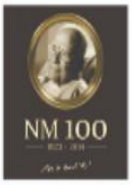


Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Udumalai Road, Pollachi, Coimbatore District - 642003
Established in 1998 ♦ Approved by AICTE ♦ Affiliated to Anna University
(A DIVISION OF NIA EDUCATIONAL INSTITUTIONS)

NAAC A++ GRADE
Cycle 3 (2023-2030)
The Highest Grade

Curriculum and Syllabi

Department of Computer Applications (MCA)

Semesters I to IV

Regulations 2024

Programme: Department of Computer Applications (MCA)
Curriculum and Syllabi: Semester I to IV
Recommended by Board of Studies on:25.04.2025
Approved by Academic Council on:04.07.2025

Action	**Responsibility**
Designed and Developed By	BoS Computer Applications
Compiled By	Office of Controller of Examination
Approved By	Principal

Dr. Mahalingam College of Engineering and Technology,
Pollachi 642003.

(An autonomous institution approved by AICTE and affiliated to Anna University)

Vision:

The Department of Computer Applications seeks to transform students from diverse backgrounds into proficient and competitive software experts who can deliberately solve the needs of the community while coming up with innovative solutions to shifting contemporary issues.

Mission:

- To become proficient with computer applications, employ state-of-the-art teaching and learning techniques.
- Teach students to be successful, moral, and effective problem solvers who will also become lifelong learners and contribute to the strengthening of our nation.
- Provide a foundation for value-based learning and integrate new research findings and discoveries into a range of scientific fields.
- To promote morality and excellence among students.
- Encourage students to develop their entrepreneurial abilities so they can lead nations globally.

Programme Educational Objectives (PEOs)

After 2 years of completion of the programme the graduates will be able to:

PEO1: Domain Expertise: Employ computational and mathematical knowledge to identify, characterize, create, implement, and improve software solutions for a range of problems across various application areas.

PEO2: Computing Skills and Ethics: Employ technical skills to solve societal and environmental issues in an ethical manner.

PEO3: Lifelong Learning and Research: Committed to continuous learning and research in computing.

Programme Outcomes (POs)

On successful completion of the programme the graduates will be able to:

PO1. An ability to independently carry out research/investigation and development work to solve practical problems

PO2. An ability to write and present a substantial technical report/document

PO3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4. Skilled to identify an appropriate design, framework, and data models to create a system that performs well.

PO5. Proficient in creating real-time applications leveraging emerging and contemporary technologies.

Programme Specific Outcomes (PSOs)

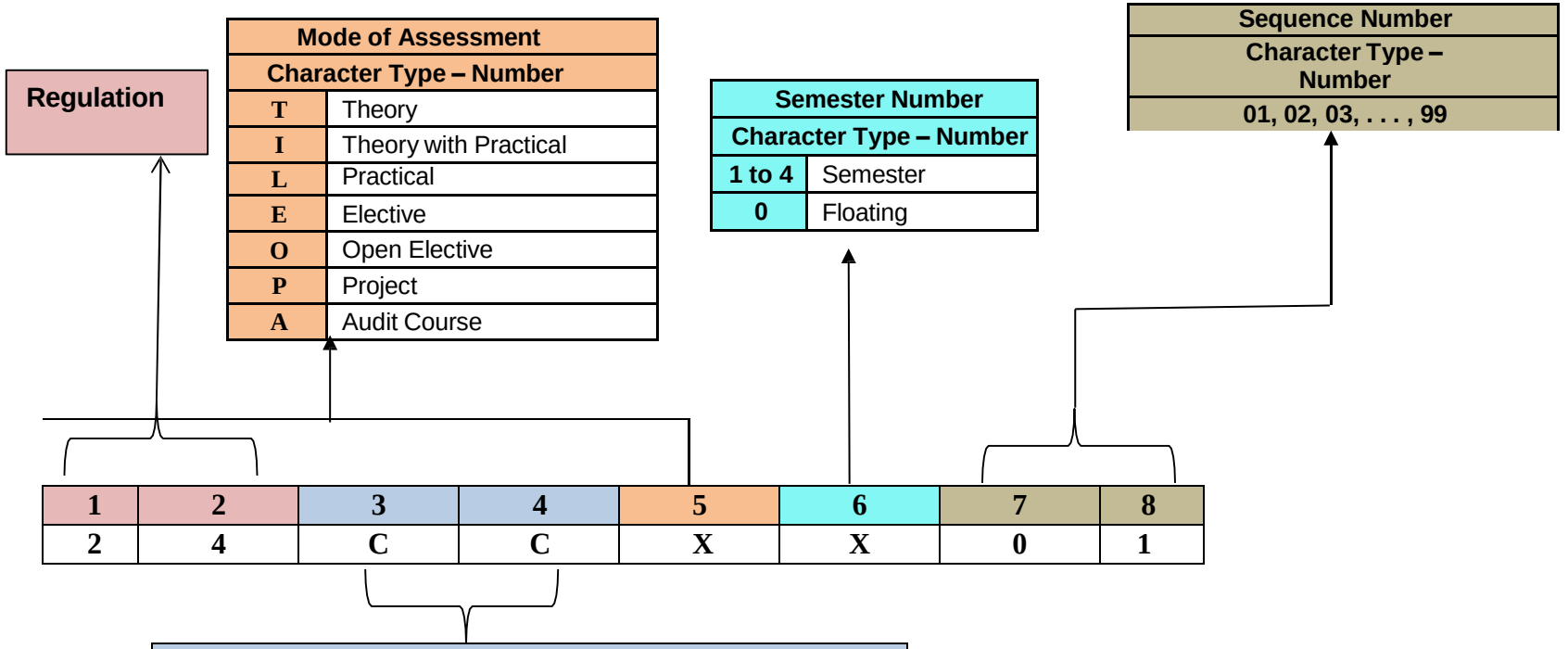
On successful completion of the programme the graduates will be able to:

PSO1. Application Development: Apply software engineering principles in the design and development of web and mobile applications.

PSO2. Data management: Manage and analyze huge volume of data in real world problems.

Dr. Mahalingam College of Technology, Pollachi

2024 Regulations - Course Code Generation Procedure for PG Courses



Board/Department/Programme/Course Type	
Character Type – Alphabet	
CC	CAD/CAM
CO	Communication Systems
CP	Computer Science and Engineering
ES	Embedded System Technologies
ST	Structural Engineering
CA	Computer Application
SH	Science and Humanities

Programme: Department of Computer Applications (MCA)
2024 Regulations
(Academic Year 2024- 2025 Onwards)
Curriculum for Semesters I to IV

Semester I

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAT101	Mathematical Foundation for Computer Applications	3	1	0	4	100	-
24CAT102	Web Technology	3	0	0	3	100	-
24CAT103	Advanced Data Structures and Algorithms with Python	3	0	0	3	100	-
24CAT104	SQL and NoSQL Database Management Systems	3	0	0	3	100	-
24CAI101	Mobile Application Development with Android	2	0	2	3	100	-
24CAL101	Web Technology Laboratory	0	0	4	2	100	-
24CAL102	Python programming Laboratory	0	0	4	2	100	-
24CAL103	SQL and NoSQL Databases Laboratory	0	0	4	2	100	-
XXXXXX	Skill Enhancement Course - I	0	0	2	1	100	-
24CAC101	Ability Enhancement Course - I	0	0	2	1	100	-
TOTAL		**14**	**1**	**18**	**24**		

Semester II

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAT201	Machine Learning	3	1	0	4	100	-
24CAT202	Java Programming	3	0	0	3	100	-
24CAI201	Full Stack Development	2	0	2	3	100	-
XXXXXX	Professional Elective– I	3	0	0	3	100	-
XXXXXX	Professional Elective– II	2	0	2	3	100	-
24CAL201	Machine Learning Laboratory	0	0	4	2	100	-
24CAL202	Java Programming Laboratory	0	0	4	2	100	-
24CAP201	Mini Project	0	0	6	3	100	-
XXXXXX	Skill Enhancement Course - II	0	0	2	1	100	-
24CAC201	Ability Enhancement Course - II	0	0	2	1	100	-
TOTAL		**13**	**1**	**22**	**25**		

Semester III

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAT301	Artificial Intelligence	3	0	0	3	100	-
24CAT302	Cyber Security	3	0	0	3	100	-
24CAT303	Cloud Computing	3	0	0	3	100	-
24CAT304	Big Data Analytics	3	0	0	3	100	-
XXXXXX	Professional Elective–III	3	0	0	3	100	-
24CAL301	Automated Software Testing Laboratory	0	0	4	2	100	-
24CAL302	Cloud Computing Laboratory	0	0	4	2	100	-
24CAL303	Big Data Analytics Laboratory	0	0	4	2	100	-
TOTAL		**15**	**0**	**12**	**21**	**-**	-

Semester IV

Course Code	Course Title	~~Hours~~/Week			Credits	Marks	Common to Programmes
		L	T	P			
23CAP401	Project Work	-	-	24	12	100	-
Total		**-**	**-**	**24**	**12**		

Internship

Course Code	Course Title	~~Hours~~/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAC021	Internship	-	-	2	1	100	-

Total Credits: 83

Professional Electives

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
Computer Networks and Security						
24CAE001	Unix and Network Programming	3	0	0	3	100
24CAE002	Ethical Hacking	3	0	0	3	100
24CAE003	Block Chain Management	3	0	0	3	100
24CAE004	Wireless Networking	3	0	0	3	100
24CAE005	Security in Computing	3	0	0	3	100
Artificial Intelligence and Data Science						
24CAE006	Internet of Things	3	0	0	3	100
24CAE007	Web Mining and Social Networking	3	0	0	3	100
24CAE008	Deep Learning	3	0	0	3	100
24CAE009	Evolutionary computing	3	0	0	3	100
24CAE010	Human Computer Interface	3	0	0	3	100
24CAE011	Visualization Techniques	3	0	0	3	100
24CAE012	Virtual Reality	3	0	0	3	100
24CAE013	Semantic Web Technologies	3	0	0	3	100
24CAE014	Foundations of Data Science	3	0	0	3	100
24CAE015	Business Intelligence	3	0	0	3	100
24CAE016	Data Mining and Data Warehousing	3	0	0	3	100
24CAE017	Information storage and Management	3	0	0	3	100

24CAE018	Information Retrieval Techniques	3	0	0	3	100
Database Architecture and Software Project Management						
24CAE019	Agile Software Development	3	0	0	3	100
24CAE020	Database Architecture and Administration	3	0	0	3	100
24CAE021	Software Project Management	3	0	0	3	100
24CAE022	Software Quality and Testing	3	0	0	3	100
24CAE023	Multimedia Systems	3	0	0	3	100
Professional Ethics and Research Methodology						
24CAE024	Human Values and Professional ethics	3	0	0	3	100
24CAE025	Research Methodology and Intellectual Property Rights	3	0	0	3	100
Business Management						
24CAE026	Principles of Business Management	3	0	0	3	100
Advanced Technologies						
24CAE027	Augmented Reality	3	0	0	3	100
24CAE028	Information Security	3	0	0	3	100
24CAE029	Deep Learning with Computer Vision	3	0	0	3	100
24CAE030	Ethics for Data Science	3	0	0	3	100
24CAE031	Generative AI	3	0	0	3	100

Advanced Technologies(Lab Integrated)						
24CAE032	Image Data Analysis	2	0	2	3	100
24CAE033	Design Patterns	2	0	2	3	100
24CAE034	Bio-Inspired Computing	2	0	2	3	100
24CAE035	Natural Language Processing	2	0	2	3	100
24CAE036	Game Design using Python	2	0	2	3	100

Skill Enhancement Courses

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAC001	Mobile Programming With Swift	0	0	2	1	100	-
24CAC002	Mobile Application Development With React Native	0	0	2	1	100	-
24CAC003	Flutter	0	0	2	1	100	-
24CAC004	Spring Boot	0	0	2	1	100	-
24CAC005	MEAN Stack	0	0	2	1	100	-
24CAC006	MERN Stack	0	0	2	1	100	-
24CAC007	UX Design	0	0	2	1	100	-
24CAC008	Scalable Application Development for Cloud	0	0	2	1	100	-
24CAC009	IoT Basic Concepts	0	0	2	1	100	-
24CAC010	Web Application Development Using Angular	0	0	2	1	100	-
24CAC011	Advanced in IoT	0	0	2	1	100	-
24CAC012	DevOps Technologies	0	0	2	1	100	-
24CAC013	Power BI	0	0	2	1	100	-

Foundation Courses

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAT101	Mathematical Foundation for Computer Applications	3	1	0	4	100	-

Ability Enhancement Course

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAC101	Ability Enhancement Course - I	0	0	2	1	100	-
24CAC201	Ability Enhancement Course - II	0	0	2	1	100	-

Bridge Courses

Semester I

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAC102	Computer Organization	5	0	0	0	0	-
24CAC103	Operating Systems	5	0	0	0	0	-
24CAC104	Programming in C	5	0	5	0	0	-
24CAC105	Software Engineering	5	0	5	0	0	-

Semester II

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAC203	Linear Algebra	5	0	0	0	0	-
24CAC204	Computer Networks	5	0	0	0	0	-
24CAC205	Internet Technologies	5	0	0	0	0	-
24CAC206	Object Oriented Programming in C++	5	0	5	0	0	-

SEMESTER - I

SEMESTER - I

Course Code: 24CAT101	Course Title: Mathematical Foundation for Computer Applications		
Course Category: Foundation Course		Course Level: Introductory	
L:T:P(Hours/Week):: 3:1:0	Credits: 4	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course focuses on probabilistic random variables, their practical applications, and statistical methods for data classification and analysis, including hypothesis testing and variance analysis.

Module I **30 Hours**

Sample spaces – events – probability definition – conditional probability – total probability - Bayes' theorem - Random variable - Distribution function – discrete, continuous randomvariables – Probability mass function – Probability density function - Expectation.

Discrete Distributions - Bernoulli trials - Binomial distribution – Poisson distribution – Continuous distributions: Exponential distribution - Normal distribution. Classification-Tabulation-Graphical representation – Simple bar chart – Pie chart measures of central tendency: Arithmetic Mean, Median and Mode.

Module II **30 Hours**

Measures of variation - Range, Quartile deviation - Standard deviation and Coefficient of variation. Statistical hypothesis – Type I and Type II errors – Testing of hypothesis: One-tailed and two tailed Tests – t test for single mean and difference of mean – F-Test - Chi-square test for independence of attributes.

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – RandomizedBlock Design (RBD) – Latin Square Design (LSD).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Infer the concepts of random variables in probability	Understand
CO2: Infer the problems under probability distributions	Understand
CO3: Apply the measures of central tendency and dispersion for analysis of data	Apply
CO4: Apply various tests in hypothesis testing for small samples	Apply
CO5: Analyze experiments based on one-way, two-way and Latin square classifications	Analyze

Text Book(s):

T1. Ravichandran. J, “Probability and Statistics for Engineers”, 4th Edition,Wiley India Publication,2019

Reference Book(s):

R1. Veerarajen.T, “Probability, Statistics and Random Process”,1st Edition Tata McGraw Hill,2018

R2. Ross, Sheldon. M, “Introduction to Probability and Statistics for Engineers and Scientists”, 3rd Edition, Academic Press, 2020

R3. Freund John, E and Miller, Irvin, “Probability and Statistics for Engineering”, Duxbury Press;6th edition, 2016

Web References:

1. http://nptel.ac.in/downloads/111101004
2. http://nptel.ac.in/downloads/111105041/10
3. http://nptel.ac.in/downloads/111104079

Course Code: 24CAT102	Course Title: Web Technology		
Course Category: Professional Core	Course Level: Mastery		
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course focuses on web application development, covering server-side and client-side topics. It emphasizes HTML, CSS, JavaScript, file management, form submissions, ASP.NET, standard controls, data binding, error control, authentication, and web forms. It also covers server-side programming.

Module I **22 Hours**

Introduction to WWW - Understanding the working of Internet-Web Application Architecture - Web Standards – Web components -Technologies involved in Web development – Protocol.

Markup Language (HTML) - Introduction to HTML - Formatting and Fonts–Commenting Code– Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – Frames - HTML Forms.

Cascading Style Sheet (CSS) - Introduction to CSS–Basic syntax and structure -Inline Styles – Embedding Style Sheets - Linking External Style.

JavaScript - Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements - Functions - Objects - Array- Date Object -Document Object Model - Event Handling- Form handling and validations.

Java script Response Web Design - Menu – Tabs – Navigations – drop downs – Image operations – Buttons-Forms- Filters – Tables –Tool tips – progress bars – count down timer - User ratings –Chat message.

Module II **23 Hours**

JavaScript and XML - Overview of XML, XML Elements, XML Attributes, XML Namespaces, Displaying XML, XML Http Request, XML Validator, XML DOM, XML DTD.

Overview of ASP.NET - The .NET framework – The C# language: Datatypes-Variables-Conditional Structures-Loop Structures-Methods. Types, Objects and Namespace. WebForm: Standard Controls- Building a web form, Creating Button, Label, Textbox, File Upload, HTML Server Controls. ASP.NET, Using Visual web Developer, Deigning Web Form. Including C# code in ASP.NET Hosting the Web Pages**.**

Error Handling & Grid View in ASP.NET- Error Handling, Logging and Tracing: Common Errors – Exception Handling-Handling Exception-Throwing your own Exception. Data Binding-Data Source Controls-The Grid View- Formatting Grid View.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Define the fundamental concepts of the World Wide Web (WWW) and web application architecture.	Understand
CO2: Apply HTML, CSS and JavaScript functions to improve user interactivity on a web page by validating forms and responding to user events.	Apply
CO3: Integrate XML data into a web application and use JavaScript to dynamically display that data on a web page.	Apply
CO4: Analyze ASP.NET to develop web forms using standard controls like buttons, labels, and textboxes, and implement exception handling within the applications.	Analyze

Text Book(s):

T1. Harvey & Paul Deitel and Associates, Harvey Deitel and Abbey Deitel," Internet and World Wide Web - How to Program", 5th Edition, Pearson Education, 2020.

T2. Kogent Learning Solutions Inc, ASP.NET 4.5 Black Book Includes VB 2005 and C# 2005 Dreamtech Press, 2013.

T3. Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre, Programming PHP Paperback – Import, O′Reilly; 2nd edition, 2020.

Reference Book(s):

R1. Thomas A Powell, Fritz Schneider, JavaScript: The Complete Reference, 3rd Edition, Tata McGraw Hill, 2013.

R2. Dan Hurwitz, Dan Maharry, and Jesse Liberty, Programming ASP.NET 3.5, O'Reilly Media, Inc, USA, 4th edition, 2008.

R3. Thomas A Powell, HTML & XHTML: The Complete Reference Paperback, Tata McGraw Hill Education,2003.

Web References:

1. http://nptel.ac.in/courses/106105084/
2. https://www.coursera.org/learn/dot-net-foundation
3. https://www.w3schools.com/references/index.php

Course Code: 24CAT103	Course Title: Advanced Data Structures and Algorithms with Python		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course covers fundamental data structures, tree structures, algorithms, graph computations, and shortest path algorithms, focusing on students' proficiency in searching, sorting, heap, graph computations, and optimization strategies.

Module I **22 Hours**

Python Overview – Objects in Python – Expressions Operators and Precedence – Control Flow – Functions – Simple Input and Output – Exception Handling – Iterators and Generators – Additional Python Conveniences - Scopes and Namespaces – Modules and Import Statements.

Classification of Data Structures - Operations on Primitive and Non-Primitive Data Structures – Analysis of Algorithms – Arrays: Array Representation – Basic Operations – Multidimensional Data Sets – List and Tuple Classes – String Class –Arrays vs List.

Module II **23 Hours**

Linked Lists - Implementation of Singly Linked Lists - Doubly Linked Lists - Circular Linked Lists. Stacks - Implementation of Stack - Applications of Stack. Queues - Implementation of Queue - Applications of Queues - Priority Queues.

Trees - Binary Trees – Implementing Trees – Tree Traversal Algorithms – Binary Search Trees – AVL Trees – Splay Trees – (2,4) Trees – Red-Black Trees. Graphs: Graph ADT – Graph Traversal – Directed Acyclic Graph – Shortest Paths – Minimum Spanning Trees.

Sorting - Merge Sort - Quick Sort – Sorting with Priority Queue. Pattern Matching Algorithm – Text Compression and Greedy Method. Hash Tables - Search Trees - Binary Search Trees.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the linear and non-linear data structure concepts to real world problems.	Apply
CO2: Apply the time and space complexity of operations performed on linked lists, stacks, and queues and make informed decisions to optimize program performance.	Apply
CO3: Apply the concepts of linked lists (singly, doubly, and circular) by designing and implementing solutions for data storage and manipulation problems.	Analyze
CO4: Examine various tree data structures, including binary trees, AVL trees, and red-black trees, and identify their suitability for different searching, sorting, and hierarchical storage needs	Analyze
CO5: Examine priority queues and hash tables, evaluating their use in applications requiring fast data retrieval, task scheduling, and memory organization.	Analyze

Text Book(s):

T1. Michael T. Goodrich, Roberto Tamassia and Michael H.Goldwasser, Data structures and algorithms in python, Wiley India Pvt. Ltd, Wiley; 1st edition, 2013.

Reference Book(s):

R1. Narasimha Karumanchi, Data Structures and Algorithmic Thinking with Python", Careermonk Publications, 1st Edition, 2015.

R2. Dr Shriram K. Vasudevan, Mr Abhishek S. Nagarajan, Prof Karthick Nanmaran, Data Structures Using Python, OUP India Publications, 1st Edition, 2021.

R3. Chandan Banerjee Atanu Das, Data Structures and Algorithms in C & Python, Universities Press, 2022.

Web References:

1. https://archive.nptel.ac.in/courses/106/106/106106145/
2. https://www.coursera.org/learn/python-data
3. https://www.geeksforgeeks.org/advanced-data-structures/

Course Code: 24CAT104	Course Title: SQL and NoSQL Database Management Systems		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Marks: 100

Course Objectives

The course covers fundamental database system concepts, SQL queries, authorization mechanisms, programming language access, relational database construction, ER modeling, normalization techniques, and databases like MongoDB, Graph databases and Cassandra.

Module I **23 Hours**

Introduction to Relational Databases - Database System Applications – Purpose of Database systems – View of Data – Database Languages– Relational Databases – Database Design – Data Storage and Querying – Transaction Management – Database Architecture – Database Users and Administration - Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Operations.

SQL - Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries - Aggregate Functions – Null values - Nested Sub queries – Complex Queries – Views – Modification of the database – Joined relations. **Advanced SQL -** SQL data types and schemas – Integrity constraints – Authorization – Embedded SQL – Dynamic SQL – Functions and Procedural constructs – Recursive queries – Advanced SQL features – Triggers.

Module II **22 Hours**

NoSQL (Not only SQL) - Use, Types, advantages AND Vendors of NoSQL - SQL versus NoSQL - NewSQL. MongoDB - Definition- Data types - Using JSON - Creating and generating unique key - Replications – Sharding - Create and Drop Database - MongoDB Query Language. Cassandra - Features – CQL data types – CQLSH – Keyspaces – CRUD operations – Collections HBase - Introduction – Data Model - HBase and Schema Design – Case study: Performance Issue on a Single Node. Graph Database - Introduction – Features – Use case: Social Networks.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of database systems and relational model in a real time scenario.	Apply
CO2: Build the SQL queries and authorization mechanism in relational tables.	Apply
CO3: Examine the characteristics of NoSQL and NewSQL in the context of non- relational databases.	Analyze
CO4: Analyze the features of MongoDB, Cassandra, HBase and Graph databases in a real time scenario.	Analyze

Text Book(s):

T1. Abraham Silberschatz, Hentry F. Korth and S. Sudharssan, Database System Concepts, 7th Edition, Tata McGraw Hill, 2019.

Reference Book(s):

R1. Raghu Ramakrishna & Johannes Gerhrke, Database Management System, McGrawHill, 3rd Edition, 2003.

R2. C. J. Date, An Introduction to Database Systems, Eighth Edition, Pearson, 2003.

R3. Ramez Elmasri and Shamkant B.Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2015.

R4. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley, 2021.

Web References:

1. http://nptel.ac.in/courses/106106093/
2. https://www.classcentral.com/course/swayam-database-management-system-9914
3. https://hbase.apache.org/apache_hbase_reference_guide.pdf
4. https://github.com/pcmoreno/Make-IT-Work-5/blob/master/NoSQL%20Distilled.pdf

Course Code: 24CAI101	Course Title: Mobile Application Development with Android		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week):: 2:0:2	Credits: 3	Total Contact Hours: 60	Marks:100

Course Objectives:

The course covers Android fundamentals, activities, intents, permissions, layouts, animation, UI features, Android Studio, camera integration, and SQLite, enhancing proficiency in building robust applications.

Module I **15 Hours**

Mobile Application – Criteria's and Challenges for Choosing Mobile Application – Introduction to Android – The Android Platform – Android SDK – Android Installation – Understanding Basic concepts in Android – Building you First Android application.

Android Application Design Essentials – Application Context – Activities – Services – Intents – Receiving and Broadcasting Intents – Manifest File – Intent Filter – Permissions.

Android User Interface Design – Different Layout Views – Label and Edit View and Buttons/Text View – List View Controls – Image Control and Using Bitmap Streams – Drawing and Animation.

Module II **15 Hours**

UI Features – Graphics in Android – Working with Phone/SMS features – Working with Camera Capture and Play back features – Working with Audio and Video Content using Media Player.

Android APIs - Storage – Understanding Database fundamentals Android – Creating Database/Tables and Keys – Working with Data (Insert / Modify /Delete) Retrieving Data and Populating in a List View.

List of Experiments: **30 Hours**

1. Develop a simple application using GUI components, Font and Colors.
2. Develop an application using Layout Managers and event listeners.
3. Develop an application draws basic graphical primitives on the screen.
4. Write a mobile application that creates alarm clock.
5. Create a mobile application using SQLite for managing to-do lists. Users should be able to add tasks, mark them as completed, edit or delete tasks, and view their list of tasks sorted by priority or due date. Utilize Android fundamentals such as activities, intents, and permissions to allow users to interact with the application seamlessly. Implement UI features and layouts to provide an intuitive user experience.
6. Implement an application that implements Multi-threading.
7. Develop a mobile application that displays weather forecasts for different locations using the Notification Manager. The application should retrieve weather data from an external API and display it to the user. Implement notifications to alert users about upcoming weather events or changes in weather conditions. Utilize Android Studio and UI features to design a visually appealing interface for viewing weather forecasts.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Integrate multimedia features and device functionalities into Android apps to enhance user experiences.	Apply
CO2: Evaluate different storage and database options in Android applications that effectively store, manage, and retrieve data.	Evaluate
CO3: Identifying the suitable functionalities, data management, and UI elements to develop an Android application.	Evaluate
CO4: Create functional Android applications using the Android SDK.	Create
CO5: Create and implement interactive user interfaces for Android apps, incorporating various UI elements and features.	Create

Text Book(s):

T1. Erik Hellman ,Android Programming: Pushing the Limits, Wiley Publication, 1st edition 2014

Reference Book(s):

R1. Android Studio IDE 2.1 and Genymotion Android Emulator or Android Mobile Phone

R2. Neil Smyth, Android Studio 4.1 Development Essentials – Android 8 Edition, 2020

R3. Reto Meier, Professional Android 4 Application Development, Wiley India Pvt Ltd, 2015

R4. Mark L Murphy, Beginning Android, Apress, Illustrated edition, 2009

R5. Barry Burd, Android Application Development All in one for Dummies , 2nd edition, 2015

Web References:

1. https://developer.android.com/training/index.html
2. https://developer.android.com/training/data-storage/sqlite
3. https://www.digitalocean.com/community/tutorials/android-sqlite-database-example-tutorial

Course Code: 24CAL101	Course Title: Web Technology Laboratory		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week):: 0:0:4	Credits: 2	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course covers key topics like HTML, CSS, JavaScript, and ASP.NET, providing a fundamental understanding of web development. It covers static web pages, dynamic web forms, server-side scripting, dynamic websites, and database interaction.

List of Experiments:

1. Design the following static web pages required for an online book store web site. 1) HOME PAGE: The static home page must contain three frames. 2) LOGIN PAGE 3) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table. 4) REGISTRATION PAGE
2. Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10 digits only). 5.Last Name and Address (should not be Empty)
3. Write a XML program to validate book details(Title of the book, Author Name, ISBN no & Publication) using DTD and Schemas.
4. Create a dynamic web application for an online shopping cart system by applying ASP.NET's exception handling concept and CRUD operation.
5. Develop a real time web application with database connectivity using triggers in ASP.NET Framework.
6. Create a secure web application that includes user authentication and authorization features. Implement a login page where users can enter their credentials (username and password). Use ASP.NET for server-side validation and authentication. Once authenticated, users should be directed to specific pages based on their roles (e.g., admin or regular user).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement web-based database applications using the .NET Framework, including exception handling and database triggers.	Apply
CO2: Design interactive web pages using HTML, CSS, and JavaScript, incorporating effective validation techniques.	Apply
CO3: Design real-time web applications with database connectivity, ensuring data integrity and responsiveness.	Apply

Reference Book(s):

R1. Harvey & Paul Deitel and Associates, Harvey Deitel and Abbey Deitel," Internet and World Wide Web - How to Program", 6th Edition, Pearson Education, 2020.

R2. Kogent Learning Solutions Inc, ASP.NET 2.0 Black Book Includes VB 2005 and C# 2005 codes, Dreamtech Press, 2006.

R3. Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre, Programming PHP Paperback – Import, O′Reilly, 4th edition, 2020.

R4. Thomas A Powell, Fritz Schneider, JavaScript: The Complete Reference, 3rd Edition, Tata McGraw Hill, 2013.

R5. Dan Hurwitz, Dan Maharry, and Jesse Liberty, Programming ASP.NET 3.5, O'Reilly Media, Inc, USA, 4th edition, 2008.

R6. Thomas A Powell, HTML & XHTML: The Complete Reference Paperback, Tata McGraw Hill Education, 2008.

Web References:

1. http://nptel.ac.in/courses/106105084
2. https://www.coursera.org/learn/dot-net-foundation
3. https://www.tutorialspoint.com/internet_technologies/internet_quick_guide.html

Course Code: 24CAL102	Course Title: Python Programming Laboratory		
Course Category: Professional Core	Course Level: Practice		
L:T:P(Hours/Week):: 0: 0: 4	Credits: 2	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course teaches Python graphical user interface development using tkinter, numpy packages for efficient numerical operations, and pandas library for data manipulation and analysis, focusing on linear and nonlinear data structures and graph traversal methods.

List of Experiments:

1. Develop a GUI database application using tkinter in Python for managing inventory. The application should allow users to add, update, delete, and view items in the inventory. Utilize tkinter widgets such as buttons, entry fields, and list boxes for user interaction. Implement functionality to store and retrieve inventory data from a local database file.
2. Implement the numpy packages for arrays in python.
3. Create a data analysis tool using the Pandas library in Python. This tool should enable users to load datasets, perform various data manipulation and analysis tasks, and visualize the results. Utilize Pandas functions to read data from different file formats (e.g., CSV, Excel), clean and preprocess the data, calculate summary statistics, and generate visualizations (e.g., plots, histograms) to aid in data interpretation.
4. Develop applications using stack and Queue.
5. Implement applications using various lists.
6. Implement the application using binary tree.
7. Apply the graph to find shortest path.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Develop a GUI database application and implement the numpy packages for efficient array operations in Python.	Apply
CO2: Apply Pandas library to perform data analysis in Python.	Apply
CO3: Apply applications using stacks, queues, and various lists that implement different data structures for practical scenarios.	Apply

Reference Book(s):

R1.Michael T. Goodrich, Roberto Tamassia and Michael H.Goldwasser, Data structures and algorithms in python, Wiley India Pvt. Ltd, Wiley; 1st edition, 2013.

R2. Narasimha Karumanchi, Data Structures and Algorithmic Thinking with Python", Careermonk Publications, 1st Edition, 2015.

R3. Dr Shriram K. Vasudevan, Mr Abhishek S. Nagarajan, Prof Karthick Nanmaran, Data Structures Using Python, OUP India Publications, 1st Edition, 2021.

R4. Chandan Banerjee Atanu Das, Data Structures and Algorithms in C & Python, Universities Press, 2022.

Web References:

1. https://archive.nptel.ac.in/courses/106/106/106106145/
2. https://www.coursera.org/learn/python-data
3. https://www.geeksforgeeks.org/advanced-data-structures/

Course Code: 24CAL103		Course Title: SQL and NoSQL Databases Laboratory	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week):: 0: 0: 4	Credits: 2	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

Students will learn how to design and implement PL/SQL procedures for applications using triggers, cursors, exception handling, and NoSQL databases like MongoDB, Cassandra, and HBase commands. They will also develop web-based applications that have database connectivity.

List of Experiments:

1. Design and develop a web-based application using any front-end and back-end tools with database connectivity. Utilize a SQL database for this scenario. The application should allow users to manage the inventory of books in an online bookstore. Implement CRUD operations (Create, Read, Update, Delete) for adding new books, viewing existing books, updating book details, and removing books from the inventory. Ensure proper exception handling for error scenarios such as duplicate entries or invalid input.
2. Write PL/SQL procedure for an application using cursors.
3. Create a real-time data monitoring system using MongoDB as the NoSQL database. Simulate sensor data streams representing various environmental parameters such as temperature, humidity, and air quality. Develop a Python script to generate and insert simulated sensor data into MongoDB collections. Implement a web interface to visualize the real-time data using JavaScript libraries like D3.js or Chart.js. Allow users to select specific sensors or time periods for data visualization and provide functionalities for querying historical data from the database.
4. Execute the table operations, CRUD operations, CQL types in Cassandra on specific application.
5. Execute HBase commands to operate the book management system.
6. Visualize any type of graph data using any graph database.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply exception handling, triggers, and cursors to write PL/SQL blocks for transaction operations in a typical application.	Apply
CO2: Develop the ability to execute an application's NoSQL commands.	Apply
CO3: Design a standard application by combining a database management system (either SQL or NoSQL) and front-end tools.	Apply

Reference Book(s):

R1. Abraham Silberschatz, Hentry F. Korth and S. Sudharssan, Database System Concepts, 7th Edition, Tata McGraw Hill, 2019.

R2. Raghu Ramakrishna & Johannes Gerhrke, Database Management System, McGrawHill, 3rd Edition, 2003.

R3. C. J. Date, An Introduction to Database Systems, Eighth Edition, Pearson, 2003.

R4. Ramez Elmasri and Shamkant B.Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2015.

R5. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley, 2021.

Web References:

1. http://nptel.ac.in/courses/106106093/
2. https://www.classcentral.com/course/swayam-database-management-system-9914
3. https://hbase.apache.org/apache_hbase_reference_guide.pdf
4. https://github.com/pcmoreno/Make-IT-Work-5/blob/master/NoSQL%20Distilled.pdf

SEMESTER – II

SEMESTER - II

Course Code: 24CAT201		Course Title: Machine Learning	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week):: 3: 1: 0	Credits: 4	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course teaches machine learning foundations, dimensionality reduction techniques, model selection, feature engineering, probability and Bayesian learning, enabling students to design and implement real-world applications and analyze complex data models.

Module I **30 Hours**

Introduction - Human Learning - Types – Machine Learning - Types - Problems not to be solved - Applications - Languages/Tools– Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Pre-processing.

Model Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Feature Transformation - Feature Subset Selection.

Module II **30 Hours**

Bayesian Learning - Basic Probability Notation- Inference – Independence - Bayes' Rule. Bayesian Learning: Maximum Likelihood and Least Squared error hypothesis-Maximum Likelihood hypotheses for predicting probabilities- Minimum description Length principle -Bayes optimal classifier - Naïve Bayes classifier - Bayesian Belief networks -EM algorithm.

Parametric Machine Learning - Logistic Regression: Classification and representation – Cost function – Gradient descent – Advanced optimization – Regularization - Solving the problems on overfitting. Perceptron – Neural Networks – Multi – class Classification - Backpropagation – Non-linearity with activation functions (Tanh, Sigmoid, Relu, PRelu) - Dropout as regularization.

Non Parametric Machine Learning - k- Nearest Neighbors- Decision Trees – Branching – Greedy Algorithm - Multiple Branches – Continuous attributes – Pruning. Random Forests: ensemble learning. Boosting – Adaboost algorithm. Support Vector Machines – Large Margin Intuition – Loss Function - Hinge Loss – SVM Kernels.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply data preprocessing techniques and dimensionality reduction methods to classify the real world dataset problem.	Apply
CO2: Implement training methodologies to optimize machine learning models for different datasets.	Apply
CO3: Utilize Bayesian inference and probability notation to solve real-world problems.	Apply
CO4**:** Examine the techniques of parametric, non-parametric models and non-parametric classification for information classification.	Analyze

Text Book(s):

T1. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, Machine Learning, 2nd Edition, Pearson Education, 2024.

Reference Book(s):

R1. Ethem Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 4th Edition 2020

R2. Muller Andreas C, Guido Sarah, Introduction to Machine Learning With Python: A Guide to Data Scientist, Third Edition, 2017.

R3. Tom M. Mitchell, Machine Learning, India Edition, 1st Edition, McGraw-Hill Education Private Limited, 1997.

R4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2023

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_cs03/
2. https://onlinecourses.nptel.ac.in/noc16_cs18
3. https://www.coursera.org/learn/machine-learning

Course Code: 24CAT202		Course Title: Java Programming	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week):: 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course covers fundamental programming concepts, exception handling, multithreading, collections, string manipulation, and Java's graphical user interface development using AWT, JDBC and Servlets concepts.

Module I **22 Hours**

Java Fundamentals: Introduction – Overview of Java virtual machine- Data types, variable, arrays, expressions, operators, and control structures. Classes and Objects: Classes – Objects – Abstract classes- Static classes- Inner classes- Method Overloading- Inheritance, Constructors and Method Overriding.

Packages, Interfaces and Exception handling: Packages and member access – Importing packages – Interfaces: Defining method, Implementation, nested, applying and variables in interfaces - Exception Handling: Types, try and catch block - Multiple catch block -Nested try - finally block - throw keyword - Exception Propagation - throws keyword - Custom Exception.

Java I/O classes and String handling - File Concepts - Stream class: byte stream and character stream – Serialization - String handling: String operations - String comparison: Searching, Modifying and Conversion.

Module II **23 Hours**

Multithreading: Life Cycle of a Thread – Main thread - Creating a Thread- Creating multiple threads – Using isAlive() and join() - Thread priorities - synchronization – inter thread communication.

Collections: Overview - classes and interfaces - Iterator and User-defined classes - comparators and collection algorithms- Arrays, generic collections, legacy classes and interfaces - String tokenizer.

Applet: Basics and Architecture - HTML tags - Event handling: Event model - Event classes – KeyEvent class – Sources of events – Event Listener interfaces - Handling Mouse Events and Keyboard Events.

JDBC: Manipulating databases with JDBC – Connecting to and Querying a database.

Servlets: Life cycle of a Servlet – Simple Servlet – servlet and http packages – Handling HTTP requests. and responses – Using Cookies – Session tracking.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply operators, control structures, classes, and objects to develop real-time applications.	Apply
CO2: Analyze the effectiveness of string manipulation, I/O operations, and collection classes in solving real-world problems.	Analyze
CO3**:** Apply multithreading, event handling, and JDBC to develop efficient, secure, and interactive Java applications.	Apply
CO4: Analyze and implement interactive server-side Java applications using Servlets.	Analyze

Text Book(s):

T1. H. M. Deitel, P. J. Deitel, Java How to Program, 10th Edition, Prentice Hall, 2014

Reference Book(s):

R1. H. M.Deitel, P. J. Deitel, S. E. Santry, Advanced Java 2 Platform How to program, Prentice Hall, 2012

R2. Antonio Goncalves, Beginning Java EE 7, Apress publication, 2013

R3. Herbert Schildt, The Complete Reference JAVA 2, 13th edition, Tata McGraw-Hill, 2023

Web References:

1. http://www.tutorialspoint.com/java
2. https://nptel.ac.in/courses/106105191
3. https://www.tutorialspoint.com/servlets/index.htm

Course Code: 24CAI201		Course Title: Full Stack Development	
Course Category: Theory with lab		Course Level: Mastery	
L:T:P(Hours/Week) ::2:0:2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to impart knowledge on apply CSS for styling text and images and implement server-side rendering with templating Engines and then implement user authentication mechanisms in Node.js and finally explore React.js fundamentals, including ReactDOM and JSX.

Module I **15 Hours**

Introduction to CSS and Javascript - Introduction to Web: Server - Client - Communication Protocol (HTTP) - Structure of HTML Documents - Basic Markup tags - Working with Text and Images with CSS- CSS Selectors - CSS Flexbox - JavaScript: Data Types and Variables - Functions – Events- AJAX **-** GET and POST.

Advanced Client Side Programming - React JS - ReactDOM - JSX - Components - Properties - Fetch API - State and Lifecycle -JS Local storage - Events - Lifting State Up - Composition and Inheritance.

Module II **15 Hours**

Advanced NodeJS And Database - Introduction to NoSQL databases - MongoDB system overview - Basic querying with MongoDB shell - Request body parsing in Express - NodeJS MongoDB connection - Adding and retrieving data to MongoDB from NodeJS - Handling SOL databases from NodeJS - Handling Cookies in NodeJS - Handling User Authentication with NodeJS.

Server Side Programming with Node JS - Introduction to Web Servers - Javascript in the Desktop with NodeJS - NPM - Serving files with the http module - Introduction to the Express framework - Server-side rendering with Templating Engines - Static Files - async/await - Fetching JSON from Express.

List of Experiments: **30 Hours**

1. Create a Simple Login form using React JS
2. Build a simple calculator app with React. The user should be able to add numbers and operations to the app by clicking on buttons, just like you would do in a mobile phone.

3. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter
4. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
5. Build an online MCQ quiz app. The questions and options should be fetched based on the chosen topic from a NodeJS server.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply CSS selectors and Flexbox layout to design responsive page layouts.	Apply
CO2: Integrate advanced React concepts to create structured applications	Apply
CO3: Determine how NoSQL differs from traditional relational databases, evaluating its use in various application scenarios.	Apply
CO4: Structure the application using NodeJS with authentication in react application.	Analyze

Text Book(s):

T1. David Flanagan, Java Script: The Definitive Guide, O'Reilly Media, Inc, 7th Edition,2020.
T2. Alex Banks, Eve Porcello, Learning React, O'Reilly Media, Inc, 2nd Edition, 2020.

Reference Book(s):

R1. Matt Frisbie, Professional JavaScript for Web Developers, Wiley Publishing, Inc, 5th Edition, ISBN: 978-1-119-36656-0, 2023.
R2. Stoyan Stefanov, React: Up & Running - Building Web Applications, O'Reilly Media, 2nd Edition, 2022.
R3. Marc Wandschneider, Learning Node, Addison-Wesley Professional, 2nd Edition, 2016.

Web References:

1.https://www.w3schools.com/React/Default.ASP
2. https://nodejs.org/en/learn/getting-started/introduction-to-nodejs
3. https://www.javatpoint.com/nosql-databases

Course Code: 24CAL201		Course Title: Machine Learning Laboratory	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week):: 0:0:4	Credits: 2	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course teaches machine learning libraries, algorithms, regression models, and statistical predictions, while also enhancing skills in data analysis and classification concepts.

List of Experiments:

1. Implement python basic libraries Pandas, Math, Numpy, Spicy and create an ML application.
2. Implement Find-S Algorithm and Candidate elimination algorithm.
3. Implement Simple and Multiple Linear Regression Models.
4. Implement Naive Bayesian and KNN Classification in Python.
5. Performance analysis on a Specific dataset.
6. Develop a machine learning application in Python using libraries like Pandas, NumPy, and Scikit-learn to classify emails as spam or non-spam. Utilize the Naive Bayes classification algorithm for this task. The application should preprocess email data, extract relevant features (e.g., word frequencies), train the classifier on a labeled dataset, and evaluate its performance using metrics such as accuracy, precision, recall, and F1-score.
7. Create a predictive model for estimating house prices based on various features such as the number of bedrooms, square footage, location, etc. Implement multiple linear regression using Python libraries like Pandas, NumPy, and Scikit-learn. The application should preprocess housing data, split it into training and testing sets, train the regression model, make predictions on test data, and evaluate the model's performance using metrics like mean squared error (MSE) or R-squared.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: **I**mplementing essential Python libraries for data manipulation, numerical computation, and developing machine learning applications efficiently.	Apply
CO2: Implement simple and multiple linear regression models in Python, and make predictions based on observed data.	Apply
CO3: Design and implement end-to-end machine learning solutions for real-world problems or research areas.	Apply

Reference Book(s):

R1. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, Machine Learning, 2nd Edition, Pearson Education, 2024

R2. Ethem Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 4th Edition, 2020

R3. Muller Andreas C, Guido Sarah, Introduction to Machine Learning With Python: A Guide to Data Scientist, Third Edition, 2017.

R4. Tom M. Mitchell, Machine Learning, India Edition, 1st Edition, McGraw-Hill Education Private Limited, 1997.

R5. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2023.

Web References:

1) https://onlinecourses.nptel.ac.in/noc16_cs03/
2) https://onlinecourses.nptel.ac.in/noc16_cs18
3) https://www.coursera.org/learn/machine-learning

Course Code: 24CAL202		Course Title: Java Programming Laboratory	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week):: 0: 0: 4	Credits: 2	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on application development using control structures, OOPS, multithreading, exception handling, collections, serialization, deserialization, event handling, JDBC and Servlets for a well-rounded skill set in software development.

List of Experiments:

1) Design, build, and deploy an application that incorporates a custom package for specific functionalities.
2) Investigate the impact of race conditions and apply synchronization programming techniques to analyze and develop an effective solution.
3) Analyze the efficiency and applicability of the Collections Framework by designing and implementing a student management application for effective data handling.
4) Examine the impact of Serialization and Deserialization by developing an application that converts objects into a transferable format and reconstructs them while assessing data consistency.
5) Create and implement an application using AWT controls and event handling functions to develop an interactive graphical user interface.
6) Design and implement a real-time application utilizing JDBC for efficient database connectivity and management.
7) Analyze the functionality of the HttpSession object by developing a server-side application that monitors session creation and last-accessed times.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply multithreading concepts to analyze and solve real-time problems.	Apply
CO2: Analyze collections, serialization, and deserialization techniques for effective real-time problem-solving.	Analyze
CO3: Utilize event handling functions and JDBC to design and develop real-time applications with database integration.	Apply
CO4: Develop and analyze server-side applications using Servlets for real-world scenarios.	Analyze

Reference Book(s):

R1. H. M. Deitel, P. J. Deitel, Java How to Program, 9th Edition, Prentice Hall, 2014
R2. H. M. Deitel, P. J. Deitel, S. E. Santry, Advanced Java 2 Platform How to program, Prentice Hall, 2012
R3. Antonio Goncalves, Beginning Java EE 7, Apress publication, 2013
R4. Herbert Schildt, The Complete Reference JAVA 2, 13th edition, Tata McGraw-Hill, 2023

Web References:

1) http://www.tutorialspoint.com/java
2) https://nptel.ac.in/courses/106105191
3) https://www.tutorialspoint.com/servlets/index.htm

Course Code: 24CAP201	Course Title: Mini Project		
Course Category: Project	Course Level: Practice		
L:T:P(Hours/Week):: 0: 0: 6	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course focuses on identifying and analyzing business problems, applying SDLC methodology, developing domain-specific applications, preparing mini project reports, and honing effective project presentation skills.

List of Experiments:

The objective of Mini Project is to enable the student to develop an application software in the broad field of information technology, either fully practical work to be assigned by the department on an individual basis under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) in software development work. The assignment to normally include:

1. The progress of the mini project is evaluated based on a minimum of three reviews.
2. The review committee may be constituted by the Head of the Department.
3. A mini project report is required at the end of the semester.
4. The mini project work is evaluated based on oral presentation and the mini project report evaluates by internal examiners constituted by the Head of the Department.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Software development principles to design, implement, document, and present a software application that addresses a specific problem or fulfills a need, demonstrating mastery over the chosen technology stack within the broad field of information technology.	Create
CO2: A comprehensive mini-project report that effectively documents the project's design, development process, outcomes, and evaluation**,** demonstrating strong communication skills	Create

Course Code: 24CAC021	Course Title: Internship		
Course Category: Internship	Course Level: Practice		
L:T:P(~~Hours~~/Week):: 0: 0: 2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

This internship aims to bridge the gap between academic knowledge and industry requirements by providing students with hands-on exposure to real-world work environments. It helps students develop practical skills, enhance communication and problem-solving abilities, and gain insights into current industry trends, thereby improving their employability and professional growth.

List of Experiments / Activities for 2-Week Internship:

1. **Industry Orientation:** Understand company structure, policies, and current projects.
2. **Hands-on Task Assignment:** Work on specific tasks or modules assigned by the supervisor related to real projects.
3. **Application of Technical Skills:** Apply programming, testing, or design skills on live or simulated industry problems.
4. **Soft Skills Development:** Participate in team meetings, presentations, and report writing to enhance communication and professional etiquette.
5. **Final Report Preparation and Presentation:** Document the internship experience, learning outcomes, and challenges faced; present to the supervisor or review committee.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Create practical solutions and contribute to project development by applying industry-relevant skills and knowledge in a real-world environment.	Create
CO2: Create a comprehensive internship report that effectively documents the project work, learning experiences, and professional growth.	Create

SEMESTER - III

SEMESTER III

Course Code: 24CAT301	**Course Title: Artificial Intelligence**		
Course Category: Professional Core		**Course Level: Mastery**	
L:T:P(Hours/Week) 3: 0: 0	**Credits:3**	**Total Contact Hours:45**	**Marks:100**

Course Objectives

This course provides an understanding of intelligent agents and their behaviors, along with techniques to analyze the efficiency of different search methods. It also covers the application of inference rules to knowledge bases, selecting appropriate planning techniques, and exploring the real-world applications of AI.

Module I **22 Hours**

Evolution and applications of AI– Intelligent Agents – PEAS framework for agent description- Nature of environments-Agent architectures and design.

Problem solving agents – Measuring Problem Solving Performance- Uninformed Search Strategies: BFS, DFS, DLS, IDS, Bidirectional Search – Informed Search Strategies: Greedy BFS- A* Search – Heuristic function – Local search algorithms- Online Search Agent.

Constraint Satisfaction Problem – Backtracking Search for CSP – Adversarial Search – Logical Agents – Propositional Logic – Reasoning Patterns – Resolution – Forward and Backward Chaining.

Module II **23 Hours**

First-Order Logic – Syntax And Semantics of FOL – Representing Knowledge in FOL – Using First-Order Logic – Knowledge Engineering in FOL- Unification and lifting- Inference in FOL – Forward and Backward chaining –Resolution.

Planning – Classical Planning – Planning as State-Space Search – Planning and Acting in Real world – Planning in Non-Deterministic Domains - Hierarchical Planning.

AI Applications – Natural Language Processing – Language Model - Text classification – Information retrieval– Information extraction – Speech recognition.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply agent models and search algorithms to design intelligent systems.	Apply
CO 2: Analyze reasoning patterns and constraint satisfaction techniques using propositional logic and game strategies.	Analyze
CO 3: Apply planning algorithms in deterministic and non-deterministic environments for goal-directed behavior.	Apply
CO 4 Analyze the use of AI in real-world applications including NLP, text classification, IR, and speech.	Analyze

Text Book(s):

T1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson, 4th Edition, 2020

Reference Book(s):

R1. David Poole & Alan Mackworth, “Artificial Intelligence: Foundations of Computational Agents”, 2nd Edition, Cambridge, 2017.

R2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, 2nd Edition, MIT Press, 2022.

Web References:

1. https://aima.cs.berkeley.edu
2. https://nptel.ac.in/courses/106105079
3. https://www.geeksforgeeks.org/artificial-intelligence/

Course Code: 24CAT302		Course Title: Cyber Security	
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Marks:100

Course Objectives

This course is designed to outline key cybersecurity metrics and frameworks, providing a foundation for assessing security performance. It examines critical cybersecurity issues, including cyber hacking and cybercrime, while exploring the knowledge required for computer forensics.

Module I **23 Hours**

Cyber security Objectives And Guidance - Cyber Security Metrics – Security Management Goals – Counting Vulnerabilities – Security Frameworks: E-Commerce Systems, Industrial Control Systems, Personal Mobile Devices – Security Policy Objectives – Guidance for Decision Makers- Cyber Security Management –Catalog Approach.

Cyber Security Issues - Cyber Governance Issues: Net Neutrality -- Internet Names and Numbers, Copyright and Trademarks, Email and Messaging - Cyber User Issues: Malvertising, Impersonation, Appropriate Use, Cyber Crime, Geo location, Privacy - Cyber Conflict Issues: Intellectual, Property Theft, Cyber Espionage, Cyber Sabotage, Cyber Welfare.

Information technology ACT - Overview of the IT Act 2000 & Amendments - Data Protection and Privacy Laws (DPDPA 2023). Cyber Crime - Introduction to Cyber Crime – Classifications of Cyber Crime – Methods in Cyber Crime.

Module II **22 Hours**

Cyber Offences: Plans and Attacks – Social Engineering – Cyber Stalking – Cyber Cafe andCyber Crimes **—** Botnets.

Computer Forensics - Introduction – Digital Forensics Science – Cyber forensics and Digital Evidence – Forensics Analysis of E-mail – Digital Forensics Life Cycle – Network Forensics – OSI Layer Model to Computer Forensics , Security/Privacy Threats –Challenges in Computer Forensics- Tools: OSForensics.

Hand-Held Devices and Digital Forensics - Hand-Held Devices and Digital Forensics – Forensics of iPods and digital music devices – Techno-legal Challenges – Organizational guidelines on mobile device forensics – Tools: Network Mapper(Nmap), BitPim.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Identify and count vulnerabilities in e-commerce, industrial control systems, and personal mobile devices.	Apply
CO 2: Examine the cyber governance and user issues faced.	Apply
CO 3: Assess security vulnerabilities in cyber cafes and recognize the techniques used in cybercrimes	Apply
CO 4: Identify the knowledge requirement for computer forensics investigation	Apply
CO 5: Analyze network and mobile forensic techniques for cyber-crime investigation	Analyze

Text Book(s):

T1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss, “Cyber Security Policy Guidebook”, John Wiley & Sons, 2012

Reference Book(s):

R1. National Cyber Safety and Security Standards, Govt. of India, “National Cyber Crime Reference Handbook” 3rd edition, 2018

R2. Nina Godbole, Sunit Belapure, “Cyber Security”, Wiley India, 2013

R3. Vakul Sharma and Seema Sharma, Information Technology Law and Practice, LexisNexis Publisher**,** 9th Edition 2025

Web References:

1. Cyber Security, URL: https://www.sans.org/course/introduction-cyber-security
2. Fundamentals of cyber security, URL: http://www.cyberaces.org/courses/
3. A Guide to Computer Forensics, URL: https://forensiccontrol.com/resources/beginners-guide-computer-forensics
4. https://www.osforensics.com/download.html
5. https://nmap.org/download
6. http://www.bitpim.org/

Course Code: 24CAT303	Course Title: Cloud Computing		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Marks:100

Course Objectives

This course aims to provide a comprehensive understanding of cloud computing by illustrating its architecture, characteristics, and services. It addresses the challenges involved in building cloud networks for enterprises, focusing on resource management and sharing in cloud systems.

Module I **22 Hours**

Cloud Computing and Migrating Into Cloud - Cloud Computing in a Nutshell – Roots of Cloud Computing – Layers and Types of Clouds – Desired Features of a Cloud – Challenges and Risks Migrating into a Cloud - Broad Approaches to Migrating into the Cloud – The Seven-Step Model of Migration into a Cloud.

Building Cloud Networks (IAAS) - MSP Model to Cloud - Data Center Virtualization - The Cloud Data Center – Virtual Machines Provisioning and Migration Services – Introduction – Background – Virtual Machine Migration Services - creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines.

Module II **23 Hours**

Technologies and Tools for Cloud Computing – Aneka Cloud Platform – Aneka Resource Provisioning Service – Hybrid Cloud Implementation.

Introduction to Amazon Virtual Private Cloud (VPC): Amazon VPC – VPC works – Plan your VPC – IP addressing - subnet CIDR Blocks – AWS IP address ranges – Virtual private cloud: VPC Basics – VPC configuration options – Create VPC – Delete VPC - Subnets – Route tables.

Connect your VPC: Internet gateways – NAT devices – Elastic IP addresses – AWS Virtual private network.

Case study: Scientific Applications - Business and Consumer Applications.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the fundamental concepts of cloud computing to identify various cloud models, layers, and services.	Apply
CO2:Implement basic cloud migration strategies using the seven-step migration model.	Apply
CO3:Deploy containers on cloud-native platforms using appropriate container orchestration tools and services.	Apply
CO4: Configure a Virtual Private Cloud (VPC) with networking components including subnets and gateways.	Apply

Text Book(s):

T1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, John Wiley & Sons, 2014

T2. Ben Piper,David Clinton,” AWS Certified Solutions Architect Study Guide”, John Wiley & Sons,4th Edition,2022

Reference Book(s):

R1. Anthony T. Velte, Toby J. Velte, Ph.D., Robert Elsenpeter, “Cloud Computing: APractical Approach”, Tata McGraw-Hill, 2017

R2. John W. Rittinghouse, JamesF. Ransome, “CloudComputingImplementation, Management and Security,” CRC Press, 2014

Web References:

1. http://nptel.ac.in/courses/106105033/41
2. https://docs.aws.amazon.com/pdfs/vpc/latest/userguide/vpc-ug.pdf
3. https://aws.amazon.com/
4. https://cloud.google.com/

Course Code: 24CAT304	Course Title: Big Data Analytics		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week)::3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

This course is designed to equip students with the skills to interpret the characteristics of big data and perform exploratory data analysis using R programming. It enables learners to implement text mining techniques for extracting insights from social media datasets and apply core Hadoop concepts to manage and manipulate data within a distributed computing environment using HDFS and YARN. Additionally, students will analyze the structure and workflow of Hadoop MapReduce and associated ecosystem tools to design efficient data processing solutions.

Module I **23 Hours**

Classification of Digital Data: Structured Data - Semi-Structured data - Unstructured Data - Characteristic of Data – Evolution, Definition and Challenges of Big Data - 4Vs of Big Data - Big Data requirement - Traditional Business intelligent versus Big Data - Introduction to Big Data Analytics.

Exploring Data in R: Data Frames – R Functions – Load Data Frames – Exploring Data - Data Summary – Data Summary – Finding the missing values – Invalid values and Outliers – Descriptive statistics - Spotting problems in Data with Visualization. Text Mining: Understanding of text – Text preprocessing – Use case: Text mining for long document/resume – Sentiment analysis using lexicon-based approach – Use case: Sentiment analysis for Twitter data - Text similarity techniques – Use case: Finding patterns on Matrimonial websites.

Recommendation systems: A model – Content-Based recommendations – Collaborative filtering – Dimensionality reduction.

Module II **22 Hours**

Hadoop: Definition, Features and Versions - RDBMS versus Hadoop - Distributed computing challenges - Hadoop Components – HDFS: Daemons, Anatomy of File read, write and Replica management Strategy - HDFS Commands - Processing Data with Hadoop - Managing resources and applications with Hadoop YARN (Yet Another Resource Negotiator) - Interacting With Hadoop Ecosystem: Pig – Hive – Sqoop – Hbase – Hive.

Mapreduce programming: Introduction: MapReduce Entities, scenario and limitations – Understanding the Hadoop MapReduce fundamentals: Objects, number of maps, number of reducers and data flow – Writing a Hadoop MapReduce example: Steps to run a MapReduce job, Calculating the frequency of the word in the provided text file.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Interpret and apply R-based data analysis techniques to handle large-scale structured and unstructured data.	Apply
CO2: Deconstruct unstructured social media content, evaluate text mining techniques, and interpret results to uncover sentiment trends, recurring patterns, and key insights for informed decision-making.	Analyze
CO3: Apply HDFS commands for file operations, configure and monitor Hadoop daemons, and manage application resources using YARN in real-world big data scenarios.	Apply
CO4: Analyze data flow in a MapReduce job, evaluate the suitability of Hadoop ecosystem tools (Pig, Hive, Sqoop, HBase), and construct solutions by identifying appropriate tools and processing strategies for a given data problem.	Analyze

Text Book(s):

T1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, 2nd edition, Wiley, 2019.
T2. Seema Acharya, “Data Analytics using R”, McGraw Hill, 2019.
T3. Reema Thareja, “Data Science and Machine Learning with R”, McGraw Hill, 2021.
T4. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization, DT Editorial Services, 2016
T5. Leskovec Jure, Rajaraman Anand, Ullman Jeffrey David, Mining of Massive Datasets, Cambridge University Press,3rd edition, 2022.

Reference Book(s):

R1 Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Publication, 2015.
R2.Chuck Lam, “Hadoop in action”, Dream Tech Press, Reprint Edition, 2016.
R3. Robert I. Kabacoff, “R in Action – Data analysis and graphics with R”, Dreamtech, 2020

Web References:

1. https://www.w3schools.com/r/r_intro.asp
2. https://www.coursera.org/learn/data-analysis-with-r
3. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-mg65/
4. https://www.geeksforgeeks.org/data-analysis-using-r/
5. https://www.geeksforgeeks.org/nlp/text-mining-in-data-mining/
6. http://hadoop.apache.org/

Course Code: 24CAL301	Course Title: Automated Software Testing Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week):: 0: 0: 4	Credits:2	Total Contact Hours: 60	Marks:100

Course Objectives

The course is designed to equip participants with essential testing concepts, tools, and techniques, emphasizing the application of the Selenium tool for developing test cases and suites. It will also cover various testing operations and provide insights into website load testing to ensure optimal performance and reliability.

List of Experiments:

1. Automate scrolling to a specific element or to the bottom of the page using Selenium's JavaScript executor.
2. Develop a Selenium program to verify the title of multiple web pages in a test suite.
3. Develop a Java program to create a test suite for Gmail login page using Selenium tool.
4. Write a program to add, retrieve, and delete browser cookies using Selenium WebDriver.
5. Create basic API test scenarios using Karate framework (e.g., validate GET and POST requests).
6. Perform simple SQL injection testing on a web form to verify backend input validation.
7. Develop a Karate test case for backend API testing including response validation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply basic testing concepts and tools for automated software testing.	Apply
CO 2: Apply Selenium to develop and execute test cases for web applications.	Apply
CO 3: Apply the Karate framework for API and backend testing.	Apply
CO 4: Apply basic security testing techniques including SQL injection and backend validation.	Apply

Reference(s):

R1. Dr. K.V.K.K. Prasad , Software Testing Tools, , Wiley- Dreamtech Press, 2004

R2. Nageshwara Rao Pusuluri,, Software Testing Concepts and Tools, DreamTech, 2006

R3. Paul C. Jorgensen, Software Testing: A Craftsman"s Approach, 3rd Edition, CRC Press, 2007.

Course Code: 24CAL302	Course Title: Cloud Computing Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)::0: 0: 4	Credits:2	Total Contact Hours: 60	Marks:100

Course Objectives

The course aims to equip students with the skills to apply virtualization tools effectively within cloud environments while leveraging open-source solutions for cloud hosting.

List of Experiments:

1. Network adapter connection in oracle virtual box.
2. Deploying a Java Web Application using Amazon-EC2.
3. Hosting a Static Website using Amazon S3.
4. Create a Virtual Private Cloud (VPC) with at least two subnets (One public subnet that allows internet access & One private subnet that does not have internet access by default) and deploy the EC2 instance in public subnet.
5. Create two VPCs: VPC-A and VPC-B with non-overlapping CIDR blocks and Establish VPC Peering between the two VPCs to allow the application server in VPC-A to communicate with the database server in VPC-B.

Course Outcomes	CognitiveLevel
At the end of this course, students will be able to:	
CO1: Apply the virtualization tools to set up private cloud environment and runapplication on it.	Apply
CO2: Make use of open-source solutions for deploying web applications in cloud.	Apply
CO3:Create a VPC with public and private subnets and establish VPC peering between two VPCs to enable communication between application	Apply

Reference Book(s):

R1. Barrie Sosinsky,"Cloud Computing Bible",First edition Wiley Publisher,2011

R2. Ben Piper,David Clinton," AWS Certified Solutions Architect Study Guide", John Wiley & Sons,4th Edition,2022

Course Code: 24CAL303	Course Title: Big Data Analytics Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)::0: 0: 4	Credits:2	Total Contact Hours: 60	Marks:100

Course Objectives

This course is intended to equip learners with the ability to utilize R functions for performing exploratory data analysis on big data and effectively visualize analytical workflows. It covers the application of linear regression techniques for building and evaluating recommender systems, along with the implementation of text mining methods to analyze and extract insights from social media datasets. Furthermore, the course includes hands-on experience in demonstrating a MapReduce application within a Hadoop environment, emphasizing its role in distributed data processing.

List Of Experiments:

1. Generate a generic dataset (data frame) with random values for a categorical variable (e.g., Group or Category) and a continuous variable (e.g., Measurement or Value).
   Create the following visualizations using density plots:
   (i) Plot a density curve and add a line indicating the mean value of the numerical variable.
   (ii) Customize the density plot by filling it with a color (e.g., blue) and making the plot line dashed and in a contrasting color.
   (iii) Generate density plots grouped by the categorical variable to compare distributions across groups.
   (iv) Apply transparency (alpha blending) to the density fills and include a legend positioned at the top of the plot.
2. Build a linear regression model and analyse residual diagnostics using a generic numerical dataset using R/Python.
3. Build a movie recommendation system using collaborative filtering on a generic/benchmark movie ratings dataset.
4. Perform text cleaning, visualization, and sentiment analysis on unstructured resume/social media data.
5. Apply web scraping techniques to extract and analyze Movie data.
6. Develop a Map Reduce program to analyse word frequencies in large text files.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply data visualization techniques to analyze and interpret datasets by generating density plots, scatter plots, and residual plots using statistical tools like R.	Apply
CO 2: Demonstrate the various plots and statistical functions using R.	Apply
CO 3: Develop, debug, optimize and deploy MapReduce application in Hadoop.	Apply

Reference Book(s):

R1. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, 2nd Edition, Wiley, 2019.

R2. Reema Thareja, “Data Science and Machine Learning with R”, McGraw Hill, 2021

R3. Seema Acharya, “Data Analytics using R”, McGraw Hill, 2019.

R4. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization, DT Editorial Services, 2016

SEMESTER - IV

SEMESTER IV

Course Code: 23CAP401	Course Title: Project Work		
Course Category: Project		Course Level: Practice	
L:T:P(~~Hours~~/Week) 0: 0: 14	Credits: 12	Total Contact Hours: 240	Marks:100

Course Objectives

The course is designed to equip students with the skills to address specific business problems by guiding them through the entire process, from requirement gathering to solution development. Additionally, it prepares them to create comprehensive project reports and confidently participate in reviews and viva voce examinations, while enhancing their ability to communicate project results effectively in both written and oral formats.

Project Work:

The goal of the project work is for the student to develop an application software in the software industry on an individual basis, with the help of industry and department experts. This is expected to provide a good initiation for the student(s) in industry work. The assignment to normally include:

1. Under the supervision of a faculty member from industry and the department, the students work independently on a problem provided by the industry and prepare a detailed project report after completing the task to the satisfaction of the supervisor (s).
2. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
3. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly with external and internal examiners constituted by the Head of the Department.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: On Completion of the project work students will be in a position to take up any challenging practical problems and find solutions by formulating a proper methodology.	Apply
CO2: Ensure that system development requirements are well defined and subsequently satisfied	Create
CO3: Deliver quality systems that meet or exceed customer expectations when promised and within cost estimates	Create

PROFESSIONAL ELECTIVES

Course Code: 24CAE001		Course Title: Unix and Network Programming	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course provides practical knowledge on UNIX environment, process control, session creation, interprocess communication, TCP/UDP sockets, and Client-Server Model programming.

Module I **22 Hours**

Unix - Unix Architecture and Command Usage - General Purpose Utilities – File System – Handling Ordinary Files – Basic File Attributes – File I/O – Files and Directories.

System Data Files and Information - Password File – Group File – Login Accounting. Process Environment – Process Control.

Process Relationships - Terminal Logins – Network Login – Process Groups – Session – Signals.

Module II **23 Hours**

Inter Process Communication - Introduction: Message Passing (SVR4) – Pipes – FIFO – Message Queues – Semaphores – Shared Memory.

Sockets: Introduction – Transport Layer – Socket Introduction – Elementary TCP Sockets – UDP Sockets – Socket Options – Name and Address conversions.

Applications: Debugging Techniques – TCP Echo Client Server – UDP Echo Client Server – Ping – Trace Route – Client Server Applications like File Transfer and Chat.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of UNIX environment and implement the concepts of the file system.	Apply
CO2: Apply process control and creation of sessions for session management.	Apply
CO3: Analyze the inter process communication and implement into a process in Pipes & Semaphores.	Analyze
CO4: Examine the use of TCP & UDP Sockets in UNIX environments.	Analyze

CO5: Analyze the secure and efficient Unix-based applications and implement in Client Server Applications.	Analyze

Text Book(s):

T1. Stephen Rago , W. Stevens , Advanced Programming in the UNIX Environment, Addison Wesley, New Delhi, 3rd Edition, 2013.

Reference Book(s):

R1. Stevens, Bill Fenner, Andrew Rudoff , Unix Network Programming Volume-1: The Sockets Networking API, Addison- Wesley Professional, 3rd Edition, 2003.

R2. Maurice J. Bach, The Design of the Unix Operating System, Prentice Hall, New Delhi, 1986.

R3. Kenneth Rosen UNIX: The Complete Reference, Paperback, McGraw Hill Education, 2nd edition, 1999.

Web References:

1. http://www.people.fas.harvard.edu/~lib215/lectures/
2. https://www.tutorialspoint.com/unix
3. http://www.people.fas.harvard.edu/~lib215/lectures/

Course Code: 24CAE002		Course Title: Ethical Hacking	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to teach students security testing, focusing on reconnaissance, public tools, scanning techniques, vulnerability recognition, and web application attack detection, preparing them to defend against hackers and attackers.

Module I **22 Hours**

Hacking - Introduction– Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement – Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary – Reports.

Information Gathering Techniques - Active Information Gathering – Passive Information Gathering – Sources of Information Gathering – Tracing the Location – Traceroute – ICMP Traceroute – TCP Traceroute – Usage – UDP Traceroute – Enumerating and Fingerprinting the Webservers – Google Hacking – DNS Enumeration – Enumerating SNMP – SMTP Enumeration – Target Enumeration and Port Scanning Techniques – Advanced Firewall/IDS Evading Techniques.

Module II **23 Hours**

Vulnerability Data Resources - Exploit Databases – Network Sniffing – Types of Sniffing – Promiscuous versus Nonpromiscuous Mode – MITM Attacks – ARP Attacks – Denial of Service Attacks –Hijacking Session with MITM Attack.

SSL Strip - Stripping HTTPS Traffic – DNS Spoofing – ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing – Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force Attacks – Traditional Brute Force – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication.

Metasploit - Introduction– Reconnaissance with Metasploit – Port Scanning with Metasploit Compromising a Windows Host with Metasploit – Client Side Exploitation Methods – E– Mails with Malicious Attachments – Creating a Custom Executable – Creating a Backdoor with SET - PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post– Exploitation – Acquiring Situation Awareness – Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper -– Gathering OS Information – Harvesting Stored Credentials.

Wireless Hacking: Introducing Aircrack– Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng – Evil Twin Attack – Causing Denial of Service on the Original AP – Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms – Captcha Validation Flaw – Captcha RESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection – Authentication Bypass Attacks – Testing for the Vulnerability – Automating It with Burp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) – Types of Cross-Site Scripting – Cross-Site Request Forgery (CSRF) – SSRF Attacks.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply various hacking concepts to implement testing methodologies in vulnerability Assessment.	Apply
CO2: Apply information gathering techniques and execute firewall/IDS evading techniques in cyber security and ethical hacking.	Apply
CO3: Investigate various vulnerability data resources and exploit databases used for identifying security weaknesses and Examine SSL Strip techniques used to downgrade HTTPS traffic to HTTP, exposing sensitive data.	Analyze
CO4: Analyze Metasploit tools for assessing system vulnerabilities and securing information systems.	Analyze
CO5: Examine the wireless hacking techniques and employ tools like Aircracking for WEP and WPA/WPA2 network cracking.	Analyze

Text Book(s):

T1. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2014.

Reference Book(s):

R1. Kevin Beaver, Ethical Hacking for Dummies, Sixth Edition, Wiley, 2018.
R2. Jon Erickson, Hacking: The Art of Exploitation, Second Edition, Rogunix, 2007.
R3. Georgia Weidman, Penetration Testing: A Hands-On Introduction to Hacking, No. Starch Press, 2014.

Web References:

1. https://www.edureka.co/blog/ethical-hacking-tutorial/
2. https://www.ibm.com/topics/ethical-hacking
3. https://bootcamp.du.edu/blog/the-complete-guide-to-ethical-hacking/

Course Code: 24CAE003	Course Title: Block Chain Management		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches block chain management fundamentals, block chain contracts, and block chain 3.0 advancements, enabling students to understand advanced concepts and apply their skills in real-world applications, providing a practical and industry-relevant approach.

Module I **22 Hours**

Block Chain Currency 1.0: Technology stack: blockchain, Protocol, currency – How a cryptocurrency works - summary: Relation to fiat currency - Regulatory status.

Block Chain2.0: Contracts: Financial Services - Crowd funding – Bitcoin markets - Smart property – smart contracts wallet Development Projects – Block Development Platforms and API.

Module II **23 Hours**

Block Chain 3.0: Namecoin - Digital Identity verification - Digital Art – Blockchain Government.Global public health – blockchain genomics - blockchain health – blockchain learning - blockchain academic publishing.

Advanced Concepts: Terminology and concepts – currency, token, tokenizing – currency-multiplicity – Demurrage currencies.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Design a practical application in understanding the components and workings of block chain-based currencies.	Apply
CO2: Apply various financial services components in the financial technology domain and evaluate the intricacies of financial services in development platforms.	Apply
CO3: Analyze the applications of Name coin in block chain field.	Analyze
CO4: Analyze the implications of demurrage currencies on currency circulation and economic stability, comparing them to traditional currency models.	Analyze

Text Book(s):

T1. Melanie Swan, Block Chain: Blue Print For A New Economy, O Reilly publisher, 2015.

Reference Book(s):

R1. Manav Gupta, Block chain for dummies, IBM 2nd Edition,2018.

R2. Sainul Abideen ,Block chain Expert– E-Book, Cybrosys technologies, 2014.

R3. Don Tapscott , Alex Tapscott, Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing, Portfolio Penguin, 2018.

Web References:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/
2. https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology
3. https://builtin.com/blockchain

Course Code: 24CAE004		Course Title: Wireless Networking	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course covers wireless networks, protocol stack, standards, 3G services, WLAN/WWAN principles, and 4G network evolution, analyzing network layer solutions, protocols, applications, and internetworking principles.

Module I **22 Hours**

Wireless LAN - Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, Wireless HART.

Mobile Network Layer - Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT:CoAP.

3G Overview - Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

Module II **23 Hours**

Internetworking between WLANS and WWANS - Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

4G & Beyond - Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply IEEE802.11 technologies to design wireless networks for network design and configuration.	Apply
CO2: Apply various mobile network layer protocols for effective mobile network.	Apply
CO3: Analyze the components of 3G mobile networks and evaluate the technologies in 3G mobile communication systems.	Analyze
CO4: Assess the requirements of internetworking in WLANs and WWANs.	Analyze
CO5: Examine the applications of 4G and evaluate complexities of 4G in wireless communication technologies.	Analyze

Text Book(s):

T1. Gordon Colbach, Wireless Networking: Introduction to Bluetooth and WiFi, 2017.

Reference Book(s):

R1. Nurul Huda Mahmood, Nikolaj Marchenko, Mikael Gidlund, Petar Popovski, Wireless Networks and Industrial IoT Challenges and Enablers, Springer, First Edition, 2021.

R2. Kurose James F, Ross Keith W, Computer Networking- A top down approach, 8th Edition, Pearson, 2021.

R3. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education, 2008.

R4. Simon Haykin , Michael Moher, David Koilpillai, —Modern Wireless Communications, First Edition, Pearson Education 2011.

R5. Vijay Garg, —Wireless Communications and networking‖, First Edition, Elsevier 2007

Web References:

1. https://www.cisco.com/c/en_in/solutions/small-business/resource-center/networking/wireless-network.html
2. https://www.section.io/engineering-education/introduction-to-wireless-networking/
3. https://commotionwireless.net/docs/cck/networking/types-of-wireless-networks/

Course Code: 24CAE005		Course Title: Security in Computing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course covers practical encryption techniques, digital signature development, hash algorithms, key generation, and distribution processes, focusing on computer security concepts for information system safeguarding.

Module I **22 Hours**

Security and Encryption Techniques - Overview - Computer Security Concepts - the OSI security architecture –Security Attacks- Security Services-Security Mechanisms - Classical Encryption techniques- Block Ciphers and the Data Encryption Standard.

Public Key Encryption Algorithms - Number Theory - Public-Key cryptography and RSA – Diffie-Hellman Key Exchange – ElGamal Cryptographic system- Elliptic Curve arithmetic - Elliptic Curve Cryptography.

Digital Signatures and Hash Algorithms - Cryptographic Hash functions-Message authentication codes-Security of MACs-MAC based on Hash Functions: HMAC-MACs based on Block cipher: DAA and CMAC-Digital Signatures.

Module II **23 Hours**

Key Management and Distribution - Symmetric Key Distribution Using Symmetric Encryption- Symmetric Key Distribution Using Asymmetric Encryption-Distribution of Public Keys-X.509 Certificates-Public-Key Infrastructure- User Authentication.

Security at Layers and Computer Security - Network Access control-Data Protection in the cloud-Cloud security as a Service-Transport layer security-HTTPS-Secure Shell(SSH)-Wireless Security - Mobile Device Security-Pretty Good Privacy-IP Security.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply security and encryption techniques to enhance the security posture in information systems.	Apply
CO2: Apply public key Encryption Algorithm for secure communication that ensures the confidentiality of information.	Analyze
CO3: Illustrating cryptographic techniques for secure communication through digital signatures and hash algorithms.	Analyze
CO4: Analyze the Symmetric Key distribution in symmetric encryption in key management.	Analyze
CO5: Examine the security measures across different layers to ensure comprehensive computer security.	Analyze

Text Book(s):

T1. William Stallings, "Cryptography and Network Security: Principles and Practice",8th Edition, Pearson Education, March 2019.

Reference Book(s):

R1. Charles P. Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", Pearson Education, 5th Edition, 2020.

R2. Jean-Philippe Aumasson, "Serious Cryptography: A Practical Introduction to Modern Encryption", No Starch Press , 2017.

R3. Douglas R Simson "Cryptography – Theory and practice", Third Edition, CRC Press, 2006.

R4. Man Young Rhee, "Internet Security: Cryptographic Principles, Algorithms and Protocols", Wiley Publications, 2003.

Web References:

1. http://nptel.ac.in/courses/106105031/
2. http://williamstallings.com/Cryptography/
3. https://www.cse.iitk.ac.in/users/braman/cs425/slides/security-overview.pdf

Course Code: 24CAE006		Course Code: Internet of Things	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course covers IoT fundamentals, M2M communication evolution, technology, architecture, and practical application in real-world scenarios, focusing on Machine-to-Machine communication and IoT applications.

Module I **22 Hours**

IOT Introduction - Overview: Key features – Advantages – Disadvantages - IoT Hardware - IoT Software - IoT Technology and Protocol. Introduction: Definition & Characteristics of IoT – Physical Design of IoT – Logical Design of IoT – IoT enabling Technologies - IoT Levels & deployment Templates.

Domain Specific IOTS - Introduction- Home Automation — Cities — Environment — Energy — Retail — Logistics — Agriculture – Industry – Health & Lifestyle. IoT and M2M: Introduction – M2M – Difference between IoT and M2M – Software Defined Networking (SDN) and Network Function Virtualization (NFV) for IoT. IoT System Management with NETCONF-YANG: Need for IoT System Management – SNMP – Network Operator Requirements – NETCONF – YANG – IoT System Management with NETCONF-YANG.

M2M to IOT - M2M to IoT-the Vision: Introduction - From M2M to IoT – M2M towards IoT - the Global context. M2M to IoT - A Market Perspective: Introduction — Definition - M2M value chains - IoT value chains capabilities - An IoT architecture outline — Standards considerations.

Module II **23 Hours**

M2M and IOT Technology & Architecture - M2M and IoT Technology Fundamentals - Devices and gateways - Local and wide area networking-Data management-Business processes in IoT-Everything as a service(XaaS) - M2M and IoT analytics - Knowledge management. Architecture Reference Model: Introduction Reference model and architecture - IoT domain model - Information model - Functional model -Functional model - Safety, privacy, trust, security model.

Case Studies and Real-World Applications - Real world design constraints - Asset management - Industrial automation - Smart grid - Commercial building automation - Smart cities - participatory sensing.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply key features of IoT, including hardware, software, and protocols, to make informed design decisions for IoT systems.	Apply
CO2: Apply the concepts of M2M and IoT to analyze value chains and design basic IoT architectures considering market trends and standards.	Apply
CO3: Analyze the transition from M2M to IoT, evaluating its impact on global industries and technology advancements.	Analyze
CO4: Analyze the IoT architecture reference model, focusing on safety, privacy, trust, and security concerns within the functional and domain models.	Analyze

Text Book(s):

T1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things - A hands-on approach”, , Orient Blackswan Private Limited - New Delhi; First Edition, 2015.

T2. Jan Ho ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

Reference Book(s):

R1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer,2011.

Web References:

1 https://www.tutorialspoint.com/internet_of_things/internet_of_things_overview.html

2 http://kartolo.sby.datautama.net.id/PacktPub/9781783553532learning_internet_of_thing.pdf

Course Code: 24CAE007		Course Title: Web Mining and Social Networking	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course covers information retrieval systems, web search techniques, social network analysis algorithms, web crawler implementation, and wrapper methods for comprehensive learning.

Module I **22 Hours**

Information Retrieval - Basic Concepts of Information Retrieval - Information Retrieval Models - Relevance Feedback - Evaluation Measures - Text and Web Page Pre-Processing - Inverted Index and Its Compression.

Information Retrieval and Web Search - Latent Semantic Indexing - Web Search - Meta-Search - Web Spamming.

Social Network Analysis - Social Network Analysis - Co-Citation and Bibliographic Coupling Page Rank – HITS.

Module II **23 Hours**

Web Crawling - A Basic Crawler Algorithm - Implementation Issues - Universal Crawlers - Focused Crawlers - Topical Crawlers – Evaluation.

Structured Data Extraction - Preliminaries - Wrapper Induction - Instance-Based Wrapper Learning - Automatic Wrapper Generation: Problems - String Matching and Tree Matching - Multiple Alignment - Building DOM Trees.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply Information Retrieval Models (e.g., Boolean, Vector Space, Probabilistic) to retrieve relevant information from databases or servers.	Apply
CO2: Analyze social network analysis techniques (e.g., Co-Citation, Bibliographic Coupling, PageRank) to uncover insights and patterns in social structures.	Analyze
CO3: Evaluate web crawling techniques in information retrieval and web content indexing.	Analyze
CO4: Analyze data extraction methods in tree matching, including string matching and multiple alignment.	Analyze

Text Book(s):

T1. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2nd Edition, Springer, 2011

Reference Book(s):

R1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze," Introduction to Information Retrieval", Cambridge University Press, 2008.

R2. Ricardo Baeza- Yates, Ribeiro-Neto, "Modern Information Retrieval", 2nd Edition, Pearson, 2011.

R3. Aggarwal Charu C, "Social Network Data Analytics", Springer, 2015.

R4. Xu, Guandong, Zhang, Yanchun, Li, Lin, "Web Mining and Social Networking: Techniques and Applications", Springer, 2010.

Web References:

1. https://www.cs.uic.edu/~liub/WebMiningBook.html
2. https://nlp.stanford.edu/IR-book/information-retrieval-book.html
3. https://www.cs.utexas.edu/users/mooney/ir-course/

Course Code: 24CAE008	Course Title: Deep Learning		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches deep networks, neural networks, and deep learning, focusing on convolutional neural network architectures. It equips participants with practical skills for real-world applications of deep learning.

Module I **22 Hours**

Deep Networks Basics - Linear Algebra - Scalars -- Vectors -- Matrices and tensors; Probability Distributions – Gradient based Optimization – Machine Learning Basics: Regression -- Classification – Clustering Over fitting and under fitting -- Stochastic gradient descent -- Deep Networks: Parameters-- Layers – Activation Functions – Optimization algorithms – Hyper parameters.

Convolutional Neural Networks - CNN Architectures – Input Layers -- Convolutional layers – Pooling Layers –Fully Connected Layers – Applications. Case Study: Sentence Classification using Convolutional Neural Networks.

Deep Network Architecture - Recurrent Neural Networks -- Recursive Neural Networks – Restricted Boltzmann Machines DBNs – Case Study: Dialogue Generation with LSTMs.

Module II **23 Hours**

Neural Networks and Deep Learning - Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation- Activation and Loss Functions- Hyper Parameters – Case Study : Opinion Mining using Recurrent Neural Networks.

Applications of Deep Learning - Natural Language Processing - object detection – Image Segmentation-Transfer Learning - Case Study: Named Entity Recognition – Parsing and Sentiment Analysis using Recursive Neural Networks.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply optimization algorithms to improve the performance of deep learning models for classification and regression tasks.	Apply
CO2: Apply Convolutional Neural Network (CNN) algorithms to sentence classification problems.	Apply
CO3: Analyze the effectiveness of various deep learning models in natural language processing and sentiment analysis.	Analyze
CO4: Analyze the role of neural network concepts in deep learning systems, particularly in the context of opinion mining and object detection.	Analyze

Text Book(s):

T1. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

Reference Book(s):

R1. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), Deep Learning Applications, Volume 3, Springer Publications 2021.

R2. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook", Springer International Punlishing, 2018.

R3. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.

Web References:

1. https://nptel.ac.in/courses/106/106/106106184/
2. https://www.coursera.org/courses?query=deep%20learning
3. https://www.greatlearning.in/academy/learn-for-free/courses/introduction-to-neuralnetworks-a deep -learning.

Course Code: 24CAE009	Course Title: Evolutionary Computing		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3:0: 0	Credits: 3	Total Contact Hours:45	Max Marks: 100

Course Objectives:

The course covers Evolutionary Algorithms, fitness evaluation, selection mechanisms, population management strategies, methodological issues, Ant Colony Optimization, and Particle Swarm Optimization, providing practical applications.

Module I **22 Hours**

Evolutionary Algorithm - Introduction on Evolutionary Algorithm - COMPONENT of Evolutionary Algorithms — Example Applications: The Eight-Queens Problem -The Knapsazck Problem –operations of Evolutionary algorithm - Evolutionary Computing, Global Optimization, and Other Search Algorithms.

Fitness, Selection and Population Management - Population Management Models- parent selection - Evolutionary Algorithm Variants: Genetic algorithm - Evolutionary strategies - Evolutionary programming - Genetic programming -. Particle swarm optimization.

Methodological Issues - Parameters and parameter Tuning- Evolutionary Algorithm parameters – EA and EA Instances – Designing Evolutionary Algorithms - Tuning problems – Tuning Methods- Parameter control-Examples of changing parameters.

Module II **23 Hours**

Ant Colony Optimization - Ant foraging behavior - Theoretical considerations – Convergence proofs – ACO Algorithm – ACO and model based search – Variations of ACO: Elitist Ant System (EAS), Min Max Ant System (MMAS) and Rank Based Ant Colony System (RANKAS).

Particle Swarm Optimization - Principles of bird flocking and fish schooling – Evolution of PSO – Operating principles – PSO Algorithm – Neighborhood Topologies – Convergence criteria – Variations of PSO: Binary, weighted, repulsive, combined effect PSO.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply optimization algorithms to examine the convergence properties, computational efficiency, and scalability of various optimization techniques.	Apply
CO2: Apply evolutionary algorithms to design and implement solutions for complex search problems.	Apply
CO3: Analyze and evaluate the effectiveness of evolutionary algorithms by designing and tuning their parameters.	Analyze
CO4: Analyze the application of evolutionary algorithms, such as ant colony optimization and particle swarm optimization, in solving real-world optimization problems.	Analyze

Text Book(s):

T1. Kenneth A. De Jong, "Evolutionary Computation A Unified Approach", Prentice Hall of India New Delhi, Reprint 2016.

T2. Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, NewDelhi, 2004.

Reference Book(s):

R1. Jun Sun, Choi-Hong Lai and Xiao-Jun Wu, "Particle Swarm Optimization: Classical andQuantum Perspectives", Taylor and Francis, USA, 2019.

R2. Eiben A.E and Smith J.E," Introduction to Evolutionary Computing", 2nd Edition, Springer, 2015.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_me43/preview
2. https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_8/M8L5slides.pdf
3. https://www.tutorialspoint.com/what-is-evolutionary-technologies

Course Code: 24CAE010		Course Title: Human Computer Interface	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches Human-Computer Interaction (HCI) design principles, evaluation techniques, Multimedia UI Design, mobile architecture, applications, and elements, while providing practical insights into front-end web design interfaces and advanced aspects.

Module I **22 Hours**

Foundations & Design of HCI - Interaction Models – Frameworks – Ergonomics – Styles – Elements – Interactivity Paradigms. HCI in software process – Software life cycle – Prototyping – Evaluation Techniques- Universal Design.

Multimedia UI - Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. Multimedia UI: Multimedia User Interface Design - Information Architecture - Media Selection and Combination - Interaction and Navigation.

Mobile HCI - Mobile Ecosystem: Platforms, Application frameworks - Types of Mobile Applications: Widgets- Applications- Games- Mobile Information Architecture- Mobile 2.0.

Module II **23 Hours**

Web Interface - Contextual Tools- Overlays & its types- Inlays its types – Virtual Pages.

Advanced Web Interface Design - Flow — Google blogger – Interactive single page process-Inline assistant process-dialog overlay process-static single page process.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the foundations and principles of Human-Computer Interaction (HCI), including interaction models, frameworks, ergonomics, and interactivity paradigms.	Apply
CO2: Apply HCI principles within the software development lifecycle to design user-friendly and efficient user interfaces.	Apply
CO3: Analyze and design Multimedia User Interfaces (UIs), integrating interactive design basics and multimedia principles for diverse platforms.	Analyze
CO4: Analyze web interface design concepts to create dynamic applications with interactive elements and advanced web design techniques.	Analyze

Text Book(s):

T1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2003.

T2. Brian Fling,”Mobile Design and Development, O‘Reilly Media Inc., 1st Edition, 2009.

Reference Book(s):

R1. Bill Scott and Theresa Neil, “Designing Web Interfaces”, O‘Reilly, 1st Edition, 2009.

R2. Andrew Sears, Julie A. Jacko,”The Human Computer Interaction Handbook”, 2nd Edition,Lawrence Erlbaum Associates, New York, 2012.

R3. I. A. Dhotre Soumitra Das, “Human Computer Interface” Technical Publications, 3rd Edition, 2023.

Web References:

1. https://www.tutorialspoint.com/human_computer_interface/quick_guide.htm
2. http://iiscs.wssu.edu/drupal/node/4607
3. https://onlinecourses.nptel.ac.in/noc19_cs86/preview

Course Code: 24CAE011		Course Title: Visualization Techniques	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches data visualization principles, focusing on patterns, visual objects, and space perception. It equips participants with practical skills to enhance visualization outcomes using DOM and Web technologies.

Module I **22 Hours**

Foundations of Data visualization - A Model of Perceptual processing - Types of Data — Environment - Eye - Optimal display- Luminance, Brightness, lightness and Gamma.

Multimedia UI - Color Standards- Appearance and Applications in Visualization - Visual Attention and Information - Visual field- Iconic Buffer-Gabor Model- Texture in Visualization,-glyphs andMultivariate Discrete data.

Mobile HCI - Static and Moving Patterns-Gestalt laws-Contours-Patterns in Motion - Visual Objects and DataObjects - Image-Based Object recognition-Structure-based Object Recognition- Geon diagram- Depth Cue Theory - Task Based Space Perception.

Module II **23 Hours**

Interacting with Visualizations - Interacting with Visualizations- Data Selection and Manipulation loop- Exploration and Navigation loop- Memory systems -Eye movements - Problem Solving with Visualizations.

Visualization Techniques and Systems - Structural Analysis - Statistical Exploration - Practical problems in conducting user studies- Data Driven Documents (D3) Technology Fundamentals - web DOM - web CSS -web JavaScript - Data for visualization.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the relationship between the environment, the human eye, and optimal display conditions to enhance data visualization.	Apply
CO2: Apply multimedia user interface design standards and principles to create effective visualizations within the visual field.	Apply
CO3: Analyze and illustrate interactive elements in visualizations to support data exploration and problem-solving.	Analyze
CO4: Analyze and apply appropriate visualization techniques to communicate insights effectively and drive decision-making.	Analyze

Text Book(s):

T1. Colin Ware, “Information Visualization: Perception for Design”, Morgan Kaufmann, 3rd Edition, 2012

T2. Scott Murray, ”Interactive Data Visualization for the Web-An Introduction to Designing with D3”, 2nd Edition, O’Reilly, 2017.

Reference Book(s):

R1. Ben Fry, “Visualizing Data”, 2nd Edition, O’Reilly, 2012.

R2. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", 2nd Edition, Analytics Press, 2019.

R3. Kevin Anderson, “Visualization Techniques”, Create space Independent Publishing Platform, 2016.

Web References:

1. https://www.geeksforgeeks.org/data-visualization-and-its-importance/
2. https://www.udacity.com/course/data-visualization-and-d3js--ud507
3. https://www.tutorialspoint.com/business_writing_skills/data_visualization.htm

Course Code: 24CAE012		Course Title: Virtual Reality	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to teach participants about virtual worlds, modeling techniques, human factors analysis, and programming skills, enabling them to explore diverse applications of virtual reality systems and apply them effectively.

22 Hours

Module I

Introduction - The three I"s of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three- dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces - Output Devices: Graphics displays-sound displays & haptic feedback.

Modeling - Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - modelmanagement.

Human Factors - Methodology and terminology-user performance studies-VR health and safety issues - usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality Environment.

23 Hours

Module II

VR Programming - Introducing Java 3D-loading and manipulating external models-using a lathe to makeshapes. 3D Sprites- animated 3D sprites-particle systems.

Applications - Medical applications-military applications-robotics applications- Advanced Real timeTracking-other applications- games, movies, simulations, therapy.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles and components of VR systems to evaluate existing VR experiences.	Apply
CO2: Develop and optimize VR models using geometric, kinematic, physical, and behavior-based modeling techniques.	Apply
CO3: Investigate user performance and usability aspects of VR systems through real-world applications.	Analyze
CO4: Examine the Structure and Capabilities of Java 3D for developing interactive VR applications.	Analyze
CO5: Assess the effectiveness of VR in various domains, including medical, military, robotics, games, movies, and simulations.	Analyze

Text Book(s):

T1. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc., Reprint 2017.

T2. Andrew Davison, "Killer Game Programming in Java", Oreilly SPD, 2005.

Reference Book(s):

R1. William R.Sherman, Alan Craig, "Understanding Virtual Reality, interface, Applicationand Design",2ne Edition, Elsevier, Morgan Kaufmann, 2018.

R2. Jack Challoner, Curiscope, "All About Virtual Reality", DK Children, 2017.

R3. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality", Morgan & Claypool Publishers, 2015.

Web References:

1. https://onlinecourses.swayam2.ac.in/nou23_ge34/preview
2. https://www.interaction-design.org/literature/topics/virtual-reality
3. https://www.geeksforgeeks.org/virtual-reality-introduction/

Course Code: 24CAE013	Course Title: Semantic Web Technologies		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course explores the evolution of the Semantic Web, its engineering process, web services' role, and practical application of Semantic Web concepts in real-world scenarios.

Module I **22 Hours**

Evolution of Semantic Web - Introduction - Syntactic Web and Semantic Web — Ontology-Taxonomies, Thesauri and Ontologies-Classification of Ontologies-Web Ontology Description Language - Inference Problems- RDF & RDF Schema.

Ontology Web Language - Requirements-Properties-Classes-Individual-Data Types-Rule Languages- RuleML SWRL-TRIPLE.

Semantic Web Services: Web Service Essentials - OWL–S Service Ontology Ontology Development: Uscholdand KingMethod-Toronto Virtual Enterprise Method.

Module II **23 Hours**

Semantic Web Software Tools - Ontology Sources: Metadata-Upper Ontologies - Ontology Libraries-Metadata and OntologyEditors – Reasoners.

Applications - Software Agents-Semantic Desktop-Ontology Applications in Art-Geospatial Semantic.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement the Transition from the Syntactic Web to the Semantic Web by structuring data for improved machine readability and interoperability..	Apply
CO2: Apply Ontologies, Taxonomies, Thesauri, and Classification Techniques to organize and manage knowledge effectively.	Apply
CO3: Analyze the different Semantic Web Service solutions in OWL-S Service Ontology.	Analyze
CO4: Examine Semantic Web software tools, including ontology editors, reasoners, and ontology libraries for real world applications.	Analyze

Text Book(s):

T1. K.K. Breitman, Marco Antonio Casanova and Walter Truszowski, "Semantic Web Concepts: Technologies and Applications" , Springer, 2007.

T2. Grigoris Antoniou, Frank Van, "Semantic Web Primer", MIT Press, 2nd edition, 2008.

Reference Book(s):

R1. Liyang Yu, "Introduction to the Semantic Web and Semantic web services", Chapman & Hall/CRC, Taylor & Francis group, 2009.

R2. Peter Mika, "Social networks and the Semantic Web", Springer, 1st edition 2010.

R3. Pascal Hitzler, Sebastian Rudolph, Markus Krotzsch, "Foundations of Semantic Web Technologies", Chapman & Hall (CRC press), 2010.

Web References:

1. https://www.w3.org/RDF
2. www.webcivics.org/resource.html
3. https://www.geeksforgeeks.org/semantic-web-and-rdf/

Course Code: 24CAE014		Course Title: Foundations of Data Science	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches data science fundamentals, including statistics, optimization, and mathematical operations, handling heterogeneous data, visualization, and open-source tools, while also providing insights into their applications.

22 Hours

Module I

Basics of Data Science - Introduction: Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; Structured thinking for solving data science problems, Structured and unstructured data.

Statistical Foundations - Descriptive statistics, Statistical Features, summarizing the data, outlier analysis, Understanding distributions and plots, Univariate statistical plots and usage, Bivariate and multivariate statistics, Dimensionality Reduction, Over and Under Sampling, Bayesian Statistics, Statistical Modeling for data analysis Optimization Unconstrained optimization; Necessary and sufficiency conditions for optima; Gradient descent methods; Constrained optimization, KKT conditions.

23 Hours

Module II

Introduction to non-gradient techniques - Introduction to least squares optimization. Data Handling and Visualization Data Acquisition, Data Pre-processing and Preparation, Data Quality and Transformation, Handling Text Data; Introduction to data visualization.

Visualization workflow - describing data visualization workflow, Visualization Periodic Table; Data Abstraction -Analysis: Four Levels for Validation- Task Abstraction - Analysis: Four Levels for Validation Data Representation: chart types: categorical, hierarchical, relational, temporal & spatial Data Science Tools and Techniques Overview and Demonstration of Open source tools such as R, Octave, Scilab. Python libraries: SciPy and sci-kitLearn, PyBrain, Pylearn2; Weka.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply data science problems using structured thinking, incorporating linear algebra for effective problem-solving.	Apply
CO2: Analyze statistical foundations concepts of descriptive statistics techniques in data analysis.	Analyze
CO3: Examine different data pre-processing techniques and choose appropriate methods for data quality improvement and transformation.	Analyze
CO4: Analyze data visualizations using established charts and graphs for data analysis.	Analyze

Text Book(s):

T1. R. V. Hogg, J. W. McKean and A. Craig, “Introduction to Mathematical Statistics”, 8th Edition,2020

T2. Avrim Blum, John Hopcroft, Ravindran Kannan, “Foundations of Data Science”, Cambridge University Press, Pearson Education India, 2020.

Reference Book(s):

R1. Ani Adhikari and John DeNero, ”Computational and Inferential Thinking: The Foundations of Data Science" , GitBook, 2019

R2. Cathy O"Neil and Rachel Schutt, “Doing Data Science: Straight Talk from the Frontline", O"Reilly Media, 2014.

R3. Hossein Pishro-Nik, “Introduction to Probability, Statistics, and Random Processes”, Kappa Research, LLC, 2014

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. https://www.tutorialspoint.com/data_science/index.htm
3. https://www.simplilearn.com/data-science-free-course-for-beginners-skillup

Course Code: 24CAE015		Course Title: Business Intelligence	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches fundamental business intelligence system principles, modeling aspects, CCR algorithm selection, and application, incorporating emerging technologies and basic rudimentary modeling.

Module I **22 Hours**

Business Intelligence - Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and businessintelligence.

Knowledge Delivery - The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

Efficiency - Efficiency measures – The CCR model: Definition of target objectives- Peer groups Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs Other models. Pattern matching – cluster analysis, outlier analysis.

Module II **23 Hours**

Business Intelligence Applications - Marketing models – Logistic and Production models – Case studies.

Future of Business Intelligence - Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply mathematical models to transform data into actionable insights.	Apply
CO2: Implement different BI reporting techniques, including standard reports, interactive analysis, and ad-hoc querying.	Apply
CO3: Apply pattern matching techniques, including cluster analysis and outlier analysis, for data-driven insights.	Apply
CO4: Analyze real-world business intelligence case studies to assess the effectiveness of BI strategies.	Analyze
C5: Analyze BI search, text analytics, and advanced visualization techniques for improved data interpretation.	Analyze

Text Book(s):

T1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Business Intelligence and Analytics: Systems for Decision Support", 10th Edition, Pearson Education, 2014.

T2. Larissa T. Moss, S. Atre, "Introduction to Business Intelligence and Data Warehousing",IBM, 2004.

Reference Book(s):

R1. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making",Wiley Publications, 1st edition, 2009.

R2. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager's Guide", 2ndEdition, 2012.

R3. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App",McGraw- Hill,1st edition, 2007.

Web References:

1 https://onlinecourses.nptel.ac.in/noc24_cs65/preview

2 https://www.javatpoint.com/business-intelligence-bi

3 https://www.guru99.com/business-intelligence-definition-example.html

Course Code: 24CAE016	Course Title: Data Mining and Data Warehousing		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches data warehousing architecture, pre-processing steps, classification and clustering algorithms, and spatial data analysis techniques, aiming to equip learners with fundamental knowledge and skills.

Module I **22 Hours**

Introduction to Data Warehouse - Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Data Mining & Data Preprocessing - Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

Association Rule Mining - Efficient and Scalable Frequent Item set Mining Methods Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining. Classification & Prediction: Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree-Bayesian Classification – Rule Based Classification – Classification by Back propagation.

Module II **23 Hours**

Support Vector Machines - Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracyof a Classifier or Predictor – Ensemble Methods – Model Section.

Clustering - Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid- Based Methods – Model- Based Clustering Methods – Clustering High Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Spatial Data Analysis - Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining –Text Mining – Mining the World Wide Web.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement data warehousing components, including metadata management and DBMS schemas, for decision support.	Apply
CO2: Implement data preprocessing techniques such as data cleaning, integration, transformation, and reduction.	Analyze
CO3: Utilize Scalable Algorithms for frequent itemset mining and association rule discovery to identify hidden patterns in data.	Analyze
CO4: Analyze spatial data and apply clustering and support vector machine techniques to various spatial dataset.	Analyze

Text Book(s):

T1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", 4th Edition, Morgan Kaufmann Publishers, 2022.

T2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGrawHill, 1997.

Reference Book(s):

R1. Sean Kelly, "Data Warehousing in Action", John Wiley & Sons Inc., 2007.

R2. S.K. Mourya, Shalu Gupta, "Data Mining and Data Warehousing", Alpha Science International Ltd, 2013.

R3. I. A. Dhotre, "Data Mining and Data Warehousing", Technical Publications; 1st edition, 2021.

Web References:

1. https://nptel.ac.in/courses/106106093/31
2. https://www.javatpoint.com/data-mining
3. https://www.tutorialspoint.com/dwh/

Course Code: 24CAE017	Course Title: Information Storage and Management		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on identifying and selecting storage technologies, deploying storage networking technologies, applying networked storage technologies, and implementing security measures to safeguard storage systems.

Module I **22 Hours**

Storage Technology - Introduction to Information Storage-Evolution of Storage Architecture - Data Center Infrastructure Virtualization and Cloud Computing-Data Center Environment-Application- Database Management System.

Storage Systems Architecture - RAID Implementation Methods-RAID Array Components-RAID Techniques-RAID Levels-RAID Impact on Disk Performance-Intelligent Storage Systems-Components-Storage Provisioning.

Storage Networking Technologies - Fibre Channel Storage Area Networks- Fibre Channel: Overview-SAN and Its Evolution- Components of FC SAN-FC Connectivity-Virtualization in SAN-iSCSI-FCIP-FcoE.– Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Module II **23 Hours**

Networked Storage - Servers versus NAS Devices-Benefits of NAS File Systems and Network File Sharing- Components of NAS-NAS I/O Operation-File-Level Virtualization -Object-Based Storage Devices- Content-Addressed Storage.

Case Study - Introduction to Business Continuity-Information Availability-BC Terminology - BC Planning Life Cycle- Failure Analysis-Business Impact Analysis-Information Security Framework-Risk Triad- Storage Security Domains.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement storage solutions in data centers, including virtualization and cloud-based storage architectures.	Apply
CO2: Implement RAID configurations and analyze their impact on disk performance and data redundancy using storage network technologies.	Apply
CO3: Examine RAID configurations based on different RAID levels to meet specific data storage requirements.	Analyze
CO4: Analyze NAS file systems, network file sharing, and file-level virtualization to optimize data accessibility with case analysis.	Analyze

Text Book(s):

T1. Soma sundaram Gnana sundaram, Alok Shrivastava," Information Storage and Management", EMC2 John Wiley & Sons, Inc., Second Edition, 2012.

T2. Marc Farley, "Building Storage Networks" Tata McGraw Hill , 2nd Edition, Osborne, 2001.

Reference Book(s):

R1. Robert Spalding, "Storage Networks: The Complete Reference" Tata McGraw Hill, 2003.

R2. John Watsonoca, "Oracle Database 11G: Administration 1 Exam guide", Tata McGrawHill, 1st Editon 2008.

R3. EMC Education services, "Information storage and management", 2nd Edition, 2015.

Web References:

1. https://nptel.ac.in/courses/106108058/

2.https://www.udemy.com/course/e05-001-information-storage-and-management-v3-deca-ism-p/

3. www.e-learningcenter.com/courses/emc-information-storage-and-management-ism-v2

Course Code: 24CAE018		Course Title: Information Retrieval Techniques	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course teaches fundamental information retrieval principles, advanced techniques, and application skills, focusing on modeling principles and advanced methods for effective application development.

Module I **22 Hours**

Introduction - Basic concepts – Retrieval process – Classic Information retrieval – set probabilistic models –Structured Text Retrieval models –Retrieval evaluation.

Querying - Languages — Keyword based querying –Pattern Matching –Structural Queries — QueryOperations – User Relevance Feedback- Text and Multimedia language.

Text Operations and User Interface - Document preprocessing –Clustering –Text Compression –Indexing and searching.

Module II **23 Hours**

Invertedfiles - Boolean Queries –User Interface and Visualization –Query Specification.

Multimedia Information Retrieval - Data Models — Query Languages –Spatial Access Methods –Generic Approach –TwoDimensional Color Images –Feature Extraction.

Applications - Searching the web – Challenges – Browsing-Meta-searchers –Parallel Information Retrieval –Distributed Information retrieval.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement various retrieval models, including set-theoretic, probabilistic, and structured text retrieval models to real world application.	Apply
CO2: Implement keyword-based querying, pattern matching, and structured queries for information retrieval.	Apply
CO3: Implement document preprocessing techniques, including clustering, text compression, and indexing.	Apply
CO4: Analyze spatial access methods, feature extraction, and multimedia data models for efficient information retrieval.	Analyze
CO5: Analyze challenges in web search, browsing techniques, and distributed information retrieval methodologies.	Analyze

Text Book(s):

T1. Ricardo Baeza-Yates, Bethier Ribeiro - Neto, ”Modern Information Retrieval“, Second Edition, ACM Press Books, 2011.

T2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze,” Introduction to Information Retrieval”, Cambridge University Press, 2008.

Reference Book(s):

R1. D.A.Grossman, O.Frieder,”Information Retrieval: Algorithms and Heuristics”, Springer,2010.

R2. Stefan Buttcher, Charles L.A.Clarke, “Information Retrieval, Implementing and Evaluating search Engines”, Massachusetts Institute of Technology, 2010.

R3. Iresh A. Dhotre,” Information Retrieval Techniques”,1st edition, 2021.

Web References:

1. https://nptel.ac.in/courses/106108058/
2. https://nptel.ac.in/courses/106105175/25
3. www.e-learningcenter.com/courses/emc-information-storage-and-management-ism-v2

Course Code: 24CAE019		Course Title: Agile Software Development	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT104 - SQL and NoSQL Database Management Systems

Course Objectives

The course teaches Extreme Programming (XP) and Scrum methodologies, providing a comprehensive understanding of XP principles and practical insights on Scrum concepts. It equips participants to integrate these methodologies into their work, enhancing efficiency and collaboration.

Module I **22 hours**

Agile Methodology - Understanding Success-Beyond deadlines-importance of Organizational Success-Agile model -classification of agile methods.

Extreme Programming (XP) - Method overview – lifecycle – XP Team-XP concepts – practicing XP –Thinking collaborating- Releasing - Development.

Mastering Agility - XP values and principles: commonalities – About values, principles and practices.

Scrum Practices and Individuals - Master – Product Owner – Changed Roles: Analysts, Project Managers, Architects, Functional Managers, Programmers, DB Administrators, Testers, User Experience Designers.

Module II **23 Hours**

Technical Practices – Test-driven development –Collective Ownership – Continuous Integration – Pair Programming**.**

Scrum Teamwork - Team Structures – Small Team Productivity – Feature Teams – Component Teams – Guidelines for Good Team Structure – Team Responsibility – Foster Team Learning – Self Organizing Team.

Influencing Evolution - Selecting Environment, Defining Performance, Manage Meaning, Energizing the System.

Scrum Specification - Product Backlog – Documents to Discussions - Written Documentation Disadvantages – User Stories Progressively Refine Requirements – Emergent Requirements – Backlog Iceberg.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply Agile principles in the software development process, emphasizing iterative and incremental development.	Apply
CO2: Apply the XP lifecycle, emphasizing the iterative and customer-centric nature of development.	Apply
CO3: Analyze the commonalities between XP values and Agile principles for successful project.	Analyze
CO4: Examine the concept of team responsibility and its influence on project success.	Analyze
CO5: Analyze Agile methods like Scrum and XP to understand technical practices, team structures, requirement handling, and how Agile systems evolve.	Analyze

Text Book(s):

T1. James Shore and Shane Warden, “The Art of Agile Development”, 2nd Edition, O'Reilly Media, 2021.

T2. Mike Cohn, “Succeeding with Agile: Software Development Using Scrum”, Addison-Wesley Professional, 1st Edition, 2009.

Reference Book(s):

R1. Craig Larman, “Agile and Iterative Development A Manager‘s Guide”, Pearson Education, 2004.

R2. Alistair, ”Agile Software Development series”, 2nd Edition, Cockburn, 2006.

R3. Elisabeth Hendrickson, “Agile Testing “, Quality Tree Software Inc, 2008

Web References:

1. http://nptel.ac.in/courses/106101061/26
2. https://www.javatpoint.com/agile
3. https://www.geeksforgeeks.org/software-engineering-agile-software-development/

Course Code: 24CAE020	Course Title: Database Architecture and Administration		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT104 - SQL and NoSQL Database Management Systems

Course Objectives

The course offers in-depth understanding of Oracle 11g Database architecture, including logical, memory, and physical structures, and emphasizes effective monitoring of space usage.

Module I **22 Hours**

Oracle11g Architecture: An Overview of Databases and Instances - Oracle Logical Storage Structures - Oracle Logical Database Structures. Physical & Memory Structure Oracle Physical Storage Structures - Multiplexing Database Files.

Oracle Memory Structures: Backup/Recovery overview- Monitoring Space Usage Common Space Management Problems - Oracle Segments, Extents, and Blocks - Data Dictionary Views and Dynamic Performance Views- Managing Transactions with undo Table Spaces &Tuning Transaction Basics - Undo Basics - Rollback - Managing Undo Table spaces.

Module II **23 Hours**

Database Tuning: Tuning Application Design - Tuning SQL - Tuning Memory Usage. Backup and Recovery Options & RMAN Logical Backups - Physical Backups - Using Data Pump Export and Import - Data Pump Import Options.

Integration of Backup Procedures: Using Recovery Manager (RMAN): RMAN Features and Components-Overview of RMAN Commands and Options-Backup Operations.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of logical storage structures in Oracle.	Apply
CO2: Apply the structure and significance of segments, extents, and blocks in Oracle	Apply
CO3: Analyze the impact of SQL query optimization on database efficiency	Analyze

CO4: Examine the overview of RMAN commands and their significance in backup management.	Analyze
CO5: Analyze application design and SQL tuning techniques for improving database performance.	Analyze

Text Book(s):

T1. Bob Bryla , Kevin Loney, “Oracle Database 11G DBA Handbook”, Oracle Press, McGraw-Hill 1st Edition 2007.

Reference Book(s):

R1. Loney Kevin, “Oracle Database 11G: The Complete Reference”, Apress, 2008.

R2. Lggy Fernandez, “Beginning Oracle Database 11G Administration from Novice to Professional”, Apress, 2012.

R3. John Watsonoca, “Oracle Database 11G: Administration 1 Exam guide”, Tata McGraw Hill,Editon 2012

Web References:

1. http://nptel.ac.in/courses/106106093/
2. https://www.geeksforgeeks.org/dbms-architecture-2-level-3-level/
3. http://www.oracle-dba-online.com/

Course Code: 24CAE021	Course Title: Software Project Management		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3:0 :0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 24CAT104 - SQL and NoSQL Database Management Systems

Course Objectives

The course offers comprehensive project management insights, stepwise planning, evaluation techniques, forecasting, software effort estimation, risk management analysis, and project control metrics for effective oversight.

Module I **22 Hours**

Introduction - Software Project Management Definition – Contract Management – Activities Covered by Software Project Management –Overview of Project Planning – Stepwise Project Planning.

Project Evaluation Strategic Assessment - Technical Assessment— Cost Benefit Analysis –Cash FlowForecasting – Cost Benefit Evaluation Techniques.

Risk Evaluation - Software Effort Estimation Problems with over and under estimates - Software effort estimation techniques – Function Point- Object Point – COCOMO Parametric Model.

Module II **23 Hours**

Risk Management Nature of Risk – Managing Risk – Risk Identification – Risk Analysis – Reducing the Risk –Evaluating risks to the schedule.

Monitoring And Control - Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring–Earned Value–Prioritizing Monitoring –Getting Project Back to Target– Change Control.

Project Control Metrics - The seven core metrics -management indicators -quality indicators -life cycle expectations – pragmatics software metrics - metrics automation. Change Metrics - Overview – Metrics Derivation – Pragmatic Metrics.

Course Outcomes	Cognitive level
At the end of this course, students will be able to:	
CO1: Apply cost-benefit analysis techniques to make informed project investment decisions.	Apply
CO2: Implement cash flow forecasts to software projects.	Apply
CO3: Estimate the risk management framework that integrates data collection and visualization techniques.	Analyze
CO4: Illustrate the application of pragmatic metrics in project control.	Analyze

Text Book(s):

T1. Bob Hughes & Mike Cotterell, “Software Project Management”, Tata McGraw- Hill Publications, Fifth Edition, 2009.

Reference Book(s):

R1. Walker Royce, “Software Project Management – A unified Framework”, Pearson Education,1998.

R2. S. A. Kelkar, ”Software Project Management”, PHI, New Delhi, Third Edition, 2013.

R3. Roger Pressman S., “Software Engineering: A Practitioner's Approach”, Tata McGraw Hill,9th Edition, 2019.

Web References:

1. http://nptel.ac.in/syllabus/106101061/
2. https://www.tutorialspoint.com/software_engineering/software_project_management.htm
3. https://www.javatpoint.com/software-project-management

Course Code: 24CAE022		Course Title: Software Quality and Testing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT104 - SQL and NoSQL Database Management Systems

Course Objectives:

The course teaches software quality principles, integrating SQA components into project life cycles, illustrating infrastructure, metrics, defect prevention techniques, and practical applications for high-quality software.

Module I **22 Hours**

Introduction to Software Quality & Architecture - Need for Software quality - Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall's quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

SQA Components and Project Life Cycle - Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components.

Quality assurance tools - CASE tools for software quality **—** Software maintenance quality — Project Management - Software Quality Infrastructure Procedures and work instructions – Templates – Checklists – 3S developmenting – Staff training and certification Corrective and preventive actions.

Module II **23 Hours**

Configuration management Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval. Software Quality Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics.

Quality Characteristics ISO 9000 - 2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model. Software Quality Assurance Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention.

Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study - FSM-Based Testing of Web- Based Applications.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply McCall's quality model to assess and improve software quality factors.	Apply
CO2: Apply various Software Development methodologies and their impact on quality assurance activities	Apply
CO3: Examine the appropriate CASE tools for improving the quality of software.	Analyze
CO4: Examine different quality assurance techniques on software development processes.	Analyze
CO5: Analyze fault tolerance techniques, safety assurance methods, and quality assurance strategies for improving software reliability.	Analyze

Text Book(s):

T1. R. Chopra , "Software Quality Assurance", Mercury Learning & Information; Illustrated edition, 2018

T2. Claude Y. Laporte, Alain, "Software Quality Assurance", First Edition, wiley, 2018

Reference Book(s):

R1. Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan , "Software Quality Assurance", Morgan Kaufmann,1st edition, 2015.

R2. Milind Limaye, "Software Quality Assurance", , TMH ,New Delhi, 2011.

R3. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview
2. https://www.tutorialspoint.com/software_testing/index.htm
3. https://www.w3schools.in/software-testing/tutorials/

Course Code: 24CAE023	Course Title: Multimedia Systems		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT103 - Advanced Data Structures and Algorithms with Python
- 24CAT104 - SQL and NoSQL Database Management Systems

Course Objectives

The course enhances student learning in multimedia systems, focuses on multimedia techniques, and provides a comprehensive understanding of multimedia elements for a holistic learning experience.

Module I **22 Hours**

Introduction To Multimedia Elements - Multimedia — Medium — Properties of a Multimedia system — Traditional Data Stream Characteristics – Data Stream Characteristics of Continuous Media – Basic Sound Concepts – Speech – Images and Graphics – Computer Image Processing – Video and Animation – Computer Based Animation.

Multimedia Compression - Storage Space – Coding Requirements – Hybrid Coding – JPEG: Image Preparation, Lossy Mode, Lossless Mode, Hierarchical Mode – H.261 – MPEG: Video Encoding, Audio Encoding, Data Stream, MPEG 3, MPEG 7, MPEG 21 – DVI – Audio Encoding. Multimedia Architectures User Interfaces – OS Multimedia Support – Multimedia Extensions – Hardware Support – Distributed Multimedia Applications – Real Time Protocols.

Module II **23 Hours**

Multimedia Architectures - Play Back Architectures – Synchronization – Document And Document Architecture – Hypermedia Concepts – Hypermedia Design – Digital Copyrights – Digital Library – Multimedia Archives.

Multimedia Operating System and Databases Real Time – Resource Management – Process Management – File Systems – Interprocess Communication And Synchronization – Memory Management – Device Management – Characteristics Of MDBMS — Data Analysis — Data Structures — Operations On Data — Integration In A Database Model. Multimedia Communication & Applications.

Tele Services – Implementation Of Conversational Services, Messaging Services, Retrieval Services, Tele Action Services, Tele Operation Services – Media Consumption – Media Entertainment – Virtual Reality – Interactive Audio – Interactive Video – Games.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Determine the multimedia architecture knowledge to design user interfaces that support multimedia applications.	Apply
CO2:Examine different multimedia compression techniques and choose appropriate methods for optimizing storage and transmission.	Analyze
CO3: Apply hypermedia concepts to create well-structured interactive multimedia experiences.	Apply
CO4: Estimate the suitable multimedia database technology to create the multimedia database for real time application.	Analyze

Text Book(s):

T1. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Computing, Communications, and Applications”, Pearson India, Reprint 1999.

T2. Ranjan Parekh, “Principles of Multimedia”, 3rd Edition, McGraw Hill Education,2025.

Reference Book(s):

R1. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Systems”, Springer, 2004.

R2. Tay Vaughan, “Multimedia: Making it Work”, McGraw – Hill Education, Ninth Edition 2014.

R3. Mark S Drew, Zee Nian Li, “Fundamentals of multimedia”, Prentice Hall, 2006.

R4. Jerry D. Gibson, Toby Berger, Tom Lookabaugh David Lindbergh, Rich Baker “Digital Compression for Multimedia: Principles and Standards”, Morgan Kaufmann Publishers In, 2006.

Web References:

1. https://nptel.ac.in/courses/117105083
2. https://www.tutorialspoint.com/multimedia/index.htm
3. https://www.javatpoint.com/what-is-multimedia

Course Code: 24CAE024		Course Title: Human Values and Professional Ethics	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT302 - Cyber Security

Course Objectives

The course covers ethics, professional skills, computer crime, intellectual property rights, privacy, and technical accessibility, enhancing practical knowledge and identifying threats in the computing environment.

Module I **22 Hours**

Human Values and Engineering Ethics - Morals, Values and Ethics — Integrity — Work Ethics — Service Learning — Civic Virtue — Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time – Co-operation — Commitment — Empathy — Self-confidence — Spirituality- Character.

Engineering Ethics - The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics- Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories- Professional Ethics-Types of Inquiry – Engineering and Ethics- Kohlberg"s Theory – Gilligan"sArgument –Heinz"s Dilemma.

Computer Hacking A General Introduction – Computer Ethics: An Overview – Computer Hacking – Introduction – Definition of Hacking – Destructive Programs – Hacker Ethics – Professional Constraints – BCS Code of Conduct – To Hack or Not To Hack – Ethical Positions on Hacking. Computer Crime Aspects of Computer Crime Introduction – What is Computer Crime – Computer Security Measures – Professional Duties and Obligations.

Module II **23 Hours**

Intellectual Property Rights Intellectual Property Rights – The Nature of Intellectual Property– Intellectual Property – Patents, Trademarks, Trade Secrets, Software Issues, Copyright – The Extent and Nature of Software Piracy – Ethical and Professional Issues – Free Software and Open Source Code.

Regulating Internet Content, Technology and Safety . Introduction – In Defense of Freedom Expression – Censorship – Laws Upholding Free Speech— Free Speech and the Internet — Ethical and Professional Issues — Internet Technologies and Privacy – Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis — Reducing Risk.

Computer Technologies Accessibility Issues Introduction – Principle of Equal Access –

Obstacles to Access for Individuals – Professional Responsibility–Empowering Computers in the Workplace–Introduction Computers and Employment – Computers and the Quality of Work – Computerized Monitoring in the Work Place – Telecommuting – use of artificial intelligence and expert systems - Social, Legal and Professional Issues.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the principles of human values such as integrity, empathy, honesty, and social responsibility in personal and professional life.	Apply
CO2: Apply ethical practices and professional codes of conduct to address issues in engineering, computer ethics, and cybercrime scenarios.	Apply
CO3: Analyze various forms of intellectual property and evaluate the ethical and legal challenges related to software piracy, open-source software, and professional responsibility.	Analyze
CO4: Analyze the impact of internet technologies, privacy, accessibility, and workplace computerization on society by assessing legal, ethical, and professional implications.	Analyze

Text Book(s):

T1.M.Govindarajan, S.Natarajan and V.S.SenthilKumar, "Professional Ethics and Human Values", PHI Learning Pvt. Ltd, 2004.

T2. Penny Duquenoy, Simon Jones and Barry G Blundell, “Ethical, legal and Professional Issues in Computing", Middlesex University Press, 2008.

Reference Book(s):

R1. Mike Martin and Roland Schinzinger, “Ethics in Engineering", 7th Edition, McGraw-Hill, New York,2013

R2. George Reynolds, "Ethics in Information Technology", 5th Edition, Cengage Learning, 2011

R3. Caroline Whitback, "Ethics in Engineering Practice and Research", Cambridge University Press 2011

Web References:

1.http://nptel.ac.in/courses/109104032/

2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=109104033

3. https://www.tutorialspoint.com/professional_ethics/index.html

Course Code: 24CAE025	Course Title: Research Methodology and Intellectual Property Rights		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to identify research problems, explain ethical issues, prepare thesis reports, understand patent and copyright laws, and gain IPR knowledge.

Module I **22 Hours**

Research Methodology – An Introduction, Objectives, Types of research, Research approaches, Significance, Research methods versus Methodology, Research and Scientific Method, Importance, Research process, Criteria, Problems encountered by researchers.

Defining the research problem – Research problem, Selecting the problem, Necessity, Technique involved an illustration. Reviewing the Literature – The place of the literature review in research, How to review the Literature, Writing about the literature reviewed. Research Design – Meaning, Need, Features, Different research design, Basic principles of experimental designs, Important experimental designs.

Measurement & Scaling techniques – Sampling Design, Measurement in research, Measurement scales, Error, Measurement tools, Scaling, Meaning, Scale classification, Scale construction technique Data Collection – Collection of primary data, Collection of secondary data, Selection of appropriate method for data collection.

Research Technique Testing of Hypothesis – Basic concepts, Procedure, Test of Hypothesis, Important parametric Tests, Hypothesis Testing unifications. Interpretation & Report writing – Meaning, techniques, Precaution in Interpretation, Significance of Report writing, steps, Layout, types, mechanics, precautions.

Module II **23 Hours**

Use of Tools/ Techniques for research – Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline, Use of tools /techniques for Research methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office.

Software for detection of Plagiarism Intellectual Property – The concept, IPS in India, development, Trade secrets, utility Models, IPR & Bio diversity, CBD, WIPO, WTO, Right of Property, Common rules, PCT, Features of Agreement, Trademark, UNESCO. **Patents** – Learning objectives, Concept, features, Novelty, Inventive step, Specification,Types of patent application, E-filling, Examination, Grant of patent, Revocation, Equitable

Assignments, Licences, Licencing of related patents, patent agents, Registration of patent agents.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply appropriate research methods, designs, and data collection techniques to address defined research problems.	Apply
CO2: Apply suitable hypothesis testing procedures, measurement tools, and report writing techniques to conduct and present research findings effectively.	Apply
CO3: Analyze the use of research tools, academic databases, and reference management software to enhance the efficiency and integrity of academic research.	Analyze
CO4: Analyze the principles and legal frameworks of intellectual property rights, including patents, trademarks, and international agreements, to understand their role in protecting research innovations.	Analyze

Text Book(s):

T1. C.R.Kothari, GauravGarg, "Research Methodology: Methods and Techniques", New Age International,4th Edition, 2019.

Reference Book(s):

R1. Ranjit Kumar, "Research Methodology a step-by-step guide for beginners", SAGE Publications Ltd, 3rd Edition, 2011.

R2. Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction". Juta and Co Limited, First edition, 1996.

R3. Professional Programme Intellectual Property Rights, Law and practice, The Institute of Company Secretaries of India, Statutory body under an Act of parliament, 2013.

Web References:

1. https://nptel.ac.in/courses/106/106/106106184/
2. https://www.coursera.org/courses?query=deep%20learning
3.https://www.greatlearning.in/academy/learn-for-free/courses/introduction-to-neural-networks-and-deep-learning

Course Code: 24CAE026	Course Title: Principles of Business Management		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

This course aims to provide a comprehensive understanding of the core concepts and principles of business management, enabling students to develop critical thinking and problem-solving skills for addressing managerial challenges. It equips learners with analytical tools to assess and resolve organizational issues effectively. Additionally, the course explores the dynamics of business environments and prepares students to navigate emerging trends in management.

Module I **23 Hours**

Introduction to Management: Management – An Emerging Profession, Definition, Nature, Scope, Purpose, and characteristics of Management, Functions, roles, skills of an effective Manager

Planning: Types of Plans, Planning Process, Introduction to Strategic Management, Types of Strategies, Understanding environment of business: Environmental appraisal – Industry Analysis - Porter's Model of competitive advantage, analysis of organisational resources and capabilities

Decision-making: Introduction, Components of Decision-making, Decision-making Process, Group Decision-making, Creativity Problem-solving

Module II **22 Hours**

Organizing and Directing: Introduction, Organizational Design, Hierarchical Systems , Organization Structure, Types of Organization Structure, Formal and Informal Organization, Understanding authority and responsibility, Principles of Delegation, Authority, Developing a culture of Innovation and performance

Staffing and Coordination: Introduction, Human Resource Management, Recent Trends in HRM, Technology in HRM, Economic Challenges, Workforce Diversity, Concept of Coordination, Need for Coordination, Importance of Coordination, Principles of Coordination, Coordination Process, Types of Coordination, Issues and Systems Approach to Coordination, Techniques of Coordination

Challenges of Contemporary Business: Role of Ethics, Corporate social responsibility, and environmental issues.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply key management principles to assess the roles, skills, and functions of an effective manager in organizational settings.	Apply
CO2: Apply structured decision-making processes and creative problem-solving techniques to address organizational challenges effectively.	Apply
CO3: Analyze the business environment using tools like environmental appraisal and Porter's model to develop strategic plans and organizational capabilities.	Analyze
CO4: Analyze organizational structures, authority, and delegation processes to design systems that foster innovation and high performance.	Analyze
CO5: Analyze the role of ethics, corporate social responsibility, and environmental considerations in shaping sustainable business practices.	Analyze

Text Book(s):

T1. Stephen P. Robbins, David A. Decenzo, Fundamentals of Management, Pearson Education, 11th Edition,2022

T2. Harold Koontz, O'Donnell and Heinz Weihrich,, Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill,2012

Reference Book(s):

R1. Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage, 2014

R2. Richard L. Daft, Principles of Management, Cengage Learning. 13th Edition, 2022

R3. Stephen P. Robbins, Management, 14th edition Pearson Education. 2022

Web References:

1) https://onlinecourses.nptel.ac.in/noc21_mg30/preview
2) https://www.tutorialspoint.com/international_business_management/index.htm
3) https://www.coursera.org/learn/business-analysis-fundamentals

Course Code: 24CAE027		Course Title: Augmented Reality	
Course Category: Professional		**Course Level: Mastery**	
L:T:P(Hours/Week):: 3:0:0	**Credits: 3**	**Total Contact Hours: 45**	**Max Marks: 100**

Pre-requisites

- 24CAT103 - Advanced Data Structures and Algorithms with Python

Course Objectives

The course aims to provide a comprehensive understanding of augmented reality by exploring its historical and contemporary perspectives. Participants will learn the fundamentals of sensation and perception, alongside the scientific, technical, and engineering aspects of augmented reality systems.

Module I **22 Hours**

Introduction: Augmented reality characteristics - Difference between Augmented Reality and Virtual Reality - Technologies used in AR- Hardware components - AR devices - Real world uses of AR – AR types.

Need of technologies for Augmented Reality: Hardware technology – virtual scenes– 3D objects – AR components– Display– HMD – Eyeglasses– Contact Lenses– significance of AR– AR powered devices - AR application development drawbacks – Compatibility – Performance – AR libraries– Motion tracking – Environmental understanding

Technology Integration and Implementation of AR: Technology use and integration in industrial settings - Planning and administration for implementation - AR implications

Module II **23 Hours**

Computer Vision for Augmented Reality & A.R. Software: Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

Tools and Applications of Augmented Reality: Tools available for Augmented Reality and Recognition– Software Tools– Google Poly – native software solutions– ARKit– ARCore – software development kit - AR business applications – weather prediction - AR application for Education - AR application for Healthcare sector – Agriculture– Architecture – Crime and Security– Games– Social Media – Gaming – Education – Healthcare.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Utilize AR hardware components for creating immersive AR	Apply

experiences	
CO2: Apply AR development techniques to create, design, and implement AR applications that integrate virtual and physical environments	Apply
CO3: Apply software development kits (SDKs) such as ARKit**,** ARCore, and other AR-specific platforms to create interactive AR applications	Apply
CO4: Analyze the potential benefits and challenges of using AR in sectors like crime and security**,** games**,** and social media, identifying opportunities for innovation and development.	Analyze

Text Book(s):

T1. Kaliraj P, Devi T, Innovating with Augmented Reality: Applications in Education and Industry , 1st edition,. Auerbach Publications, 2021.

T2. Allan Fowler-AR Game Developmentll, 1st Edition, A press Publications, 2018

Reference Book(s):

R1. Dieter Schmalstieg, Tobias Hollerer, Augmented Reality: Principles & Practice, Pearson Education India; First edition, 2016

R2. Sanni Siltanen, Theory and Applications of Marker-Based Augmented Reality. Julkaisija – Utgivare Publisher. 2012

Web References:

1. https://www.geeksforgeeks.org/basics-augmented-reality/
2. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/all-about-augmented-reality
3. https://www.freecodecamp.org/news/augmented-reality-full-course/

Course Code: 24CAE028		Course Title: Information Security	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT302 - Cyber Security

Course Objectives

This course is designed to provide a foundational understanding of Information Security, covering key concepts and practices. It also addresses legal, ethical, and professional issues related to information security. Additionally, students will gain knowledge in digital signatures, email security, and web security techniques.

Module I **22 Hours**

Introduction: History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

Security Investigation : Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

Digital Signature And Authentication: Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants.

Module II **23 Hours**

Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services

E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management.

Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication-Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	

CO1: Apply various security models, such as the NSTISSC Security Model, to secure information systems by balancing security and access.	Apply
CO2: Apply different authentication schemes, including Kerberos and X.509 Directory Services, to simulate secure communication in practical scenarios.	Apply
CO3: Apply web security protocols such as SSL/TLS and Secure Electronic Transaction (SET) to ensure secure communication for e-commerce applications.	Apply
CO4: Analyze email and IP security architectures, including PGP, S/MIME, and IPsec, to assess their suitability for specific operational and trust requirements..	Analyze
CO5: Analyze secure electronic transaction protocols to determine their role in verifying digital signatures and ensuring data integrity during transactions.	Analyze

Text Book(s):

T1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security, Course Technology, 6th Edition, 2017.

Reference Book(s):

R1. Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.
R2. Harold F. Tipton, Micki Krause Nozaki,, “Information Security Management Handbook,Volume 6, 6th Edition, 2016.
R3. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, McGraw- Hill, Seventh Edition, 2012.
R4. Matt Bishop, “Computer Security Art and Science, Addison Wesley, Reprint Edition, 2015.

Web References:

1. https://www.geeksforgeeks.org/what-is-information-security/
2. https://www.tutorialspoint.com/what-is-information-security
3. https://intellipaat.com/blog/what-is-information-security/

Course Code: 24CAE029	Course Title: Deep Learning with Computer Vision		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT201- Machine Learning

Course Objectives

This course will introduce the students to traditional computer vision topics, before presenting deep learning methods for computer vision. The course will cover basics as well as recent advancements in these areas, which will help the student learn the basics as well as become proficient in applying these methods to real-world applications.

Module I **22 Hours**

Introduction - Image Processing using OpenCV – Shape detection using OpenCV – Fundamentals of Deep learning. Nuts and Bolts of Deep Learning for Computer Vision : Deep learning using Tensorflow and Keras – Tensor Definition – Developing a DL solution using CNN

Image Classification Using LeNet –Deep learning architectures – LeNet architecture – LeNet-1 architecture - LeNet-4 architecture - LeNet-5 architecture – Boosted LeNet-4 architecture – Creating image classification models using LeNet – MNIST classification using LeNet.

Module II **23 Hours**

Object Detection Using Deep Learning – Object detection – Object Detection methods – Deep Learing frameworks for object Detection – Bounding box approach – Anchor boxes – Deep Learning architecture – Faster R-CNN – Single Shot MultiBox Detector - Face Recognition and Gesture Recognition– Face recognition.

Video Analytics Using Deep Learning – Video processing – Use cases of video analytics – Vanishing gradient and exploding gradient problem – ResNet architecture – Video Analytics.

End-to-End Model Development – Deep Learning project requirements – Deep Learning project process – Business problem definition.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply image processing and deep learning techniques in computer vision tasks.	Apply
CO2: Apply the concepts of deep learning, to develop solutions for image classification tasks using Keras.	Apply
CO3: Apply computer vision methods for object detection.	Apply
CO4: Apply neural networks components, to develop solutions for face recognition, and gesture recognition.	Apply
CO5: Analyze usage of Convolutional Neural Networks (CNNs) techniques in biometric authentication, and medical imaging.	Analyze

Text Book(s):

T1. Vaibhav Verdhan, “Computer Vision Using Deep Learning”, Apress, 2021

Reference Book(s):

R1. Mahmoud Hassaballah , Ali Ismail Awad , “Deep Learning in Computer Vision”, 1st edition, 2020

R2. Nikhil Singh, Paras Ahuja, “Fundamentals of Deep Learning and Computer Vision”, 1st edition, 2020

Web References:

1. https://www.deeplearningbook.org/
2. https://www.geeksforgeeks.org/computer-vision-introduction/
3. https://www.geeksforgeeks.org/a-quick-overview-to-computer-vision/

Course Code: 24CAE030		Course Title: Ethics for Data Science	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course aims to help students recognize ethical issues in applying data science to real-world problems. It covers essential ethical aspects such as privacy, plagiarism, intellectual property rights, piracy, security, and confidentiality, ensuring a responsible approach to data science.

Module I **22 Hours**

Introduction to Data Science Ethics - The Rise of Data Science (Ethics), Right and Wrong Data Science Ethics Equilibrium- The FAT Flow Framework for Data Science Ethics.

Ethical Data Gathering- Privacy as a Human Right- Privacy Mechanisms, Case study: Backdoors and Messaging Encryption- Human Experimentation - Dating, Happiness, and Ads.

Ethical Data Preprocessing - Defining and Measuring Privacy, Re-identification - Defining and Selecting Variables Case study: Pregnancy and Face Recognition-Fair Relabeling.

Module II **23 Hours**

Ethical Modelling - PrivacyPreserving Data Mining, Discrimination-Aware Modelling Predicting Recidivism and Redlining, Comprehensible Models and Explainable AI, Including Ethical Preferences: SelfDriving Cars.

Ethical Evaluation - Ethical Measurement, Ethical Interpretation of the Results, Ethical Reporting.

Ethical Deployment - Access to the System, Different Treatments for Different Predictions. Censoring Search and Face Recognition.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply ethical frameworks such as the FAT Flow to analyze real-world data science practices and identify ethical dilemmas.	Apply
CO2: Apply ethical principles to data gathering and preprocessing processes by evaluating privacy mechanisms, human experimentation scenarios, and fairness in variable selection.	Apply
CO3: Analyze the ethical implications of data science models by examining privacy-preserving techniques, fairness-aware algorithms, and explainability in real-world applications.	Analyze
CO4:Analyze ethical risks in evaluating and deploying data science systems by interpreting ethical measurements, identifying biases in result reporting, and assessing access and treatment disparities.	Analyze

Text Book(s):

T1. Tales Rachel, David Martens , “Data Science Ethics Concepts, Techniques and Cautionary”, Oxford university press, 2021.

Reference Book(s):

R1. Mike Loukides, Hilary Mason and DJ Patil,”Ethics and Data Science”,O'Reilly Media; 1st edition, 2018.

R2. Kirsten Martin, Ethics of Data and Analytics Concepts and Cases, CRC Press, 2022

Web References:

1. https://www.geeksforgeeks.org/ethics-in-data-science-and-proper-privacy-and-usage-of-data/
2. https://www.datacamp.com/blog/introduction-to-data-ethics
3. https://scistarter.org/training-dataethics

Course Code: 24CAE031	Course Title: Generative AI		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 24CAT103 - Advanced Data Structures and Algorithms with Python
- 24CAT201- Machine Learning

Course Objectives

The course is designed to provide a comprehensive understanding of generative AI, focusing on foundational deep neural networks and their role in generative models. Students will develop practical skills in setting up a machine learning lab using tools like TensorFlow, Docker, Kubernetes, and Kubeflow.

Module I **22 Hours**

Introduction: An Introduction to Generative AI - Applications of AI - Uses of generative models - Unique challenges of generative models - Setting Up a TensorFlow Lab - Docker: A lightweight virtualization solution - Kubernetes: Robust management of multi-container applications.

Building Blocks of Deep Neural Networks: Perceptrons – a brain in a function - Multi-layer perceptrons and backpropagation - Varieties of networks: Convolution and recursive **GANs:** Image Generation with GANs.

Module II **23 Hours**

The Rise of Methods for Text Generation: Representing text - Text generation and the magic of LSTMs - LSTM variants and convolutions for text.

NLP 2.0: Using Transformers to Generate Text: Attention - GPT 1, 2, 3

Emerging Applications in Generative AI: Finding new drugs with generative models -Solving partial differential equations with generative modeling.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1:Apply generative AI techniques by setting up a TensorFlow lab using Docker and Kubernetes to efficiently manage and deploy AI models.	Apply
CO2:Implement deep neural network architectures for generative tasks.	Apply
CO3:Apply NLP models in Gen AI.	Apply
CO4:Apply GANs for various image generation tasks, including style transfer and creating deepfakes.	Apply
CO5:Utilize advanced NLP techniques and transformer models for text generation and other emerging applications in generative AI.	Analyze

Text Book(s):

T1. Joseph Babcock ,Raghav Bali, “Generative AI with Python and TensorFlow 2”,1st edition, 2021.

Reference Book(s):

R1. Francois Chollet, “Deep Learning with Python”, Manning Pubns Co; 2nd edition, 2021.

R2. David Foster , “Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play”, O'Reilly Media, 1st edition, 2019.

Web References:

1. https://www.tensorflow.org/
2. https://platform.openai.com/docs/overview
3. https://kubernetes.io/docs/home/

Course Code: 24CAE032		Course Title: Image Data Analysis	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::2:0:2	Credits: 3	Total Contact Hours:60	Max Marks: 100

Course Objectives

The course covers image processing fundamentals, enhancement techniques, supervised ML models, CNNs, YOLO-based object detection and segmentation using HSV and thresholding with applications in healthcare and agriculture.

Module I **15 Hours**

Fundamentals of Image Processing & AI Concepts: Basics of Digital Image Processing – pixels- color spaces-resolution – Image acquisition methods - sensor – drone - mobile in healthcare/agriculture – Factors Affecting Image Quality - Illumination-noise – focus – Image Enhancement Techniques – Filtering-histogram equalization – Basics of AI & ML– supervised learning - k-NN - decision trees – Feature Engineering -

Module II **15 Hours**

Deep Learning and Case Application: CNNs for Image Analysis: Convolution – Pooling –activation – flattening – fully connected layers – YOLO for Real-time Object Detection - Architecture overview – Application in agriculture/healthcare – Segmentation and Color Processing- HSV conversion-Thresholding –Real-world applications - Disease detection in leaves- Pneumonia detection in X-rays - Transfer Learning - Pretrained CNN models and fine-tuning.

List of Experiments: **30 Hours**

1. Image enhancement using filters and histogram equalization
2. Classification of health risk using ML (e.g., diabetes dataset)
3. CNN-based pneumonia detection from chest X-rays
4. Image segmentation and disease spot detection in leaves using HSV and thresholding
5. Real-time object detection in agriculture using YOLO
6. Leaf disease classification using pretrained CNN and transfer learning

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply basic image processing and enhancement techniques to healthcare and agriculture images.	Apply

CO2: Apply image preprocessing techniques and supervised machine learning models like k-NN and Decision Trees to solve classification problems.	Apply
CO3: Implement CNN and YOLO models for analyzing image datasets in healthcare and agriculture, including disease detection and object recognition.	Apply
CO4: Analyze the performance of AI models using transfer learning and image segmentation methods to detect real-world health and crop conditions.	Analyze

Text Book(s):

T1. Rafael C. Gonzalez & Richard E. Woods,"*Digital Image Processing",* 4th Edition, Pearson Education, 2018.

T2. Aurélien Géron,"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 3rd Edition, O'Reilly Media, 2022.

T3. Ian Goodfellow, Yoshua Bengio, Aaron Courville,"Deep Learning", MIT Press, Reprint Edition, 2021.

T4. Rajesh Singh, AnitImaga Gehlot, Bhupendra Singh ,"Artificial Intelligence in Agriculture", BPB Publications, 2020.

Reference Book(s):

R1. Sandeep Reddy, "Artificial Intelligence in Healthcare", CRC Press, 2020.

R2. Laurence Moroney,"AI and Machine Learning for Coders", O'Reilly Media, 1st Edition, 2020.

Web References:

1. https://nptel.ac.in/courses/106105216
2. https://www.tensorflow.org/tutorials.

Course Code: 24CAE033		Course Title: Design Patterns	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)::2:0:2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course is intended to impart knowledge on developing reusable solutions while development of a software model. This course also helps to model a reliable and efficient design in order to reduce the amount of refactoring while developing a software.

Module I **15 Hours**

Introduction: Design Patterns in Smalltalk MVC - Describing - Design Patterns - The Catalog of Design Patterns - Organizing the Catalog - Solve Design Problems - Select a Design Pattern. Fundamentals of Design Patterns: Design Pattern Configuration – Patterns of Structural Design and Behavioural Design - Design Pattern Classification.

Module II **15 Hours**

Creational Patterns: Abstract Factory - Builder - Factory Method – Prototype - Singleton.

Singleton Pattern: Motivation - Design Pattern of Monostate /Borg Singleton - Early and Lazy Singleton Instantiation Pattern. Strategy Pattern: Fundamentals - UML Diagrams – Class, Object and Interaction diagrams. Other Patterns: Proxy Pattern – Bridge Patterns - Adapter and Façade Patterns - Solid Principles with its guidelines

Case Study: JDeodorant, DesigniteJava, or DPD Tool

List of Experiments **30 Hours**

Implement the given real time application using the following types of patterns

1. Implementation of Template Method Design Pattern
2. Implementation of Singleton and Strategy Design Pattern
3. Implementation of Proxy and Bridge Patterns
4. Implementation of Adapter and Façade Patterns
5. Source Code Analysis for Design Patterns using Open Source Tools

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement software patterns for the given real time applications.	Apply
CO2: Compare the features of various methods used to develop design	Apply

patterns for the given application.	
CO3: Apply open source tools to develop reusable and reliable solutions for software development.	Apply

Text book(s):

T1. Eric Freeman, Elisabeth Robson, “Head First Design Patterns”, 2nd Edition, O’Reilly Media, 2020

T2. Sufyan bin Uzayr, “Software Design Patterns: The Ultimate Guide”, CRC Press, 2022

Reference Book(s):

R1. Lalit Mehra, “Software Design Patterns for Java Developers”, BPB Publications, 2021

R2. Olaf Musch, “Design Patterns with Java: An Introduction”, Springer, 2023

R3. Gaurav Aroraa, Jeffrey Chilberto, “Hands-On Design Patterns with C# and .NET Core”, Packt Publishing, 2019

R4. Bipin Joshi, “Beginning SOLID Principles and Design Patterns for ASP.NET Developers”, Apress, 2016

Web References:

1. https://nptel.ac.in/courses/106105224
2. https://www.coursera.org/learn/design-patterns

Course Code: 24CAE034		Course Title: Bio-Inspired Computing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 2:0:2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course introduces nature-inspired optimization algorithms and their applications in solving real-world problems. It covers the implementation and mathematical foundations of algorithms and the students will develop practical skills in applying these techniques to multi-objective and constraint-handling problems.

Module I **15 Hours**

Nature-inspired computation and swarm intelligence - Introduction - Optimization and optimization algorithms - Mathematical formulations - Gradient-based algorithms - Gradient-free algorithms

Firefly algorithm and flower pollination algorithm - Introduction - The firefly algorithm: Algorithmic equations in FA - FA pseudocode - Scalings and parameters - FA - Flower pollination algorithm: FPA pseudocode and parameters.

Module II **15 Hours**

Ant Colony Optimization, Modifications, and Application - Introduction - Standard ant system: Brief of ant colony optimization - the artificial ant selection of the edge to travel - Pseudo-code of standard ACO algorithm. Modified variants of ant colony optimization: Elitist ant systems - Ant colony system - Max-min ant system

Artificial Bee Colony - Introduction - The Original ABC algorithm in brief - Modifications of the ABC algorithm: ABC with modified local search - Combinatorial version of ABC - Constraint handling ABC - Multi-objective.

List of Experiments: **30 Hours**

1. Implement the Firefly Algorithm to find the minimum value of a simple mathematical function (e.g., Sphere or Rastrigin function).
2. Implement the Flower Pollination Algorithm (FPA) to optimize a single-variable function such as $f(x) = x^2 + \sin(x)$.

3. Simulate the Ant Colony Optimization (ACO) algorithm for solving a basic Travelling Salesman Problem (TSP) with 5-10 cities.
4. Use the Artificial Bee Colony (ABC) algorithm to optimize a two-variable function like the Himmelblau function.
5. Modify any one of the bio-inspired algorithms (FA, FPA, ACO, or ABC) to handle constraints and apply it to solve a constrained optimization problem (e.g., a knapsack problem or inequality-based problem).

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply Apply gradient-based and gradient-free optimization algorithms to real-world problems.	Apply
CO2: Apply Firefly and Flower Pollination Algorithms to optimization problems.	Apply
CO3: Analyze the Ant Colony Optimization algorithm for problem-solving.	Apply
CO4: Examine the Artificial Bee Colony algorithm for optimization.	Analyze

Text Book(s):

T1. Xin-She Yang, “Nature-Inspired Computation and Swarm Intelligence Algorithms, Theory and Applications”, Elsevier, 2020.
T2. Adam Slowik, “Swarm Intelligence Algorithms Modifications and Applications”, Taylor & Francis Group, 2021.

Reference Book(s):

R1. Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016
R2. Xin-She Yang, "Nature Ispired Optimization Algorithm,Elsevier First Edition, 2014
R3. Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

Web References:

1. https://www.udemy.com/course/bio-inspired-artificial-intelligence-algorithms-for-optimization/

Course Code: 24CAE035		Course Title: Natural Language Processing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 2:0:2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The course introduces the fundamentals of linguistics, probability, and statistics for Natural Language Processing (NLP). It focuses on statistical methods, parsing techniques, and understanding the meaning of words and sentences. Students will explore advanced topics like discourse analysis, question answering, and chatbot development.

Module I **15 Hours**

Introduction - Natural Language Processing – Language and Linguistics - Ambiguity and Layers of NLP – Grammar, Probability, and Data - Generations of NLP.

Discrete Representational Semantics - n-Gram Vectors – Caveats – Limitations - Statistical Language Models - Use of Statistical Language Modelling

Dense Representations - Dense Representation of Words - Neural Language Models - Bidirectional Encoder Representations from Transformers (BERT).

Module II **15 Hours**

Machine Translation – Introduction - Ambiguity Resolution in Machine Translation - RBMT-EBMT-SMT-NMT - Rule-Based Machine Translation - Neural Machine Translation

Sentiment Analysis - Lexicons for Sentiment Analysis: Valence, Arousal, and Dominance - Wheel of Emotions - Manual Creation of Lexicons - Automatic Creation of Lexicons - Rule-Based Sentiment Analysis - Statistical Sentiment Analysis: Classification Algorithms - Naïve Bayes. Large Language Models **-** Generative LLMs: Pre-Training LLMs - Fine-Tuning LLMs - Refining LLMs for Conversations - Enhancement of LLMs Using External Tools.

30 Hours

List of Experiments:

1. Tokenize a text document into words and sentences; build unigram and bigram frequency distributions using NLTK.
2. Generate word and sentence embeddings using a pre-trained BERT model and compute similarity between sentences.
3. Create a simple rule-based machine translator for a small vocabulary using Python or an API.
4. Perform sentiment analysis on sample sentences using lexicon-based tools like TextBlob or VADER.
5. Fine-tune a pretrained language model on custom conversational data and test chatbot responses.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Apply NLP basics including linguistics, ambiguity, and statistical language models like n-grams.	Apply
CO 2: Apply dense word embeddings and neural models such as BERT for language understanding.	Apply
CO 3: Apply machine translation techniques including rule-based and neural methods.	Apply
CO 4: Apply lexicon-based and statistical sentiment analysis methods like Naïve Bayes.	Analyze
CO 5: Apply large language model techniques for building and improving conversational AI systems.	Analyze

Text Book(s)

T1. Pushpak Bhattacharyya and Aditya Joshi, “Natural Language Processing”, Wiley India Pvt. Ltd., 2023.

T2. Daniel Jurafsky and James H.Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition” (Prentice Hall Series in Artificial Intelligence), 2020.

Reference Book(s):

R1. Samuel Burns “Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.

R2. Mohamed Zakaria Kurdi “Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)”, ISTE Ltd., 2016

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs45
2. https://www.coursera.org/specializations/natural-language-processing
3. https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial

Course Code: 24CAE036		Course Title: Game Design using Python	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):: 2:0:2	Credits: 3	Total Contact Hours: 60	Max Marks: 100

Course Objectives

The course aims to introduce students to the fundamentals of game programming using Python. It covers essential game design concepts, programming techniques, and the development of interactive 2D games using Pygame, including graphics, animations, sounds, and advanced mechanics.

Module I **15 Hours**

Introduction to Python for Game Programming: Introduction to Python, Data types and variables, Conditional statements and loops, Functions and modules.

Game Design and Development: Game design principles, Game mechanics, Game objects and attributes, Collision detection and physics, User input and event handling, Creating game levels and environments, Building a complete game using Pygame. Pygame and 3D: Getting started with OpenGL – Adding the Pygame library – Basic collision detection game.

Module II **15 Hours**

Graphics and Animation: Introduction to graphics programming with Pygame, Creating and manipulating graphics, Animation and sprite sheets, Creating backgrounds and environments, Parallax scrolling, Building a game with advanced graphics. Sound and Music: Introduction to sound programming with Pygame, Playing sounds and music, Creating sound effects, Designing music and soundtracks, Building a game with sound and music.

Advanced Topics: Advanced game programming techniques, Network programming and multiplayer games, Artificial intelligence and game agents, Game engines and frameworks, Optimization and performance tuning.

List of Experiments **30 Hours**

1. Implementation of a basic 2D arcade-style game (Ball and Paddle or Maze Runner)
2. Implementation of advanced graphics techniques (animation, backgrounds, parallax scrolling)
3. Incorporating music, sound effects, and soundtrack into an interactive game
4. Creating a multiplayer or AI-integrated game with advanced mechanics
5. Final Project: Design and development of a complete 2D platformer game using Pygame

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Implement 2D games from scratch using Python and Pygame	Apply
CO2: Apply game design principles to create engaging games	Apply
CO3: Implement game mechanics, collision detection, and physics for realism.	Apply

Text book(s):

T1. Al Sweigart, “Invent Your Own Computer Games with Python”, No Starch Press, 4th Edition, 2016

T2. Alejandro Rodas de Paz, Joseph Howse, “Python Game Programming By Example”, Packt Publishing, 2nd Edition,2021

Reference Book(s):

R1. Eric Matthes, “Python Crash Course: A Hands-On, Project-Based Introduction to Programming”, No Starch Press, 2015

R2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, 1st Edition, 2007

Web References:

1. https://inventwithpython.com/
2. https://www.pygame.org/docs/

Skill Enhancement Courses

Skill Enhancement Courses

Course Code: 24CAC001	Course Title: Mobile Programming with Swift		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week) :: 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on understanding in Swift Programming by covering fundamental concepts such as the basic building blocks, working with operators and strings for effective data manipulation and exception handling mechanisms.

Module I **22 Hours**

Basic Building Blocks - Declaring Constants and Variables – Comments – Data Types - Type Safety and Type Inference - Numeric Literals - Numeric Type Conversion - Type Aliases – Booleans –Tuples – Optional – Optional Binding.

Working with Operators and Strings - Assertions and Preconditions - Working with Operators -Strings and Characters - Manipulations on Strings. Collections and Control Flow Mutability of Collections – Arrays - Sets and its Operations - Dictionaries-Control Flow Statements - Conditional Statements.

Module II **23 Hours**

Functions Working with Functions - Closures-Enumerations - Associated Values - Raw Values -Structures and Classes - Instance Methods. Inheritance and Error Handling Inheritance - De initialization - Error Handling with Exceptions – Protocols - Delegations - Automatic Reference Counting.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply fundamental programming constructs such as constants, variables, data types, optionals, and tuples to develop basic Swift programs with type safety and inference.	Apply
CO2: Develop Swift programs that incorporate advanced control flow mechanisms, including optional binding and conditionals.	Apply
CO3: Apply functions, closures, enumerations, and structures to develop modular and reusable Swift programs with appropriate use of instance methods and associated values.	Apply
CO4: Analyze the effectiveness of Automatic Reference Counting (ARC) in managing memory and preventing memory leaks in Swift programs.	Analyze

Text Book(s):

T1. Lee, Wei-Meng. Beginning Swift Programming. 1st ed., Wrox (Wiley), 2014.

Reference Book(s):

R1. Apple Inc. The Swift Programming Language. Swift 5.2 ed., Swift Programming Series, 2014.

R2. Kaczmarek, Stefan, Brad Lees, and Gary Bennett. Swift 5 for Absolute Beginners: Learn to Develop Apps for iOS. 5th ed., Apress, 2019.

Web References:

1. https://www.udemy.com/course/make-me-an-iphone-app-developer-beginner-series/
2. https://developer.apple.com/swift/

Course Code: 24CAC002	Course Title: Mobile Application Development with React Native		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week) :: 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on Java application using Spring Initializer from scratch and to use Spring Data as an application backend. To Build complex UIs in an example application context and to implement client-server networking features, the application seamlessly facilitated communication.

Module I **23 Hours**

Creating React Environment - Installing Dependencies for the Development - Creating First App - Running App in the Simulator - Running App on Both Android and iOS Device- Simple React Native App Creation - Adding Styles to the Elements - Toggle Buttons - List Items - Flexbox to create a Layout - Navigation setup.

User Interface Implementation: Developing Reusable button - Creating Design for the Tablet and iPad -Including Custom Fonts and Icons - Orientation Change Detection - Webview to embed external websites - Creating a Form Component.

Data and Application Logic - Storing Data in Local - Retrieving and Sending Data from API - WebSockets for the communication - Persistent Database Functionality - Network Connection Lost Masking.

Module II **22 Hours**

Redux, Appwork Flow and Others - Redux Overview - Working with Redux - Choosing App Workflow - NativeBase for the Cross Platform UI - Styling UI component.

Bringing Native Functionality - Rendering Custom iOS Component - Rendering Custom Android Component - Application State Change Reaction - Push Notification Setup - Playing Audio File in IOS and Android.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply React Native environment setup and development tools to create and style basic mobile applications with navigation and responsive layouts.	Apply
CO2: Apply data handling and UI techniques to implement reusable components, manage local and remote data, and ensure smooth user interaction across devices and network conditions.	Apply
CO3: Apply Redux for state management and workflow selection in React Native applications, and utilize NativeBase to style cross-platform UI components effectively.	Apply

CO4: Apply native platform capabilities to enhance React Native apps by integrating custom components, handling application state changes, and implementing multimedia and push notifications.	Apply

Text Book(s):

T1. Paul, Akshat, and Abhishek Nalwaya. React Native for Mobile Development. 2nd ed., Apress, 2019.

T2. Brown, Bonnie Eisenman. Learning React Native: Building Native Mobile Apps with JavaScript. 2nd ed., O'Reilly Media, 2017.

Reference Book(s):

R1. Boduch, Adam, and Roy Derks. React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js. 3rd ed., Packt Publishing, 2020.

R2. Dabit, Nader. React Native in Action. Manning Publications, 2019.

Web References:

1. https://in.coursera.org/learn/react-native-course
2. https://reactnative.dev/docs/tutorial
3. https://www.simplilearn.com/react-native-tutorial-article

Course Code: 24CAC003	Course Title: Flutter		
Course Category: Skill Enhancement Course		Course Level: Mastery	
L:T:P(Hours/Week):: 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge to equip developers with the skills necessary to deliver high-performance mobile applications using Flutter and gain a foundational understanding of Flutter and its components, including the basic setup required for Flutter development.

Module I **23 Hours**

Introduction to Flutter and Dart Programming Language - Introduction - Importance of Flutter - Introduction to Dart - Writing Dart code – DartPad - Installing Dart SDK - IntelliJ IDEA - Installing Dart IDE and Writing Dart Program - Installing IntelliJ IDEA - Creating a Dart Project Using IntelliJ IDEA - Using DartPad**.**

Dart Functions & Object-Oriented Programming (OOP) - Introduction - main( ) function - Dart Variables - Dart Data Types - Input of Information to Dart Program - Writing Comments - Dart Conditional Operators – If – Statement - If – Else Statement - If…Else and Else…If... Statement - If Else and Logical Operators For - Loops - While Loops - Do-while Loops - Break Statement - Switch Case Statement .

Introduction to Flutter - Understanding Flutter - Flutter Framework - Android Studio - Installing Android Studio - Flutter SDK - Installing and Configuring - Flutter SDK - Creating a New Flutter Project - Setup an Android Virtual Device.

Module II **22 Hours**

Run a Flutter App - Installing Flutter on Mac - Test Flutter App on iOS Phone with Windows OS - Android Studio Sugar and Spice - FlutterTM Application Development AFD - Emulator Debug Mode - Introduction to Flutter Widget - Creating a Flutter App Using Widgets.

Flutter Widgets Fundamentals - Scaffold Widget - Image Widget - Container Widget - Column and Row Widgets - Icon Widget - Layouts in Flutter - Card Widget - App Icons for iOS and Android Apps - Hot Reload and Hot Restart - Stateful and Stateless Widgets - Use a Custom Font.

Navigation and Routing - Button Widget - App Structure and Navigation - Navigate to a New Screen and Back - Navigate with Named Routes - Send and Return Data Among Screens - Animate a Widget Across Screens - WebView Widget in Flutter .

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply DartPad to write and execute Dart code snippets for practical programming experience.	Apply
CO2: Develop a Flutter project using Flutter SDK and Android Studio to create cross-platform applications.	Apply
CO3: Implement mechanisms to send and receive data between screens in a Flutter app using navigation and routing techniques.	Apply
CO4: Apply concepts of stateful and stateless widgets, custom fonts, and platform-specific configurations to develop responsive Flutter applications using hot reload and hot restart.	Apply

Text Book(s):

T1. Macro L Napoli, Begging Flutter A Hands on guide to App development, 1st Edition Wrox,2019.

T2. Rap Payne, Beginning App Development with Flutter, Apress, 2019

Reference Book(s):

R1. Thomas Bailey & Alessandro Biessek, Flutter for Beginners Packt Publishing Limited,2nd edition 2021.

Web References:

1. https://www.udemy.com/course/flutter-and-dart-complete-flutter-dart-programming-course/
2. https://www.classcentral.com/course/youtube-dart-programming-language-for-flutter-complete-course-59611

Course Code: 24CAC004	Course Title: Spring Boot		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week):: 0:0:2	Credits: 1	Total Contact Hours:	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on building a Java application using Spring Initializer from scratch and to use Spring Data as an application backend. To build complex UIs in an example application context, to incorporate client-server networking functionality and features. Gain proficiency in Spring Boot dependency injection

Module I **22 Hours**

Overview of Spring Boot - Overview of spring Framework – Spring Framework architecture – IOC container & Dependency injection – Spring Bean Scopes - Spring Boot application creation – configuration – Internals of Boot Start class.

Spring Boot Annotations - Spring Boot Annotations - Spring Boot Runners – Spring data JPA introduction – CrudRepository & JPA Repository – findBy methods in JPA – custom queries in JPA – Spring Boot profiles.

Spring Web MVC - Spring Web MVC – Forms Development – Thymeleaf - Web Application development using Spring Boot .

Module II **23 Hours**

Spring Rest Introduction - Spring Rest Introduction – XML & JSON – HTTP protocol internals – Rest API Development – REST API Media Types – POSTMAN & Swagger.

Rest Client Introduction - Rest Client Introduction – Exception handling - Spring Boot Actuators - Spring Cloud Concepts – Spring Security.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply Spring Framework concepts such as IoC container, dependency injection, and bean scopes to create and configure Spring Boot applications with proper annotations and startup logic.	Apply
CO2: Apply Spring Boot MVC, Thymeleaf templating, and Spring Data JPA to develop dynamic web applications with form handling and database interaction using repositories and custom queries.	Apply
CO3: Apply Spring REST principles and tools like POSTMAN and Swagger to develop and test RESTful APIs using XML/JSON media types and HTTP	Apply

protocols.	
CO4: Apply Spring Boot features such as exception handling, actuators, Spring Security, and Spring Cloud concepts to build secure, monitorable, and scalable RESTful web services.	Apply

Text Book(s):

T1. Heckler, Mark. Spring Boot: Up and Running. O'Reilly Media, Mar. 2021.

T2. Antonov, Alex. Spring Boot 2.0 Cookbook. 2nd ed., Packt Publishing, 2018.

Reference Book(s):

R1. Varanasi, Balaji, and Maxim Bartkov. Spring REST: Building Java Microservices and Cloud Applications. 2nd ed., Apress, 28 Nov. 2021.

Web References:

1. https://www.udemy.com/course/spring-and-spring-boot-annotations/

2.https://www.cloudnativemaster.com/post/build-rest-client-using-resttemplate-in-spring-boot

Course Code: 24CAC005	Course Title: MEAN Stack		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week)::0:0:2	Credits: 1	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to impart knowledge on Implement asynchronous programming using callbacks and Implement dynamic binding, modules, controllers, and scope in AngularJS and also Create and consume RESTful services using Express.js, finally Explore JSON and dynamic schema in MongoDB.

Module I **23 Hours**

Node JS - Getting started with Node.js - Node Package Manager – Modules - Asynchronous Programming – Callbacks -Events and Event Loop - Streams and Buffers - Connecting Node.js to Database - Web Sockets.

Angular JS - Angular Architecture - Dynamic Binding - Modules, Controllers, and Scope – Views Custom Directives. Event Directives – Expressions - Built-in and Custom Filters - Understanding the Digest Loop - Form Validations.

AngularJS Service Types – Factories - Creating Custom Services - Routing, Redirects, and Promises.

Module II **22 Hours**

Express JS - MVC Pattern - Introduction to Express – Routing - HTTP Interaction - Handling Form Data - Handling Query Parameters-Cookies and Sessions - User Authentication - Error Handling - Creating and Consuming RESTful Services - Using Templates.

MongoDB - Concepts – Scaling - SQL and Complex Transactions - Documents Overview - Installing MongoDB (windows) - Installing MongoDB (Linux) - JSON- Dynamic Schema - Cursors Introduction.

Query Language - Basic Concepts - Query Language: Projection - Query Language: Advantages of a Dynamic Schema Shell: Queries – Sorting - Query Language: Cursors - User Authentication - Error Handling.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply Node.js concepts such as asynchronous programming, event loops, streams, and buffers to build efficient backend services and connect them to databases using WebSockets and Node Package Manager (NPM).	Apply
CO2: Apply AngularJS architecture to develop dynamic web applications with custom directives, filters, form validations, and routing, while utilizing	Apply

services, factories, and promises for better data handling and interaction.	
CO3: Apply the MVC pattern and Express.js features such as routing, form handling, sessions, authentication, and RESTful service creation to develop structured web applications using templates.	Apply
CO4: Apply MongoDB concepts including dynamic schemas, queries, cursors, and user authentication to implement scalable and flexible data storage solutions in modern web applications.	Apply

Text Book(s):

T1. Jonathan Wexler,"Get programming with Node.js", First edition, Manning Pubns Co, 2019

T2. Shelley Powers**, "**Learning Node: Moving to the Server-Side", second Edition, Shroff/O'Reilly**,** 2016

Reference Book(s):

R1. Ethan Brown**, "**Web Development with Node & Express: Leveraging the JavaScript Stack", second edition, O'Reilly Media, 2019

Web References:

1. https://www.udemy.com/topic/nodejs/
2. https://www.udemy.com/course/nodejs-express-mongodb-bootcamp
3. https://www.edx.org/learn/angular

Course Code: 24CAC006		Course Title: MERN Stack	
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week)::0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks:100

Course Objectives

The course is intended to impart knowledge on Implement Redux in React for state management and Design schemas in Node.js for RESTful APIs and also Implement input validations in Node.js and finally Insert data into MongoDB and perform filter queries**.**

Module I **22 Hours**

Understand ReactJS Library & directory - Build a simple React component - Hooks - States - Hooks vs States - Types of Hooks - Redux - React Bootstrap - How to deploy ReactJS App.

Introduction to NodeJS - Architecture of NodeJS Application - Synchronous and Asynchronous Programming - MongoDB with NodeJS - Design the Schema in NodeJS and Rest API's - GET, POST, PUT, DELETE - JSON web Token Authentication in NodeJS - Create the Auth APP in NodeJS - Create the E-commerce Backend - Integrated Payment Gateway.

Express - Restful services - Introducing Express - Building your First Web Server - Nodemon - Environment Variables Route Parameters - Handling HTTP GET Request - Handling HTTP POST Request.

Module II **23 Hours**

Calling Endpoints Using Postman - Input Validations - Handling HTTP PUT Request - Handling HTTP DELETE Request - Project- Build the Genres API.

Middleware - Creating a Custom Middleware - Built-in Middleware - Environment - Configuration -Debugging - Templating Engine - Database Engines - Database Integration - Authentication - Structuring Express Applications.

MongoDB - Introduction to MongoDB (NoSQL) - Collections in MongoDB - Documents In MongoDB - Difference between MySQL and NoSQL - Inserting data into database - Filter queries in MongoDB database - Schema Validation in MongoDB database - Indexing In collections - Aggregation in MongoDB - Embedded Document in MongoDB.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply React Bootstrap to enhance the styling and responsiveness of React applications.	Apply
CO2: Apply backend development techniques using NodeJS, Express, and MongoDB to design RESTful APIs, implement authentication using JWT, and	Apply

build full-stack applications with integrated payment gateway functionality.	
CO3: Apply API development techniques using Express.js and Postman to build, test, and validate RESTful endpoints with input validation, middleware, and structured routing.	Apply
CO4: Apply MongoDB NoSQL database operations such as schema validation, indexing, aggregation, and embedded documents to design and integrate efficient data models into full-stack applications.	Apply

Text Book(s):

T1. Shannon Bradshaw, Eoin Brazil, MongoDB: The Definitive Guide - Powerful and Scalable Data Storage , Third Edition, Shroff/O'Reilly, 2020.

T2. Minnick, Chris. Beginning ReactJS Foundations: Building User Interfaces with ReactJS: An Approachable Guide. 1st ed., Wiley (John Wiley & Sons, Inc.), Mar. 2022.

Reference Book(s):

R1. Greg Lim, “Beginning MERN Stack Development”, Kindle Edition 2021.

Web References:

1.https://www.udemy.com/course/hands-on-application-development-with-react-and-bootstrap/

2. https://www.coursera.org/courses?query=mongodb

Course Code: 24CAC007	Course Title: UX Design		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week)::0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks:100

Course Objectives

The course is intended to impart knowledge on Explore the basics of User Experience (UX) design, including its foundations and principles and Compose the elements of interface design for effective user experiences and then Introduce navigation design and its importance in UI/UX.

Module I **22 Hours**

Introduction to UI: What is User Interface Design (UI) -The Relationship Between UI and UX -Roles in UI/UX - A Brief Historical Overview of Interface Design - Interface Conventions- Approaches to Screen Based UI.

Introduction to UX: UX Basics- Foundation of UX design-Good and poor design-Understanding Your Users - Designing the Experience Elements of user Experience-Visual Design Principles-Functional Layout.

Elements & Components: Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design UI Design Process, Visual Communication design component in Interface Design.

Module II **23 Hours**

Interface & Testing: Interaction design-Introduction to the Interface-Navigation Design-User Testing-Developing and Releasing Your Design.

Design Tools: User Context-Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wireframing Tools-Creating the working Prototype using Prototyping tools- Sharing and Exporting Design.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply foundational principles of UI and UX design to differentiate good and poor design, understand user behavior, and create functional layouts based on visual design principles.	Apply
CO2: Apply interface design processes by utilizing formal and active UI elements, composing visual components, and implementing effective screen-based communication in user-centric applications.	Analyze
CO3: Examine the effectiveness of the interface in meeting user needs and goals.	Analyze
CO4: Analyze the efficiency of using prototyping tools to create working prototypes in the design process.	Analyze

Text Book(s):

T1. Westley Knight, "UX for Developers: How to Integrate User-centered Design Principles into Your Day-to-day Development Work", Apress; 1st edition, 2018

T2. Amolendu H, "The Golden Ratio In UX Design : And Other Articles On User Experience" , First edition, Notion Press, 2020

Reference Book(s):

R1. Jon Yablonski, "Laws of UX: Using Psychology to Design Better Products & Services", First edition, Shroff/O'Reilly , 2020

R2. Jeff Gothelf, "Lean UX:Applying Lean principles to improve user experience", First edition, Shroff/O'Reilly, 2016

Web References:

1. https://www.mygreatlearning.com/academy/learn-for-free/courses/ui-ux

2. https://www.udemy.com/course/ui-ux-designs/

Course Code: 24CAC008	Course Title: Scalable Application Development for Cloud		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week)::0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on Explore virtualization using Amazon Elastic Compute Cloud (EC2) and Explore load balancing and auto-scaling in the cloud and then Introduce containerization with Docker and finally, Explore Azure database and networking services.

Module I **22 Hours**

Basics of Scripting and Networking and Architecting Cloud Solutions - Introduction to Python and Control Flow Statements - Functions-Modules and OOPs Concepts in Python – OOPs - File Handling and Exception Handling - Linux Fundamentals - Bash Fundamentals - Basics of Networking.

Introduction to Cloud Computing - Introduction to AWS - Virtualization using EC2 - Cloud Storage - Networking on Cloud - Cloud Databases - Application Services and Server less Computing - Machine Learning Essentials in Cloud - IoT Essentials in Cloud.

Managing Cloud Solutions and DevOps - Load Balancing and Auto Scaling - Security Management and IT Governance - Monitoring Cloud Solutions - Analytics and Cost Metrics - High Availability -Fault Tolerance and Disaster Recovery - Popular Cloud Architectures - Well Architected Framework.

Module II **23 Hours**

DevOps and Containers - Introduction to DevOps, Continuous Deployment: Containerization with Docker - Orchestration (Kubernetes And Terraform). Introduction to DevOps in Cloud - Automating Infrastructure on Cloud - Application Deployment and Orchestration using ECS, ECR & EKS, Application Deployment using Beanstalk - Configuration Management using OpsWorks.

Migrating to Cloud - Cloud Migration Strategies - Application Migration to Cloud - Database Migration to Cloud - Data Migration to Cloud - Migrating Monolithic Applications.

Azure & GCP Essentials - Azure Compute and Storage - Azure Database and Networking - Monitoring and Managing Azure Solutions - GCP Compute and Storage - GCP Networking and Security - Google App Engine (PaaS).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply Python programming concepts, including OOPs, file handling, and exception handling, along with Linux and networking fundamentals, to automate tasks and build foundational scripts for cloud-based environments.	Apply
CO2: Apply core cloud computing principles using AWS services such as EC2, S3, and serverless computing, and implement cloud architecture solutions with load balancing, auto-scaling, and disaster recovery strategies.	Apply
CO3: Apply DevOps practices to automate infrastructure and application deployment on cloud platforms like AWS, ECS, and Beanstalk.	Apply
CO4: Apply cloud migration strategies for moving applications, databases, and data to cloud environments, leveraging Azure and GCP services for compute, storage, and networking while ensuring effective management and security of cloud solutions.	Apply

Text Book(s):

T1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing", First edition, McGraw Hill Education, 2017

T2. Steve Swoyer, " Migrating Applications to the Cloud Securing the Value of Digital Transformation for Your Business", O'Reilly, 2021

Reference Book(s):

R1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi , "Mastering cloud Computing: Foundations and Applications Programming", Morgan Kaufmann Publishers, 2013

Web References:

1. https://www.udemy.com/topic/cloud-architecture/
2. https://www.coursera.org/learn/aws-fundamentals-migrating-to-the-cloud

Course Code: 24CAC009	Course Title: IoT Basic Concepts		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week)::0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge to create simple web pages using a concept called object-oriented programming and to configure the Arduino IDE to communicate with the Arduino hardware. Also to use the Arduino IDE to load, compile, download and execute (provided samples and user-written) programs.

Module I **23 Hours**

Introduction - Programming in C - Introduction — Program Structure in C - Basic Syntax - Data Types - Variables - Constants Operators - Conditional Statements and Loops - Functions - Array and Pointers - Strings and I/O.

Programming Fundamentals with C using Arduino IDE - Understanding the Arduino IDE – Installing and Setting up the Arduino IDE - Connecting the Arduino IDE with devices - Using Arduino C Library functions for Serial - Delay and other invoking functions.

Module II **22 Hours**

Working with Arduino for data acquisition with IOT Devices - Understanding Sensors and Devices - Understanding basic electronic components.

Raspberry pi Interfaces – Level 1 - IR Sensor and Buzzer Interfacing - Ultrasonic Sensor Interfacing - Relay Interfacing.

Raspberry pi Interfaces – Level 2 - Create Database using WAMP – Web Interface – Interfacing with cloud database.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply comprehensive programming concepts in C and Arduino, integrating various elements such as data types, loops, functions, and libraries.	Apply
CO 2: Apply knowledge of the Arduino IDE, effectively installing and setting it up for programming.	Apply
CO 3: Apply knowledge of sensors and basic electronic components to design and implement IoT solutions for data acquisition.	Apply
CO 4: Analyze the integration of various electronic components, ensuring effective communication and collaboration within the IoT ecosystem.	Analyze

Text Book(s):

T1. Bahga, Vijay Masdisetti.Internet of thing A Handson-On Approach, Univetsity Press, 2015.

T2. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, John Wiley & Sons Ltd 2014.

Web References:

1. https://www.udemy.com/course/learn-cc-with-arduino-ide/
2. https://www.coursera.org/learn/raspberry-pi-interface

Course Code: 24CAC010	Course Title: Web Application Development Using Angular		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week):: 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on developing modern, complex, responsive and scalable web applications through Angular. It creates full understanding of the architecture behind an Angular application and its usage and gives deep understanding of the Angular fundamentals to quickly establish themselves as front end developers. Also, gives knowledge to create single-page applications with one of the most modern JavaScript frameworks.

Module I **23 Hours**

Introduction to Angular - Introduction - New Frameworks - Angular – Typescript - Angular Basic Concepts – Directives -Components - Databinding.

Navigation and Remote Access – Routing - Services - Dependency Injection - Http - Pipes**.**

Module II **22 Hours**

Module Development – Forms – Authentication - Token Based - Social Login.

Testing and Deployment - Unit Testing - Project Review

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply Angular basics such as directives, components, and data binding in the development of web applications.	Apply
CO 2: Apply the routing principles to remote access mechanisms.	Apply
CO 3: Design a forms for data input, implementing authentication mechanisms for secure access.	Apply
CO 4: Analyze the thoroughness of unit testing in identifying and addressing potential issues.	Analyze

Text Book(s):

T1. Erik Hellman ,Android Programming: Pushing the Limits, Wiley Publication, 2013

Reference Book(s):

R1. Uluca, Doguhan. Angular for Enterprise-Ready Web Applications. 2nd ed., Packt Publishing, May 2020.

R2. Asim Hussain, Angular: From theory to practice, Kindle edition, 2017

Web References:

1. https://www.toptal.com/angular/angular-5-tutorial
2. https://dzone.com/articles/building-angular5-application-step-by-step

Course Code: 24CAC011	Course Title: Advanced in IoT		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week):: 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge about on the historical evolution of IoT and its impact on various industries and Implement an open-source IoT platform on a local machine and also Gain practical experience working with General Purpose Inputs/Outputs (GPIOs) and Analog I/Os and then finally Examine the building blocks of IoT cloud infrastructure.

Module I **23 Hours**

Introduction – IoT Platform – Introduction — History and evolution of IoT - IoT Architecture - Trends in the Adoption of IoT - IoT Is Powerful and Pervasive - Societal Benefits of IoT - Risks, Privacy, and Security.

Setup IoT Platform - Opensource IoT Platform on local machine – Amazon IoT - Implementation on two platforms.

Micro-controller programming using Arduino platform - Overview of Embedded Systems - Components of Embedded Systems - Micro-controller Architecture and Properties - Blinky Sketch.

Module II **22 Hours**

Hands-on working with GPIOs, Analog I/Os, Memory usage - Micro controller peripherals usage - Communication protocols Wired and Wireless communication.

Programming with Python - Overview of Programming with Python - Native Datatypes and Operators - Relay Interfacing - Statements and Conditionals - Programming with Python - Errors and Exception Handling - File handing - Modules and Packages.

IoT Cloud Infrastructure - IoT cloud building blocks – Using the platform specific dashboards –Device configuration and addressing - Data monitoring, visualization and IoT Analytics - Rest API interface.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply IoT architectures to design and configure simple IoT systems using open-source and cloud-based platforms.	Apply
CO2: Apply microcontroller programming techniques to create and troubleshoot simple embedded IoT applications,	Apply
CO3: Apply the concepts of microcontroller peripherals, including GPIOs, Analog I/Os, to design and implement wired and wireless communication.	Analyze
CO4: Analyze IoT data through cloud-based analytics tools to derive insights and understand trends, supporting decision-making in IoT solutions.	Analyze

Text Book(s):

T1. Bahga, Vijay Masdisetti.Internet of thing A Handson-On Approach, Univetsity Press, 2015

Reference Book(s):

R1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, John Wiley & Sons Ltd 2013

Web References:

1. https://www.coursera.org/courses?query=microcontroller
2. https://www.edx.org/learn/iot-internet-of-things

Course Code: 24CAC012	Course Title: DevOps Technologies		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week): : 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on Analyze the principles and significance of DevOps in modern software development and Demonstrate proficiency in setting up and managing Git repositories for collaborative development and Integrate static analysis tools like SonarQube into the Jenkins pipeline and finally Create and run Ansible playbooks for configuring infrastructure.

Module I **22 Hours**

Introduction - DevOps - Cloud Computing (AWS/OpenStack/VMware) – Version Control Introduction – Continuous Integration – Continuous Deployment.

GIT - Introduction to GIT – Advantage of using GIT – Install GIT – Setting up Permissions – Branching Strategy – Clone Repository – Import existing code into newly created repository - Pull Request – Push Request – Merging.

Module II **23 Hours**

Continuous Integration - CI tools – Introduction to Jenkins – Jenkins Installation - Static Analysis tools (SonarQube) - Generating Build.

Continuous Deployment - CD tools – Introduction to Ansible – Install Ansible – Ansible playbook and inventory file – How to run playbook - Functional testing – Performance testing.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply DevOps principles in conjunction with cloud computing platforms such as AWS, OpenStack, or VMware..	Apply
CO2: Apply GIT commands to clone repositories, importing existing code into newly created repositories.	Apply
CO3: Analyze various CI tools, evaluating their features and suitability for different development environments.	Analyze
CO4: Analyze the role of Ansible in deployment automation, evaluating its effectiveness in various scenarios.	Analyze

Reference Book(s):

R1. Davis, J., & Daniels, R. Effective DevOps: Building a culture of collaboration, affinity, and tooling at scale. O'Reilly Media, 2016.
R2. Micro Hering, DevOps for the Modern Enterprise, IT Revolution Press, 2018

Web References:

1. https://www.coursera.org/learn/intro-to-devops
2. https://www.udemy.com/course/valaxy-git/

Course Code: 24CAC013	Course Title: Power BI		
Course Category: Skill Enhancement Courses		Course Level: Mastery	
L:T:P(Hours/Week): : 0:0:2	Credits: 1	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

Power BI is a Microsoft business analytics tool for visualizing data and sharing insights. It connects to various data sources, transforms raw data, and builds interactive reports.

Module I **23 Hours**

Introduction to Power BI - Overview of Business Intelligence (BI)-Introduction to Power BI and its components-Installing and setting up Power BI Desktop.

Data Preparation and Transformation - Connecting to various data sources (e.g. Databases, Excel, Web services)- Data loading and transformation using Power Query Editor-Data cleansing and shaping techniques.

Data Modeling - Understanding data models in Power BI - Creating relationships between tables - DAX (Data Analysis Expressions) basics for calculations.

Module II **22 Hours**

Data Visualization - Building basic visualizations – Charts – Tables – Matrices - Customizing and formatting visuals - Creating interactive reports and dashboards.

Power BI Service and Data Sharing - Publishing reports to Power BI Service -Sharing and Collaboration options - Power BI Mobile app usage.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain the fundamentals of Business Intelligence and the components of Power BI.	Apply
CO2: Connect to various data sources and perform data transformation using Power Query Editor.	Apply
CO3: Create data models, establish relationships between tables, and use DAX for basic calculations.	Apply
CO 4: Design interactive reports and dashboards using various Power BI visualizations and formatting tools.	Apply
CO 5: Publish reports to Power BI Service and implement sharing, collaboration, and mobile accessibility features.	Analyze

Text Book(s):

T1. Powell, Brett. Mastering Microsoft Power BI: Expert Techniques for Effective Data Analytics and Business Intelligence. Packt Publishing, 2018.

T2. Russo, Marco, and Alberto Ferrari. Introducing Microsoft Power BI. 1st ed., Microsoft Press, 2016.

Reference Book(s):

R1. Ferrari, Alberto, and Marco Russo. The Definitive Guide to DAX: Business Intelligence for Microsoft Power BI, SQL Server Analysis Services, and Excel. 2nd ed., Microsoft Press, 2019.

R2. Getz, Ken, and Michael Alexander. Power BI Desktop and the Power BI Service: Business Intelligence with Power Pivot and Power Query. 1st ed., Packt Publishing, 2021.

Web References:

1. https://www.linkedin.com/learning/power-bi-essential-training-2024?upsellOrderOrigin=default_guest_learning&trk=default_guest_learning
2. https://www.edx.org/certificates/professional-certificate/davidsonx-from-database-to-dashboard-using-sql-and-power-bi?index=product&queryId=542e66fd52ce30c191d1a63c563494c0&position=2
3. https://learn.microsoft.com/en-us/power-bi/

Ability Enhancement Courses

Ability Enhancement Courses
Semester I

Course Code: 24CAC101	Course Title: Ability Enhancement Courses I:Problem solving skills & Logical Thinking		
Course Category: AEC	**Course Level: Introductory**		
L:T:P(Hours/Week)::0: 0: 3	**Credits: 1.5**	**Total Contact Hours:30**	**Max Marks:100**

Course Objectives:

To enhance the students' numerical, analytical and logical reasoning ability.

To make them prepare for various public and private sector exams and placement drives

Module I **15 Hours**

Quantitative Ability: Shortcuts- Number System - Percentage - Ratio and Proportion - Average- Ages –Partnership- Profit and loss- Interest calculation - Time and work– Time, Speed and Distance - Permutation and Combination – Probability - Data Sufficiency - Data

Module II **15 Hours**

Reasoning Ability: Number & Alpha series- Odd man out-Coding and Decoding- Syllogisms-Problems on Cubes and Dices-Visual Reasoning- Direction Problems- Arrangement Problems-Element & logical series- Analogies- Statement and conclusion – Statement and Assumption - Causes and effects.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Enhance their problem solving skills & Logical thinking Skills	**Apply**
CO2: Build the competence in numerical, analytical and logical reasoning ability.	**Apply**

Textbook(s):

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

T2: Dr. R. S. Aggarwal. A Modern Approach to Logical Reasoning. 2nd ed., Sultan Chand & Sons (S. Chand & Co.), 2007.

Reference Book(s):

R1: R. V. Praveen. “Quantitative Aptitude and Reasoning” 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013

R2: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition, 2020

R3: Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021.

Web References:

1 https://www.indiabix.com/aptitude/questions-and-answers/

2 https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Semester II

Course Code: 24CAC201	Course Title: Ability Enhancement Courses II: Communication Skills and Interview Essentials		
Course Category: AEC		Course Level: Introductory	
L:T:P(Hours/Week)::0:0:3	Credits:1.5	Total Contact Hours:30	Max Marks:100

Course Objectives:

It is designed to equip students with the necessary skills to effectively communicate in various professional settings and excel in the interview process.

Module I **15 Hours**

Resume Building & Portfolio Management: Importance of a Strong Resume - Resume Content Development & Core Components – Formatting and Design - Tailoring and Customization – Proofreading - Portfolio Content, design and Structure : Components & Efficient portfolios – Preparing and Maintaining documents for interview – maintaining repositories - Enhancing Personal Brand - Digital Tools and Platforms

Interview - Dress code, Body Language and Grooming: Dress Code Essentials - Body Language – Facial expression, eye contact, gesture, posture, touch behavior & space- Personal Grooming.

Effective Communication: Communication in Diverse Contexts - Presentations – Individual and group presentations - Public Speaking - Visual Aids and Presentation Tools

Module II **15 Hours**

Group Discussion: Introduction & types of Group Discussion – Prerequisites of GD – Techniques and tips of GD - Role of GDs in various professional contexts – GD Etiquettes – Strategies to enhance GD – Mock GD.

Interview Skills: Purpose of an interview - Types of Interviews –Interview Techniques – Interview Etiquette – Planning and Preparation - Mock Interviews with Feedback - Post-Interview Etiquette and Follow-Up

Activities: Building Portfolio: Resume Building, Updating LinkedIn, Maintaining Repositories.

Effective Presentation: Oral Presentation: JAM, Impromptu speech, Picture Perception (Both Speaking and Writing)

Visual presentation: Email Writing, Power Point Presentation, Vlog

Group Discussion: General, Technical

Mock Interview: General, Technical

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Communicate effectively and exhibit required competency in various professional environments and demonstrate proficiency in interview process.	**Apply**
CO2: Demonstrate professional etiquette, portfolio development, and real-world readiness.	**Apply**

Textbook(s):

T1. Ashraf Rizvi, "Effective Technical Communication" 2nd Edition, McGraw-Hill India, 2017.

T2. Pease, Allan, and Barbara Pease. "The Definitive Book of Body Language." Bantam, 2006.

Reference Book(s):

R1. Cheryl Hamilton, “Communicating for Results: A Guide for Business and the Professions”, 11th edition, Wadsworth Publishing Co Inc, 2017.

R2. Whitcomb, Susan Britton. Resume Magic: Trade Secrets of a Professional Resume Writer. JIST Works, 1998.

R3. Carnegie, D. The Quick and Easy Way to Effective Speaking. Pocket Books,2009.

Web References:

1 https://www.linkedin.com/pulse/interview-etiquette-dos-donts-interviews-brian-vander-waal-fmy8e/

2 https://www.simplilearn.com/group-discussion-tips-article

Bridge Course

Bridge Course
Semester I

Course Code: 24CAC102		Course Title: Computer Organization	
Course Category: Bridge Course		Course Level: Introductory	
L:T:P(Hours/Week):: 5: 0: 0	Credits: 0	Total Contact Hours: 15	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge about various codes, digital components, and number systems. Understanding the fundamentals of computer programming and instructions as well as the layout of the memory and CPU organizations.

Module I **7 Hours**

Data Representation And Digital Components: Number Systems - Binary Codes – Error Detection Codes - Logic Gates – Boolean Algebra - ICs – Encoders – Decoders – Registers.

Computer Organization: Instruction Codes - Basic Computer Instructions - Register Reference Instructions – Memory Reference Instructions – Input/Output Instructions – Machine Language – Assembly Language - Peripheral Devices.

Module II **8 Hours**

Memory Organization And CPU: Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory CPU: General Register Organization – Control Word – Stack Organization – Instruction Format – Addressing Modes.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply foundational computer programming principles and instructions to execute computer operations.	Apply
CO2: Apply memory management techniques, including virtual memory, to optimize memory resource allocation and enhance overall system performance.	Apply

Text Book(s):

T1 M. Morris Mano,"Computer System Architecture", Prentice Hall of India, 4th edition, 2014.

T2 Nicholas Carter,"Computer Architecture", Tata Mcgraw Hill Publishing Company Limited Newdel, 2013.

Reference Book(s):

R1. M. Morris Mano, "Digital Logic & Computer Design", Prentice Hall of India, 2012.

Web References:

1. https://nptel.ac.in/courses/106105163

Course Code: 24CAC103		Course Title: Operating Systems	
Course Category: Bridge Course		Course Level: Introductory	
L:T:P(Hours/Week):: 5:0:0	Credits: 0	Total Contact Hours: 15	Max Marks: 100

Course Objectives:

The course is intended to explain main components of OS and their working and to familiarize the operations performed by OS as a resource Manager. Additionally, to educate the various memory management strategies and OS scheduling principles.

Module I **7 Hours**

Operating Systems Overview: Introduction - operating system structure - process management - memory management - storage management - protection and security.

Operating Systems Structures: Operating system services - systems calls - system programs - operating system structure - Operating systems design and implementation.

Module II **8 Hours**

Process: Process concepts – Process scheduling – Interprocess communication – Threads – overview - CPU Scheduling - Scheduling Algorithms. Deadlocks - System model - Deadlock characterization.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain the structure of an operating system, including process management, memory management, storage management, and protection and security mechanisms.	Understand
CO2: Apply knowledge of operating systems to solve practical problems in computing environments	Apply
CO3: Apply knowledge of process management and deadlock handling to practical scenarios in computing environments.	Apply

Text Book(s):

T1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 9th edition, Wiley India Private Limited, New Delhi, 2012.

T2. William Stallings, Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India, 2006

Reference Book(s):

R1. Andrew S. Tanenbaum, Modern Operating Systems, 3rd edition, Prentice Hall of India, India, 2009.

R2. Deitel & Deitel, Operating systems, 3rd edition, Pearson Education, India, 2008.

Web References:

1. https://archive.nptel.ac.in/courses/106/105/106105214/

Course Code: 24CAC104		Course Title: Programming in C	
Course Category: Bridge Course		Course Level: Introductory	
L:T:P(Hours/Week):: 5:0:5	Credits:0	Total Contact Hours: 30	Max Marks:100

Course Objectives:

The course is intended to identify appropriate programming constructs and create programs that use unions, structures, and arrays as well as functions. Utilize pointer ideas and file management to create programs.

Module I **7 Hours**

Basics of C Programming: Overview of C Language - Constants, Variables and Data Types - Operators, Expressions and Assignment statements.

Arrays and Strings: Introduction to Arrays – One dimensional arrays: Declaration – Initialization - Accessing elements– Operations - Algorithms using arrays. Matrix operations, sort, search and applications using arrays.

Module II **8 Hours**

Functions and Pointers: Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference.

List of Exercises: **15 Hours**

1. Develop Programs using Input, output, assignment statements and looping statements.
2. Develop Programs using Functions and decision statements.
3. Implement Programs using arrays and pointers for sorting the values.
4. Design application using structures and file for storing, retrieving data in the form.
5. Develop applications using Functions and file for text processing.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the basics of C programming, including the syntax, structure, and semantics of the C language.	Understand
CO2: Apply array and string manipulation techniques in C programming to develop a student database management system	Apply
CO3: Apply the concept of parameter passing mechanisms, including pass by value and pass by reference, in function implementations.	Apply

Text Book(s):

T1. Herbert Schildt, "C - The Complete Reference, McGraw Hill", 4h Edition, 2017.

T2. Yashawant Kanetkar, "Let us C", BPB, 16th Edition, 2019.

Reference Book(s):

R1. Kernighan B.W. and Ritchie D.M., "C Programming Language (ANSI C)", Paperback-1, Pearson Education, 2015.

R2. E. Balaguruswamy, “Programming in ANSI C”, 8th Edition, McGraw Hill Education, 2019.

R3. Pradip Dey, Manas Ghosh, “Programming in C”, 2nd Edition, Oxford University Press, 2018.

Web References:

1. http://nptel.ac.in/courses/106104019/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://online-learning.harvard.edu/course/data-structures-and-algorithms

Course Code: 24CAC105		Course Title: Software Engineering	
Course Category: Bridge Course		Course Level: Mastery	
L:T:P(Hours/Week):: 5:0:0	Credits: 0	Total Contact Hours: 15	Max Marks: 100

Course Objectives:

The course focuses on software development process models, architectural design, testing strategies, Software Configuration Management (SCM), and dependability dimensions, emphasizing the importance of architectural design in software.

Module I **7 Hours**

Introduction to Software Engineering: Prescriptive Process Models – Waterfall – Incremental -Prototyping and Spiral Model.

Requirements Modeling: Scenario – Based – Data – based – Class – Based – Flow – Oriented – Behavioral Modeling.

Module II **8 Hours**

Software Design: Design Models Introduction – Use case – Class diagram - Sequence Diagram - Package Diagram - StateMachine Diagram - Activity Diagram - Collaboration Diagram – Interaction Diagram.

Review techniques: cost impact of software defects - review metrics and their use.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Explain the characteristics and principles underlying each prescriptive process model, highlighting their strengths and limitations.	Understand
CO 2: Identify the different methods for requirements modeling, such as Scenario-Based, Data-Based, Class-Based, Flow-Oriented, and Behavioral Modeling.	Understand
CO 3: Apply various testing strategies and SCM for real-time projects.	Apply

Text Book(s):

T1. Roger Pressman S," Software Engineering: A Practitioner's Approach", Tata McGraw Hill,8th Edition, 2014.

Reference Book(s):

R1. Ian Somerville , Software Engineering, 10th Edition, Pearson Education Asia 2017.

R2. Len Bass, Paul Clements and Rick Kazman, Software Architecture In Practice, 3rd Edition,Pearson India 2018.

R3. Rajib Mall, Fundamentals of Software Engineering, 5th Edition, PHI Learning Private Ltd, 2018.

R4. Pankaj Jalote, An integrated approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2018

Web References:

1. http://nptel.ac.in/courses/106105087/

Semester II

Course Code: 24CAC203	Course Title: Linear Algebra		
Course Category: Bridge Course	Course Level: Introductory		
L:T:P(Hours/Week):: 5:0:0	Credits: 0	Total Contact Hours: 15	Max Marks: 100

Course Objectives:

The course teaches Echelon form equation solving, vector spaces application, basis, rank, nullity, and Inner product spaces, enabling effective solution determination and orthonormal bases determination.

Module I **7 Hours**

System of Linear equations – Homogeneous and Non Homogeneous forms - Row Echelon form - Rank of the Matrix. Vector spaces- Subspace of a vector space- Basis and dimension of vector space.

Module II **8 Hours**

Linear combination: spanning sets of vectors – linear independence and linear dependence of vectors. **Inner product of vectors:** length of a vector- distance between two vectors- and orthogonality of vectors – Orthogonal projection of a vector.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the idea of matrix-based linear equations and the connection between matrices and linear equation systems.	Understand
CO2: Apply the concept of vector spaces to find basis, rank and nullity of subspaces.	Apply
CO3: Apply the concept of Inner product spaces to find orthonormal basis.	Apply

Reference Book(s):

R1. David C Lay, “Linear Algebra and its Applications”, Fifth Edition, Pearson Education, 2015.

R2. Howard Anton, Anton Kaul, “Elementary Linear Algebra”, Twelfth Edition, Wiley & sons Publication, 2019.

R3. Gilbert Strang, “Linear algebra and its Applications”, Fourth Edition, Cengage Learning (RS), 2012.

Course Code: 24CAC204		Course Title: Computer Networks	
Course Category: Bridge Course		Course Level: Mastery	
L:T:P(Hours/Week):: 5:0:0	Credits: 0	Total Contact Hours: 15	Max Marks: 100

Course Objectives:

The course covers network models, error detection techniques, data link layer architecture, routing algorithms, transport protocol selection, congestion control mechanisms, and application layer protocols in network development.

Module I **7 Hours**

Fundamentals of Data Communications and Data Link Layer: Data Communications – Components – Data flow – Physical structures – Network types – Network Models ISO/OSI model – TCP/IP Model – Line Coding - Transmission Media.

Error – Detection and Correction – Data Link Control - Flow control – Simple Protocol – Stop and Wait Protocol – Ethernet - IEEE 802.3 - 802.11 – Connecting Devices – VLAN.

Module II **8 Hours**

Network Layer, Transport Layer, and Application Layer :Services – Switching concepts – Circuit switching – Packet switching – IP-Datagram - Ipv4 Address – Subnetting - Network Address Translation (NAT) - Ipv6 – ICMP - Routing Algorithms - Distance-Vector Routing - Link-State Routing - BGP.

Transport layer – services – Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol – Transport for Real Time Applications (RTP). Applications – DNS – SMTP – FTP – WWW – SNMP - Security – RSA - DES – Web security – SSL – PGP - Firewall.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the different types and models of networks, such as TCP/IP and ISO/OSI models, and the way they are used in data transfer.	Understand
CO2: Apply the basic components of network models for data communication.	Apply
CO3: Apply IPv6, ICMP, and routing algorithms to analyze and design streamlined network architectures for enhanced efficiency.	Apply

Text Book(s):

T1. Behrouz A. Forouzan ,"Data Communications and Networking", 5th Edition, McGraw Hill, 2017.

Reference Book(s):

R1. William Stallings, Data and Computer Communications, 9th Edition, Prentice Hall, 2010.

R2. Larry L. Peterson & Bruce S. Davie, Computer Networks — A systems Approach", 4thEdition, Harcourt Asia / Morgan Kaufmann, 2007.

Web References:

1.https://nptel.ac.in/courses/106/106/106106091/

2.https://www.classcentral.com/course/fundamentals-network-communications-9267

Course Code: 24CAC205	Course Title: Internet Technologies		
Course Category: Bridge Course		Course Level: Introductory	
L:T:P(Hours/Week):: 5:0:0	Credits: 0	Total Contact Hours: 15	Max Marks: 100

Course Objectives:

The course is intended to learn how computers are connected to the Internet and to demonstrate an ability to create basic Web pages with HTML and creating Web pages using CSS.

Module I **7 Hours**

Introduction of Internet: Introduction to WWW – Protocols and programs – Secure connections– Application and development tools – The web browser – Web design – Web site design principles –Planning the site and navigation.

Introduction to HTML: The development process – Html tags and simple HTML forms – web site structure.

Introduction to XHTML: XML – Move to XHTML– Meta tags – Character entities – Frames and frame sets – inside browser.

Module II **8 Hours**

Style sheets : Need for CSS – Introduction to CSS– Basic syntax and structure – Using CSS background images colors and properties – Manipulating texts – Using fonts – Borders and boxes – Margins – Padding lists – Positioning using CSS – CSS2.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the fundamental components of the internet, the WWW, different protocols and its applications	Understand
CO2: Apply various web development tools for creating, testing, and optimizing web content	Apply
CO3: Apply CSS for background images, colors, text manipulation, font usage, borders, boxes, margins, padding, lists, and positioning.	Apply

Text Book(s):

T1. Steven Holzner,"HTML Black Book" Dremtech press, 2000.

T2. Web Technologies, Black Book, Dreamtech Press,2018.

Reference Book(s):

R1. Knuckles, Web Applications : Concepts and Real World Design, Wiley-India,2006.

R2. P.J. Deitel & H.M. Deitel, Internet and World Wide Web How to program, Pearson,1999.

Web References:

1. https://nptel.ac.in/courses/106105084

Course Code: 24CAC206	Course Title: Object Oriented Programming in C++		
Course Category: Bridge Course	Course Level: Introductory		
L:T:P(Hours/Week):: 5:0:5	Credits: 0	Total Contact Hours: 30	Max Marks: 100

Course Objectives:

The course teaches fundamental programming principles and techniques for creating high-quality programs, focusing on C/C++, code development, documentation, testing, and reusable module creation.

Module I **7 Hours**

Introduction to Object Oriented Programming: Object Oriented Principles – Overview of C++ - Types and Declarations – Conditional Statement, Looing Statement and Switch Statement – Arrays, Structures, and Reference.

Object Oriented Concepts: Classes and Objects – Operator Overloading – Inheritance **-** Polymorphism and Virtual Functions Class – Inline function – Constructors & Destructors.

Module II **8 Hours**

Functions and Pointers: Functions – Function Parameters – Function Overloading – Operator Overloading – Pointers to Functions– Pointer to Class, Object – this pointer – Pointers to derived classes and Base classes.

List of Exercises: **15 Hours**

1. Write a C++ program to display Names, Roll No., and grade of 3 students who have appeared in the examination. Declare the class of name, roll no., and grade. Create an array of class objects. Read and display the contents of the array.
2. Write a C++ program to declare a class . Declare pointer to class. Initialize and display the contents of the class members.
3. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
4. Write a C++ program to allocate memory using new operator.
5. Write a C++ program to create multilevel inheritance.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1:Understand the fundamentals of looping statements, switch statements, and conditional statements.	Understand
CO2:Understand the structure of virtual functions, inheritance, and polymorphism in C++ Object-Oriented Concepts.	Understand
CO3: Apply pointers to effectively manage and manipulate objects in an inheritance hierarchy.	Apply

Text Book(s):

T1. E Balagurusamy, “Object oriented Programming with C++”, Third edition, Tata McGraw Hill, 2006.

Reference Book(s):

R1. Bjarne Stroustrup, “The C++ Programming language”, Third edition, Pearson Education, 2017.

Web References:

1. http://nptel.ac.in/courses/106104019
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://online-learning.harvard.edu/course/data-structures-and-algorithms