Yourself J2EE in 21 days, Pearson.* 6. *Java Server Programming Java EE 7 (J2EE 1.7) Black book, Kogent Learning Solutions Inc., DreamTech Publication.* 7. *Advance Java Technology, by M.T. Savaliya, Kogent Learning Solutions Inc., DreamTech Publication.* 8. *Advanced Java Programming, by Uttam Kumar Roy, Oxford University Press.*

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA541**						
Course Title	**Advanced Operating System**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Basics of Operating Systems (13 Hours)**						CO1
	Operating System Structure, Operations and Services.						
	System Calls, Operating-System Design and Implementation; System Boot.						
	Process Management: Process Scheduling and Operations. Inter process 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 2	**Memory Management (13 Hours)**						CO2
	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 3	**File and Input /Output Systems (10 Hours)**	CO3
	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 4	**Linux Operating Systems (10 Hours)**	CO4
	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 Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA542**						
Course Title	AI & Machine Learning						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							CO Mapping
Unit 1	**Artificial Intelligence (10 Hours)**						CO1
	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 2	**Introduction (12 Hours**						CO2
	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 3	**Unsupervised Learning Algorithms (12 Hours)**						CO3
	K-means Clustering, Hierarchical clustering Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.						
	Ensemble Machine Learning models						
	Ensemble Machine Learning techniques such as Bagging, Boosting and Voting.						

	Model Selection Model Selection : Metrics, Feature Selection, Principal Component Analysis, Confusion Matrix, Overfitting, Underfitting, Bias- Variance Trade-off.	
	Deep Learning (12 Hours)	CO4
	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	
Reference Books	1. *Norvig, P., & Russell, S. J. (2020). Artificial intelligence: A modern approach (4th ed.). Pearson.* 2. *Raschka, S., & Mirjalili, V. (2022). Python machine learning (4th ed.). Packt Publishing.* 3. *Sipser, M. (2012). Introduction to the theory of computation (3rd ed.). Cengage Learning.* 4. *Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.* 5. *Mitchell, T. M. (2020). Machine learning (Reissue edition). McGraw-Hill.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA577**						
Course Title	**Design and Analysis of Algorithms**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Algorithms and Analysis (10 Hours)**						CO1
	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 2	**String Processing and Greedy Method (10 Hours)**						CO2
	KMP, Boyre-Moore, Robin Karp algorithms						
Unit 3	**Dynamic Programming (10 Hours)**						CO3
	General method, Optimal Binary Search Trees						
	0/1 Knapsack, The Travelling Salesperson Problem.						
	BackTracking: General method, 8 queen's problem, Graph Coloring Hamiltonian Cycles, Analysis of these Problems.						
Unit 4	**Branch and Bound (15 Hours)**						CO4
	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 Book/s	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	Marks
4	0	0	4	100

Course Code	**CSA578**						
Course Title	**Computer Based Optimization Techniques**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (10 HOURS)**						CO1
	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 2	**Linear Programming (15 Hours)**						CO2
	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 3	**Integer & Dynamic Programming(10 Hours)**						CO3
	Integer programming problem						
	Branch and Bound Techniques, Characteristics						

	Deterministic DP Problems, Recursive Approach and Tabular method.	
	PERT / CPM: Project Planning, Scheduling, Activity Cost Network Diagram Representation, Difference between CPM and PERT,Floats and Slack Times	
Unit 4	**Queuing Models (10 Hours)**	CO4
	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 Book/s	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.*	

L	T	P	Credits	Marks
0	0	4	2	50

Course Title: JAVA & Network Programming Laboratory

Course Code: CSA528

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

Course Outcomes:

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.

L	T	P	Credits	Marks
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.

L	T	P	Credits	Marks
0	0	4	2	50

Course Title: Advanced Operating System Laboratory

Course Code: CSA544

- 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.

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA612**						
Course Title	**Theory of Computer Science**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Automata Theory (15 Hours)**						CO1
	Deterministic Finite Automata, Moves.						
	Non-Deterministic Finite Automata.						
	Moore and Mealy Machines.						
	Minimization Algorithm.						
Unit 2	**Context Free Grammars (15 Hours)**						CO2
	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 3	**Linear Bounded Automata (LBA) (15 Hours)**						CO3
	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 4	**Undecidability (15 Hours)**	CO4
	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 Book/s	*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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA628**						
Course Title	**Computer Networks and Data Communication**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to Data Communication (18 Hours)**						CO1
	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 2	**Data Link Layer (15 Hours)**						**CO3**
	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 3	**Network Layer (15 Hours)**	CO3
	Design Issues, Routing Algorithms (Shortest Path, Flooding, Distance Vector, Hierarchical, Broadcast, Multicast.	
	Internetworking, IP Protocol, ARP, RARP.	
Unit 4	**Transport Layer (12 Hours)**	CO4
	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 Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA693**						
Course Title	**Cyber Security**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to Security: Need for security. (15 Hours)**						CO1
	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 2	**Antivirus and Other Security solution (12 Hours)**						CO2
	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 3	**Networks Vulnerability Scanning (10 Hours)**						CO3
	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 4	**Cyber Crime and law (8 Hours)**						CO4

	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 Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA654**						
Course Title	**Web Technology**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**(10 Hours)**						CO1
	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 2	**(12 Hours)**						CO2
	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 3	**(13 Hours)**						CO3
	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 4	**(10 Hours)**						CO4
	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 Book/s	1. *KyleBanker,PeterBakkum,ShaunVerch,DouglasGarrett,TimHawkins,"MongoDB in Action", Dream Tech 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, The road to learn React: your journey to master plain yet pragmatic React.jS by Robin Wieruch.*

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA627**						
Course Title	**Research Methodology**						
Course Outcomes	On the completion of the course the student will be able to: 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: Creating dynamic websites with help of re-usable compon Student must be able to understand Hypothesis testing. CO 4: Student must be knowing dissertation design and report writing.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**(10 Hours)**						CO1
	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 2	**(12 Hours)**						CO2
	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 3	**(12 Hours)**						CO3
	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 4	**(11 Hours)**						CO4

	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**.**	
References Book/s	*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.*	

L	T	P	Credits	Marks
0	0	4	2	50

Course Code	**CSA630**
Course Title	**Computer Network and Data Communication Laboratory**
Course Outcomes	On the completion of the course the student will be able to: 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)

L	T	P	Credits	Marks
0	0	4	2	50

Course Title: Web Technology Laboratory
Course Code: CSA655

- 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

In hours			
L	T	P	Credit
1	0	2	2

DAV UNIVERSITY
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Course Code	**CEC103**						
Course Title	**Community Engagement Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Gain an understanding of rural life, culture and social realities. **CO2:** Develop a sense of empathy and bonds of mutuality with local community. **CO3:** Appreciate significant contributions of local communities to Indian society and economy. **CO4:** Learn to value the local knowledge and wisdom of the community. **CO5:** Identify opportunities for contributing to community's socio-economic improvements.						
Examination Mode	**Theory/ Practical/ Theory + Practical**						
Assessment Tools	**W Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	**10%**	--------	--------	**25%**	**25%**	**35%**	**5%**

Syllabus		CO Mapping
Unit 1:	**Appreciation of Rural Society** Appreciation of Rural Society: Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages" (Gandhi), rural infrastructure. **Teaching Methodology:** Classroom Discussions **Assignment:** Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village. **Mode of Assignment Submission:** Written Assignment	**CO1**
Unit 2:	**Understanding Rural Economy and Livelihood** Understanding rural economy and livelihood: Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets. **Teaching Methodology:** Group Discussions in Class **Assignment:** Describe your analysis of rural household economy, its challenges and possible pathways to address them. **Mode of Assignment Submission:** Written Assignment	**CO2**

Unit 3:	**Rural Institutions** Rural Institutions: Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration. **Teaching Methodology:** Classroom Discussions **Assignment:** How effectively are Panchayati raj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual). **Mode of Assignment Submission:** Group presentations of Assignment	**CO3**
Unit 4:	**Rural Developmental Programmes** Rural Developmental Programmes: History of rural development in India, current national programmes, Sarva Shiksha Abhiyan, Beti Bachao Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awas Yojana, Skill India,Gram panchayat Decentralised Planning, NRLM, MNREGA etc. **Teaching Methodology:** Classroom Discussions **Assignment:** Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community; give suggestions about improving implementation of the programme for the rural poor. **Mode of Assignment Submission:** Written Assignment	**CO4 & CO 5**

Reference Materials:-

Books

1. Singh, Katar. *Rural Development: Principles, Policies and Management*, SagePublications, New Delhi, 2015.
2. *A Hand book on Village Panchayat Administration*, Rajiv Gandhi Chair for PanchayatiRaj Studies, 2002.
3. United Nations. *Sustainable Development Goals*, 2015. un.org/sdgs/
4. M.P.Horuian. *Best Practices in Rural Development*, Shanlax Publishers, 2016.

Journals

1. Journals of Rural development, (published by NIRD & PR Hyderabad)
2. Indian Journal of Social Work, (by TISS, Bombay)
3. Indian Journal of Extension Education (by Indian Society of Extension Education)
4. Journal of Extension Education (by Extension Education Society)
5. Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India
6. Kurukshetra (Ministry of Rural Development, GoI)

7. Yojana (Ministry of Information and Broadcasting, GoI)

Practical Field Activities:-

Total Field Hours Required: 30 hours

Activity Selection: Students must select 5 activities from the comprehensive list provided above.

Practical Evaluation:

- Practical CA: 50%
- End Term Practical Examination: 50%

The students are required to spend a total of 30 hours in field and select any 5 activities from among the following:

- Interaction with SHG women members and study of their fnctions and challenges , planning for their skill building and livelihood activities.
- Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site.
- Field visit to Swachh Bharat pmject sites, conduct analysis and initiate problem solving measures
- Conduct Mission Antyodaya surveys to support under Gram Panehayat Development Plan (GPDP)
- Interactive community exercise with thcal leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization
- Visit Rural Schools / mid-clay meal centres, study Academie and infrastructural resources andgaps
- Participate in Gram Sabha mectinp, and study community pathcipation
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
- Attend Parent Teacher Association meetings, and interview school drop outs Fostering SocialResponsibility & Community Engagement in Iiigher Education Institutions in India
- Visit local Anganwadi Centre and observe the services being provided
- Visit local NG0s, civil society organisations and interact with their staff and beneficiaries,
- Organize awarenexs programmes, health camps, Disability camps and cleanliness camps
- Conduct soil health test, drinking water analysis, cncrgy u.se and thel efficiency surveys
- Raise understanding a people's impacts of climate change, building up community's disaste,reparcdness
- Organise orientation programmes for thrmers regarthng organic cultivation, rational u. ofirrigation and fcthlizers and pmmotion of traditional species of crop:: and plants
- Formation of committees for common property resource management, village pond maintenance and fishing.

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA605**						
Course Title	**Data Mining and Data Warehousing**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction(10 Hours)**						CO1
	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 2	**Data Mart(13 Hours)**						CO2
	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 3	**Data Pre-processing (13 Hours)**	**CO3**
	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 4	**Classification (10 Hours)**	CO4
	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	
References Book/s	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.* 11. *Dr. Arti Deshpande& Dr. Pallavi N. Halarnkar , TechKnowledge publications, 3rd Edition.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA608**						
Course Title	**Distributed and Parallel Processing**						
Course Outcomes	On the completion of the course the student will be able to: CO1: 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						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction(15 Hours)**						CO1
	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 2	**Distributed Operating Systems (15 Hours)**						CO2
	Introduction, The Kernel, Process and Threads, Communication.						
	Simple distributed transactions and Nested transactions, Atomic Commit protocols						
	Concurrency control, N distributed transaction, Distributed deadlocks, Transactions with replicated data.						
	Parallel Processing						
	Introduction, Need for Computational speed; Applications of parallel computers in various fields including Mathematics, Physics, Chemistry and Computer Science						
Unit 3	**Parallel Processing Architectures (15 Hours)**						CO3
	Parallelism in Sequential Machines, Abstract model of parallel computer. Multiprocessor architecture, programmability issues.						
	Data Dependency Analysis						
	Types of Dependencies, Loop and Array Dependence. Loop Dependence Analysis, Solving Diophantine Equations.						

	Thread Based Implementation: Thread Management, Thread Implementation	
Unit 4	**Recovery and Fault Tolerance (15 Hours)**	CO4
	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	
References Book/s	*1. Sasikumar. M., Shikhara, Dinesh and Prakash Ravi, Introduction to Parallel Processing, New Delhi: PHI, 2014.* *2. Coulouris George, Dollimore Jean, KindbergTim, Distributed Systems: Concepts and Design, New Delhi:Pearson Education 5th edition, 2011.* *3. Madnick and Donovan, Operating System, New delhi: McGraw Hill, 2017.* *4. Wilkinson and Barry, Parallel Programming Techniques & Applications, New Delhi: Pearson Education, 2007.* *5. Crichlow and Joel M., An Introduction to Distributed and Parallel Computing, New delhi: PHI, 1997.* *6. RajaramanV., Elements of Parallel Computing, New Delhi:PHI, 1990* 7. *A.S. Tenenbaum, Operating System: Design and Implementation, New Delhi:PHI, 2006.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA616**						
Course Title	**System Simulation and Modelling**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Systems and environment (12 Hours)**						CO1
	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 2	**Continuous-time and Discrete time Systems (10 Hours)**						CO2
	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 3	**Random Numbers (13 Hours)**						CO3
	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	
	Thread Based Implementation	
Unit 4	**Queuing Models (10 Hours)**	CO4
	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	
References Book/s	1. *Law Averill, System Simulation Modeling and Analysis, New Delhi: Tata McGraw-Hill, 2014.* 2. *Gordan G., System Simulation, New Delhi: Pearson Education, 2nd Ed. 2015* 3. *Deo Narsingh, System Simulation with Digital Computer, New Delhi: Prentice Hall of India, 2011.* 4. *Banks J., Garson J.S., Nelson B.L., Discrete Event System Simulation, New Delhi: Prentice Hall of India, 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*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA619**						
Course Title	**Advanced Software Engineering**						
Course Outcomes	On the completion of the course the student will be able to: 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 behaviour 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.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (15 Hours)**						CO1
	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 2	**System Analysis (10 Hours)**						CO2
	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 3	**System Administration and Training (10 Hours)**	CO3
	User manual, Implementation Documentation, Operation plan and maintenance	
	Hardware and Software Selection	
Unit 4	**Testing Fundamentals (10 Hours)**	CO4
	Objectives, Principles, Testability.	
	Test Cases: White Box & Blackbox Testing.	
	Testing Strategies: Verification& Validation.	
	UNIT Test, Integration Testing, Validation Testing, System Testing.	
	Software documentation procedures, Software reliability and quality assurance. Quality Matrics and software models.	
	Software maintenance and configuration management.	
	Software engineering tools and environment	
	International software engineering standards and their relevance Case studies in software engineering	
References Book/s	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.Joel Henry, Pearson Education: Software Project Management*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA620**						
Course Title	**Compiler Design**						
Course Outcomes	On the completion of the course the student will be able to: CO 1: Student must be able to understand Structure of a Compiler and Syntax Analysis CO 2 Student must be able to learn Syntax Directed Translation. CO 3: Student must be able to understand Run Time Environment. CO 4: Student must know Code Generation & Code Optimization.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**The Structure of A Compiler (13 Hours)**						CO1
	Phase of a Compiler, Compiler Tools, Finite Automata, Regular Expressions, Conversion From Regular Expression To Finite Automata.						
	Syntax Analysis						
	Context Free Grammars, Top Down &Bottom Up Parsing Techniques.						
	Parsing Table Construction, LR, SLR & LALR Parsers.						
Unit 2	**Syntax Directed Translation (12 Hours)**						CO2
	Syntax-directed translation & implementation, Intermediate Code, Postfix translation.						
	Phase Trees, Syntax Trees.						
Unit 3	**Run Time Environment (10 Hours)**						CO3
	Storage Organization Allocation Strategies, Parameter Passing.						
	Symbol Tables, Code Generation, Problem In Code Generation.						
Unit 4	**Code Generation & Code Optimization (10 Hours)**						CO4
	Principle Sources, Loop Optimization, DAG Representation						
References Book/s	1. *Aho, Alfred V. and Ullman Jeffery D.,Principles of Compiler Design, Addison-Wesley, 1977.* 2. *Barrett, Compiler Construction, Prentice Hall* 3. *Trembley, Jean-Paul & Paul G. Sorenson, The Theory and Practice of Compiler Writing, New York: McGraw Hill, 1985.* 4. *Keith Cooper and Linda Torczon, Engineering a Compile, Morgan Kaufmann Publishers, 2011* 5. *Dhamdhere D.M, Compiler Construction—Principles and Practice, Macmillan India, 2008*						

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA632**						
Course Title	**Big Data Analytics**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to Big Data (10 Hours)**						CO1
	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 2	**Mining Data Streams (10 Hours)**						CO2
	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 3	**Hadoop (15 Hours)**						CO3
	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 4	**Frameworks (10 Hours)**	CO4
	Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive.	
	Fundamentals of HBase and ZooKeeper	
	Visualizations :Visual data analysis techniques, interaction techniques	
	Systems and applications	
References Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA634**						
Course Title	**Internet of Things**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (15 Hours)**						CO1
	An Overview of Internet of things, Internet of Things Technology, Behind Io Ts Sources of the Io Ts, M2M Communication, Examples of IoTs.						
	Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity						
	Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.						
	Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities						
Unit 2	**Communication Technology and Web Connectivity (10 Hours)**						CO2
	Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability						
	Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices						
Unit 3	**Data Acquition (10 Hours)**						CO3
	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 4	**Data Collection and Services (10 Hours)**						CO 4

	Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models	
	IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology	
Reference Book/s	1. *Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Higher Education, 2017.* 2. *A.Bahgya and V.Madisetti, Internet of Things, Univesity Press, 2015* 3. *Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 2013.* 4. *CunoPfister, Getting Started with the Internet of Things, Oreilly, 2011*. 5. *Prof.* Satish Jain Shashi Jain, IoT and its applications, bpb	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA635**						
Course Title	**R ProgrSamming**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (10Hours)**						CO1
	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 2	**Matrices, Arrays and Lists (10 Hours)**						CO2
	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 3	**Data Frames (10 Hours)**						C03
	Creation of data frames, significance of data frames in R language accessing data element of a frame, printing data frames, getting structure of data frames, summary of data frames, extracting rows and column of the data frames, appending data frames.						
Unit 4	**OOP (15 Hours)**						CO4
	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 Book/s	1. *Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, McGraw No Starch Press, 2011.* 2. *Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Data & Analytics Series, 2013.* 3. *Mark Gardener, Beginning R – The Statistical Programming Language, Wiley, 2013.* 4. *Robert Knell, Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R, Amazon Digital South Asia Services Inc, 2013.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA636**						
Course Title	**Mobile Application Development**						
Course Outcomes	On the completion of the course the student will be able to: CO 1: Acquired the Introduction to Mobile Computing and Android. CO 2 To learn about Android Application Design Essentials and Android User Interface Design Essentials. CO 3: Understand the concepts of Files, Content Providers, and Databases. CO 4: To learn the use of Common Android APIs						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							
Syllabus							**CO Mapping**
Unit 1	**Introduction (10 Hours)**						CO1
	Introduction to Mobile Computing						
	Introduction to iOS Android Development Environment						
	Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User						
	Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file						
Unit 2	**Android Application Design Essentials (15 Hours)**						**CO2**
	Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permission.						
	Android User Interface Design Essentials: User Interface Screen elements, Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool,Gallery, Image Switcher, GridView, and ImageView views to display images, Creating Animation						

Unit 3	**Files, Content Providers, and Databases (10 Hours)**	CO3
	Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers	
	Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources	
Unit 4	**Using Common Android APIs (10 Hours)**	CO4
	Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	
TextBook/s		
Reference Book/s	1. *Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education, 2nd ed. (2011)* 2. *Reto Meier, Professional Android 2 Application Development, Wiley India Pvt Ltd* 3. *Mark L Murphy, Beginning Android, Wiley India Pvt Ltd, 2011.* 4. *Barry Burd ,Android Application Development All in one, For Dummies, 2015.* 5. *Meikang Qiu, Mobile Application Development with ANROID technology and Algorithms, 2016 , 1st Edition.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA637**						
Course Title	**Scientific Computing using MATLAB**						
Course Outcomes	On the completion of the course the student will be able to: CO 1: Acquired the basic of matlabnd Linear Systems. CO 2 To provide knowledge of Matrices. CO 3: To provide knowledge of Eigenvalues, Eigenvectors and Complex Numbers and Polynomials and Interpolation. CO 4: To provide knowledge of Numerical Differentiation and Optimization						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (15 Hours)**						CO 1
	Introduction to Matlab						
	Scripts and Arrays, Data Types and Cell Arrays, Flow Control and Matrix Algebra, Functions and Vectorization, Two-Dimensional Graphics, Monte-Carlo Methods						
	Linear Systems						
	Matrix representation of Linear Systems, Echelon Forms, Rank, Consistent Systems, Homogeneous Linear Systems						
	Applications of Linear Systems						
Unit 2	**Matrices (10 Hours)**						CO 2
	Matrix Algebra**,** Inverses LU Factorization, Applications of Matrices, Determinants						
	Least squares approximations, QR factorization						
Unit 3	**Eigenvalues and Eigenvectors and Complex Numbers (10 Hours)**						CO3
	omit eigenspaces, Diagonalization, Applied Eigenvalue Problems: Predator-Prey Model, Car Rental						
	Algebraic Theory, Geometric Theory, Polar Form.						
	Polynomials and Interpolation: Polynomials, Curve-Fitting, MATLAB Commands for Polynomials, Linear Interpolation						
Unit 4	**Numerical Differentiation (10 Hours)**						CO4
	Derivatives of Interpolation Polynomials**,** Difference Approximations ,Taylor Expansion Method, Differentiation.						
	Optimization: Zero-Finding, Roots of Nonlinear Equations:						

	Graphical Method, Bisection Method, Newton Iteration Method	
TextBook/s		
Reference Book/s	*1. Duane C. Hanselman, Bruce L. Littlefield, Mastering MATLAB, Prentice Hall (Pearson), 2012.* *2. Kenneth Hardy, Linear Algebra for Engineers and Scientists Using Matlab, Prentice Hall (Pearson), 2005.* *3. Shoichiro Nakamura, Numerical Analysis and Graphic Visualization with MATLAB, 2/E, Prentice Hall (Pearson), 2002.* *4. S.N. Siranandam, S. Sumathi and S.N. Deepa : Introduction to Neural Networks using MATLAB, McGraw Hill, 2014.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA671**						
Course Title	**Microprocessors and Its Applications**						
Course Outcomes	On the completion of the course the student will be able to: 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						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (15 Hours)**						CO1
	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 2	**Memory Interface (15 Hours)**						CO2
	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., 279 Programmable Keyboard/Display Interface., 8254 Programmable Interval Timer, 16550 Programmable Communication Interface						
Unit 3	**Interrupts (15 Hours)**						CO 3
	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 4	**Bus Interface (15 Hours)**	CO4
	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.	
TextBook/s		
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	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA678**						
Course Title	**Digital Image Processing**						
Course Outcomes	On the completion of the course the student will be able to: 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 .						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (15 Hours)**						CO1
	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 2	**Introduction to the Fourier Transformation. (10 Hours)**						CO2
	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 3	**Techniques of Color Image Processing (10 Hours)**	CO3
	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 4	**Introduction to Image Compression (10 Hours)**	CO4
	Coding Redundancy	
	Spatial and Temporal Redundancy	
	Irrelevant Information	
	Measuring Image Information	
	Basic Compression Methods: Huffman Coding, LZW Coding Run Length Coding, Wavelet Coding.	
TextBook/s		
Reference Book/s	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.* 7. *Rafael C. Gonza Lez, Digotal Image Processing , Fourth Edition.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA682**						
Course Title	**Soft Computing**						
Course Outcomes	On the completion of the course the student will be able to: 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.						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction (15 Hours)**						CO1
	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 2	**Artificial Neural Networks and Applications (15 Hours)**						CO2
	Introduction, Basic models of ANN, Important terminologies, Supervised Learning Networks, Perception Networks, Adaptive Linear Neuron.						
	Back propagation 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 3	**Fuzzy Systems and Applications (15 Hours)**	CO3
	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 4	**Applications (15 Hours)**	CO 4
	Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design.	
	Robotics and Sensors, Information Retrieval System, Share Market Analysis, Natural Language Processing	
TextBook/s		
Reference Book/s	1. *Sivanandam S N and Deepa S 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. *Rajasekaran S. and Pai G.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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA683**						
Course Title	**System Software**						
Course Outcomes	On the completion of the course the student will be able to: 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..						
Examination Mode	Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**System Software (15 Hours)**						CO1
	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 2	**Loaders & Linkage Editors (15 Hours)**						CO2
	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 3	**Compilers (15 Hours)**						CO3
	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 4	**Parsing Techniques (15 Hours)**	CO4
	Top Down & Bottom-Up Parsing.	
	Shift Reduce Parsing, Operator Precedence Parsing, Predictive Parsers Automatic Construction of Efficient Parsers, R Parsers.	
	The Canonical Collection of LR(0) Items.	
	Constructing SLR Parsing Tables. Constructing Canonical LR Parsing Tables, Constructing LALR Parsing Tables	
TextBook/s	.	
Reference Book/s	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.*	

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA691**						
Course Title	**Natural Language Processing**						
Course Outcomes	On the completion of the course the student will be able to: 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 .						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus	**CO Mapping**
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**
  o Parts of Speech
  o Rule-based POS tagging
  o Statistical POS tagging
  o Evaluation metrics
• **Syntax & Grammers**
  o Phrase structure
  o Constituency vs Dependency grammar
  o Context-Free Grammars (CFG)
  o Parse trees
• **Parsing Techniques**
  o Top-down parsing
  o Bottom-up parsing
  o CYK algorithm
  o Dependency parsing (intro)	

UNIT – C	**15 Hours**
Semantics, WSD & Traditional ML NLP	

• **Lexical Semantics**
  o Word meaning
  o Synonymy, Polysemy, Homonymy
  o Lexical resources (WordNet)
• **Word Sense Disambiguation (WSD)**
  • Knowledge-based approaches
  • Selectional restriction
  • Dictionary-based methods
  • Unsupervised WSD
  • Supervised ML-based WSD
• **Feature-Based NLP**
  o Bag of Words (BoW)
  o TF-IDF
  o N-grams
  o 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**
  o Probability basics
  o Language Modeling
  o N-gram models
  o Smoothing techniques	

• **Sequence Models**
  o Hidden Markov Models (HMM)
  o POS tagging using HMM
  o CRF vs HMM
• **Word Embeddings**
  o Distributional hypothesis
  o Word2Vec (CBOW, Skip-Gram)
  o GloVe
  o FastText
  o 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).

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA694**						
Course Title	**Blockchain Technology**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Understand the applications of blockchain in different domains. CO2: Understand basic technologies like cryptographic hash functions, blocks, Merkle trees, elliptic curve cryptography and digital signatures. CO3: To Have knowledge of decentralized consensus algorithms like Proof of Work, Proof of Stake, Proof of Capacity etc. CO4: To Learn how to record transactions in blockchain, computing Bitcoin addresses etc.						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**

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

L	T	P	Credits	Marks
0	0	2	1	50

Course Code: CSA696

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.

L	T	P	Credits	Marks
4	0	0	4	100

Course Code	**CSA695**						
Course Title	**Cloud Computing**						
Course Outcomes	On the completion of the course the student will be able to: CO 1: To understand the basic building blocks and evolution of cloud computing as well as aspects of cloud security. CO 2 Able to implement virtualization by creating different types of virtual machines on physical hosts. CO 3: To understand the advancements in the cloud computing platforms. CO 4: To understand concepts of cloud computing by creating Cloud platform using Virtual machines						
Examination Mode	Theory/ Practical/ Theory+ Practical.						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to Cloud Computing (15 Hours)**						CO 1
	Introduction to cloud computing, Definition, Vision, Reference Model, Benefits, Limitations, Open Challenges, Grid and Utility Computing.						
	Definition of Virtualization, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance						
Unit 2	**Cloud Architecture and Service Models (12 Hours)**						CO 2
	Cloud Computing Architecture: Service Models, Deployment Models, Cloud Entities, Cloud Clients, Cloud Programming Models.						
	Cloud Terminology: Resource Provisioning, Bill Management, Multi-tenancy and Isolation, Service Level Agreement (SLA) and Quality of Service (QoS), Mobile Cloud Computing, Mobile Cloud Service Models.						
Unit 3	**Cloud Security and Privacy Management (10 Hours)**						CO 3
	Cloud Security: Infrastructure Security, Data Security, Identity and Access						
	Management, Privacy Management, Security as a Service on Cloud.						
	Governance and auditing for cloud operations.						
	Threats, risk and requirements landscape						

	Privacy, data and digital identity.	
	Data sensitivity, location and legal jurisdiction.	
	Cloud security approaches and challenges.	
Unit 4	**Cloud Simulators (6 Hours)**	CO 4
	Introduction to CloudSim simulators, its architecture and working	
	Cloud computing simulation using GreenCloud.	
	Introduction to VMWare Simulator, basics, advantages, using VMWare, understanding virtual machines, creating virtual machine, cloning virtual machine starting and stopping virtual machines.	
TextBook/s		
Reference Book/s	1. *Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6529803, New Delhi, India, 2011.* 2. *Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt.Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011* 3. *Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Cloud Computing For Dummies, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.* 4. *Cloud Computing Concepts, Technology & Architecture, Thomas Erl, Pearson Publications.*	

L	T	P	Credits	Marks
0	0	4	2	50

Course Title: Digital Image Processing Laboratory
Course Code: CSA680

1. To implement basic image processing operations and image enhancement filters.
2. To implement image enhancement operations in spatial and frequency domain.
3. To implement Color and Morphological Image Processing and applications of image processing
4. Implementation of image compression techniques.

***Implementation will be done using Matlab or Python libraries.**

Course Outcomes:

CO Number	CO Description
CO1	Fundamentals of image processing operations and basic image enhancement filters
CO2	Image Enhancement operations in Spatial and Frequency domain.
CO3	Color and Morphological Image Processing and applications of image processing.
CO4	Image Compression and its methods