

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	4	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	3	1	100	-
24CAC101	Ability Enhancement Course - I	0	0	3	1	100	-
TOTAL		14	1	20	25	1000	

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	4	100	-
XXXXXX	Professional Elective– I	3	0	0	3	100	-
XXXXXX	Professional Elective– II	3	0	0	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	3	1	100	-
TOTAL		14	1	18	26	1000	

Tentative Curriculum

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	800	-

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	100	

Internship

Course Code	Course Title	Duration	Credits	Marks	Common to Programmes
24CAC202	Internship	2 weeks	1	100	--

Total Credits: 85

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

Skill Enhancement Courses

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
24CAC001	Mobile Programming With Swift	0	0	3	1	100	-
24CAC002	Mobile Application Development With React Native	0	0	3	1	100	-
24CAC003	Flutter	0	0	3	1	100	-
24CAC004	Spring Boot	0	0	3	1	100	-
24CAC005	MEAN Stack	0	0	3	1	100	-

24CAC006	MERN Stack	0	0	3	1	100	-
24CAC007	UX Design	0	0	3	1	100	-
24CAC008	Scalable Application Development for Cloud	0	0	3	1	100	-
24CAC009	IoT Basic Concepts	0	0	3	1	100	-
24CAC010	Web Application Development Using Angular	0	0	3	1	100	-
24CAC011	Advanced in IoT	0	0	3	1	100	-
24CAC012	DevOps Technologies	0	0	3	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	3	1	100	-
24CAC201	Ability Enhancement Course - II	0	0	3	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			
24CAC202	Linear Algebra	5	0	0	0	0	-
24CAC203	Computer Networks	5	0	0	0	0	-
24CAC204	Internet Technologies	5	0	0	0	0	-
24CAC205	Object Oriented Programming in C++	5	0	5	0	0	-

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 random variables – 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) – Randomized Block 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, 2014

Reference Book(s):

R1. Veerarajen. T, "Probability, Statistics and Random Process", 1st Edition Tata McGraw Hill, 2006

R2. Ross, Sheldon. M, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Academic Press, 2009

R3. Freund John, E and Miller, Irvin, "Probability and Statistics for Engineering", Duxbury Press; 6th edition, 2003

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.

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: Demonstrate understanding of web development concepts by identifying the components of a web application architecture and the technologies involved.	Apply
CO2: Evaluate and utilize GridView control in ASP.NET for efficient data presentation and manipulation, enhancing user experience and data management capabilities.	Evaluate
CO3: Develop a static web page using HTML and CSS, incorporating basic formatting, interactivity, and multimedia elements.	Create
CO4: Implement basic JavaScript functionalities, such as DOM manipulation, event handling, and form validation, to enhance user interaction in a web page.	Create

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, 2019.
- T2. Kogent Learning Solutions Inc ASP.NET 2.0 Black Book Includes VB 2005 and C# 2005 codes, New Edition.

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, 4th Edition.
- R3. Thomas A Powell "HTML & XHTML: The Complete Reference".

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: Identify the practical significance of linear data structures in addressing real-world problems across various domains, such as software engineering, data analysis, finance, and healthcare.	Analyze
CO2: Examine the time and space complexity of operations performed on linked lists, stacks, and queues and make informed decisions regarding data structure selection to optimize program performance.	Analyze
CO3: Design and implement solutions to real-world problems using trees.	Create
CO4: Develop practical skills in implementing sorting techniques using the Python programming language and methodologies.	Create
CO5: Design and implement Python programs that utilize compound data structures effectively to solve real-world computational problems.	Create

Text Book(s):

T1. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, “Data structures and algorithms in python” Wiley India Pvy. Ltd., 2021 Edition.,

Reference Book(s):

R1. Narasimha Karumanchi, “Data Structures and Algorithmic Thinking with Python”, Careermonk Publications, 2015 Edition.

R2. Dr Shriram K. Vasudevan, “Data Structures Using Python“, OUP India Publications, 2021 Edition.

R3. Chandan Banerjee Atanu Das “Data Structures and Algorithms in C & Python”.

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: Illustrate the principles of Database systems and fundamentals of relational model	Understand
CO2: Build the SQL queries and authorization mechanism in relational tables.	Apply
CO3: Analyze the features of MongoDB, Cassandra and Graph databases in a real time scenario.	Analyze
CO4: Create the methods that accessing NoSQL from a programming language in an application development.	Create

Text Book(s):

T1. Abraham Silberschatz, Henry F. Korth and S. Sudharssan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2019.

Reference Book(s):

R1. Raghu Ramakrishna & Johannes Gerhrke, "Database Management System", McGrawHill, 3rd Edition, 2010.

R3. R3.C. J. Date, "An Introduction to Database Systems", Eighth Edition, Addison-Wesley, 2003.

R4. Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", 3rd Edition, Pearson Education, 2010.

R5. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley, 2018.

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/pcmoro/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: 4	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 an 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, 2014

Reference Book(s):

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

R2. Android Studio 3.0 Development Essentials – Android 8 Edition

R3. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd

R4. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd

R5. Android Application Development All in one for Dummies by Barry Burd, Edition

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>
4. <https://www.javatpoint.com/android-sqlite-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) CATALOGUE 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: Analyze user requirements and create well-structured, interactive web pages using HTML, CSS, and JavaScript, incorporating effective validation techniques.	Analyze
CO3: Create real-time web applications with database connectivity, ensuring data integrity and responsiveness.	Create

Reference Book(s):

R1. Web Technologies Laboratory Manual.

R2. Thomas A Powell, Fritz Schneider, Java Script: The Complete Reference", 3rd Edition, Tata McGraw Hill, 2013

R3. Raghu Ramakrishna & Johannes Gerhrke, "Database Management System", McGraw Hill, 3rd Edition, 2010

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 listboxes 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: Analyze with the Pandas library to perform data analysis in Python.	Analyze
CO3: Create applications using stacks, queues, and various lists that implement different data structures for practical scenarios.	Create

Reference Book(s):

- R1. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, "Data structures and algorithms in python" Wiley India Pvy. Ltd., 2021 Edition.,
- R2. Narasimha Karumanchi, "Data Structures and Algorithmic Thinking with Python" , Careermonk Publications, 2015 Edition
- R3. Dr. Shriram K. Vasudevan, "Data Structures Using Python ", OUP India Publications, 2021 Edition.

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: Develop how to use exception handling, triggers, and cursors to write PL/SQL blocks for transaction operations in a typical application.	Create
CO2: Develop the ability to execute an application's NoSQL commands.	Create
CO3: Create a standard application by combining a database management system (either SQL or NoSQL) and front-end tools.	Create

Reference Book(s):

- R1. Abraham Silberschatz, Henry F. Korth and S. Sudharssan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2019.
- R2. Raghu Ramakrishna & Johannes Gerhrke, "Database Management System", McGraw Hill, 3rd Edition, 2010.
- R3. C. J. Date, "An Introduction to Database Systems", Eighth Edition, Addison-Wesley, 2003.
- R4. Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", 3rd Edition, Pearson Education, 2010.

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/pcmoro/Make-IT-Work-5/blob/master/NoSQL%20Distilled.pdf>

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.	Apply
CO2: Apply advanced techniques for model evaluation and validation to optimize model performance and generalize well to unseen data.	Apply
CO3: Analyze and choose an appropriate model for a real-world problem, incorporating feature engineering techniques.	Analyze
CO4: Analyze the working model and features of the decision tree.	Analyze
CO5: Evaluate the probability techniques by implementing them to solve real-world problems.	Evaluate

Text Book(s):

T1. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, Third Edition 2018.

Reference Book(s):

R1. Muller Andreas C, Guido Sarah, "Introduction to Machine Learning With Python: A Guide to Data Scientist", Third Edition, 2017.

R2. Tom M. Mitchell, "Machine Learning", India Edition, 1st Edition, McGraw-Hill Education Private Limited, 2013.

R3. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, Pearson Education, 2019.

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 the operators, control structures, classes, and objects in the real-time applications.	Apply
CO2: Evaluate the string, I/O and collection classes in light of real-life problems.	Evaluate
CO3: Create an efficient, secure, and interactive Java applications, employing multithreading, event handling , and JDBC.	Create
CO4: Create an interactive server side Java applications, employing Servlets.	Create

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", 9th edition, Tata McGraw-Hill, 2014.

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: 4	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 SQL 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 client-side technologies to create interactive and responsive user interfaces.	Apply
CO2: Analyze the concepts of state and lifecycle methods within React components	Analyze
CO3: Evaluate interactive and dynamic web interfaces using React JS components.	Evaluate
CO4: Design and develop full-stack web applications with data security.	Create
CO5: Create and implement database-driven web applications using both SQL and NoSQL databases.	Create

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. Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016.

R2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019.

R3. Stoyan Stefanov, "React: Up & Running - Building Web Applications", O'Reilly Media, 2nd Edition, 2021.

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: Implementing 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.	Create

Reference Book(s):

- R1. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, Third Edition 2018.
- R2. Machine Learning Laboratory – Manual.
- R3. Stephen Marsland "Machine Learning: An Algorithmic Perspective", Second Edition

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2. <https://machinelearningmastery.com/start-here/#bayesian>
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. Develop an application using custom Package.
2. Create synchronization programming to provide the solution for the scenario involving the race condition.
3. Develop a student management application using Collections Framework.
4. Develop an application using serialization and deserialization for managing inventory. This system should allow users to add, update, delete, and view items in the inventory. Serialize the inventory data to a file for persistence, allowing users to save and load inventory information across sessions. Implement functionality to serialize objects when adding or updating inventory items, and deserialize objects when loading inventory data.
5. Create an application using AWT controls and event handling functions to develop an online quiz platform. This application should present questions to users through GUI components such as buttons, labels, and text fields. Implement event handlers to capture user responses and verify answers. Use AWT to design the quiz interface and handle user interactions, such as selecting answers and navigating through questions.
6. Develop an application with JDBC.
7. Making use of the HttpSession object, develop a server-side application which tracks the creation and last-accessed times of a session.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze the multithreading concepts for real-time problems.	Analyze
CO2: Examine collections, serialization, and deserialization for real-time problems.	Evaluate
CO3: Create an application using JDBC for real-time problems..	Create
CO4: Develop a real-time server-side application with Servlets.	Create

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", 9th edition, Tata McGraw-Hill, 2014

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 - I	
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 - II 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

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.

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: Create and evaluate the use of TCP & UDP Sockets in UNIX environments.	Create
CO5: Design and implement secure and efficient Unix-based applications and implement in Client Server Applications.	Create

Text Book(s):

T1. W. Richard Stevens, Advanced Programming in the UNIX Environment, Addison Wesley, New Delhi, 3rd Edition, 2016.

Reference Book(s):

R1. Stevens, Bill Fenner, Andrew Rudoff , “Unix Network Programming Volume-1: The Sockets Networking API”, Addison- Wesley Professional, 2014.

R2. Maurice J. Bach, “The Design of the Unix Operating System”, Prentice Hall, New Delhi, 2007.

R3. Kenneth Rosen UNIX: The Complete Reference, Second Edition Paperback, 2007.

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: Apply vulnerability data resources in ethical hacking and cybersecurity contexts.	Apply
CO4: Analyze Metasploit tools for assessing system vulnerabilities and securing information systems.	Analyze
CO5: Evaluate wireless hacking techniques and employ tools like Aircracking for WEP and WPA/WPA2 network cracking.	Evaluate

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".

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: Demonstrate a practical application in understanding the components and workings of block chain-based currencies.	Analyze
CO2: Analyze various financial services components in the financial technology domain evaluate the intricacies of financial services in development platforms.	Analyze
CO3: Analyze the applications of Name coin in block chain field.	Evaluate
CO4: Create block chain management learning for real time applications.	Create

Text Book(s):

T1. Melanie Swan, "Block Chain: Blue Print For A New Economy", O Reilly publisher, 2018.

Reference Book(s):

R1. Manav Gupta, "Block chain for dummies" IBM Limited Edition, 2017.

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".

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.

22 Hours

Module I

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: Analyze various mobile network layer protocols for effective mobile network design and management.	Analyze
CO3: Analyze the components of 3G mobile networks and evaluate the technologies in 3G mobile communication systems.	Analyze
CO4: Evaluate the requirements of internetworking in WLANs and WWANs.	Evaluate
CO5: Examine the applications of 4G and evaluate complexities of 4G in wireless communication technologies.	Evaluate

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”, First Edition, 2021.

R2. Kurose James F, Ross Keith W, “Computer Networking- A top down approach”, Sixth Edition, Pearson, 2017.

R3. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.

R4. Simon Haykin, Michael Moher, David Koilpillai, —Modern Wireless Communications, First Edition, Pearson Education 2013.

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: Analyze 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: Evaluate Symmetric Key distribution using symmetric encryption in key management.	Evaluate
CO5: Evaluate security measures across different layers to ensure comprehensive computer security.	Evaluate

Text Book(s):

T1. William Stallings, "Cryptography and Network Security: Principles and Practice", 5th Edition, Pearson Education, March 2017.

Reference Book(s):

- R1. Charles P. Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", Pearson Education, 2009
R2. Bruce Schneier, "Applied Cryptography", John Wiley, 2008.
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 the key features of IoT to make informed design decisions.	Apply
CO2: Analyze IoT enabling technologies to design domain-specific solutions for industries such as home automation, agriculture, and healthcare.	Analyze
CO3: Evaluate the transition from M2M to IoT in the global context.	Evaluate
CO4: Create a comprehensive IoT architecture reference model considering safety, privacy, trust, and security.	Create
CO5: Create real-world design constraints for various IoT applications.	Create

Text Book(s):

- T1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities Press, 2017.
- T2. Jan Ho ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan AvesandDavid 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.
- R2. Tutorialspoint, "Internet of Things", Tutorialspoint (I) Pvt. Ltd, 2016.
- R3. Peter Waher, "Learning Internet of Things", Packt publishing, Birmingham Mumbai, 2015.

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
- 3 <https://www.codeproject.com/Learn/IoT/>

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 to retrieve the relevant information from databases or servers.	Apply
CO2: Analyze social network analysis techniques to uncover insights and patterns in social structures.	Analyze
CO3: Estimate web crawling techniques in information retrieval and web content indexing.	Analyze
CO4: Evaluate the fundamentals of structured data extraction, including wrapper induction.	Evaluate

Text Book(s):

T1.Bing Liu, “Web Data Mining: Exploring Hyperlinks, Content, and Usage Data”, 2nd Edition, Springer, 2015

Reference Book(s):

R1.Ricardo Baeza- Yates, Ribeiro-Neto, “Modern Information Retrieval”, Pearson, 2016.

R2.Aggarwal Charu C, “Social Network Data Analytics”, Springer, 2015.

R3.Xu, Guandong, Zhang, Yanchun, Li, Lin, “Web Mining and SocialNetworking: Techniques and Applications”, Springer, 2013.

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 the optimization algorithm to classify the real world dataset.	Apply
CO2: Determining CNN algorithm to Sentence Classification problem.	Apply
CO3: Integrating the effectiveness of various deep learning models over sentiment analysis.	Analyze
CO4: Analyze neural network concepts in working deep learning.	Analyze
CO5: Generate the deep learning model for object detection problem.	Evaluate

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 2022.

R2. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 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-and-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 Knapsack 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: Examine the convergence properties, computational efficiency, and scalability of different optimization algorithms.	Apply
CO2: Design and implement evolutionary algorithms that efficiently search for optimal solutions in complex search spaces.	Apply
CO3: Analyze the effectiveness of EAs by designing and tuning their parameters.	Analyze
CO4: Create evolutionary algorithms to solve real-world optimization problems, incorporating techniques like ant colony optimization and particle swarm optimization.	Create
CO5: Develop team-based projects that implement optimization solutions that leverage evolutionary algorithms, to address real-world optimization challenges.	Create

Text Book(s):

- T1. Kenneth A. De Jong, “Evolutionary Computation A Unified Approach”, Prentice Hall of India, New Delhi, 2008.
- T2. Marco Dorigo and Thomas Stutzle, “Ant Colony optimization”, Prentice Hall of India, New Delhi, 2004.

Reference Book(s):

- R1. Jun Sun, Choi-Hong Lai and Xiao-Jun Wu, “Particle Swarm Optimisation: Classical and Quantum Perspectives”, Taylor and Francis, USA, 2012.
- R2. Eiben A.E and Smith J.E,” Introduction to Evolutionary Computing” Springer, 2008.
- R3. Dervis Karaboga, Bahriye Akay,” A comparative study of Artificial Bee Colony algorithm” Applied Mathematics and Computation 214, Elsevier Publications, 2009.

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 - Design Drag & Drop- Direct Selection- 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: Demonstrate the foundations and principles of Human-Computer Interaction (HCI), with styles, elements, and interactivity paradigms.	Apply
CO2: Apply HCI principles effectively within the software development lifecycle, to design user-friendly and efficient interfaces.	Apply
CO3: Analyze and design Multimedia User Interfaces (UIs), integrating interactive design basics, for diverse multimedia platforms.	Analyze
CO4: Implement advanced web interface design concepts to create dynamic applications.	Create
CO5: Create advanced web interfaces integrating Google Blogger to facilitate interactive single-page processes, enabling seamless user experiences.	Create

Text Book(s):

T1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2015.

T2. Brian Fling, "Mobile Design and Development, O'Reilly Media Inc., 1st Edition, 2012.

Reference Book(s):

R1. Bill Scott and Theresa Neil, "Designing Web Interfaces", O'Reilly, 1st Edition, 2013.

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: Execute the relationship between the environment, the human eye, and optimal display conditions for effective data visualization,	Apply
CO2: Examine multimedia user interface design standards and their applications in visualization within the visual field.	Apply
CO3: Illustrate interactive elements in visualizations for data exploration.	Analyze
CO4: Detecting appropriate visualization techniques for effective communication and insight generation.	Evaluate
CO5: Evaluate various visualization tools and techniques while maintaining data integrity and accuracy.	Evaluate

Text Book(s):

T1. Colin Ware, “Information Visualization: Perception for Design”, Morgan Kaufmann, 2013

T2. Scott Murray, ”Interactive Data Visualization for the Web-An Introduction to Designing with D3”, O’Reilly, 2013

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", Analytics Press, 2013.

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 time Tracking-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: Estimating programming skills in Java 3D to create basic VR environments and design principles.	Analyze
CO3: Evaluate the usability and potential health impacts of VR systems and propose design solutions to mitigate cyber sickness.	Evaluate
CO4: Design and develop simple VR applications for various domains using appropriate tools and techniques.	Create
CO5: Design immersive responsible virtual reality experiences, leveraging diverse programming tools for impactful applications across various fields.	Create

Text Book(s):

T1.C. Burdea & Philippe Coiffet, “Virtual Reality Technology”, Second Edition, Gregory, John Wiley & Sons, Inc., 2014.

T2. Andrew Davison, “Killer Game Programming in Java”, Oreilly SPD, 2008.

Reference Book(s):

R1. William R. Sherman, Alan Craig, “Understanding Virtual Reality, interface, Application and Design”, Elsevier, Morgan Kaufmann, 2002.

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.swyam2.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.

22 Hours

Module I

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: Examine the Semantic Web's tools and technologies, Software Agents.	Apply
CO2: Determine a model for various domains, using appropriate ontology development methodologies and tools.	Apply
CO3: Analyze the different Semantic Web Service solutions in OWL-S Service Ontology.	Analyze
CO4: Evaluate Semantic Web services using OWL-S, considering service discovery, composition, and execution.	Evaluate
CO5: Assessing the principles and technologies of the Semantic Web while considering sustainability factors and fostering collaborative development in diverse domains.	Evaluate

Text Book(s):

- T1. K.K. Breitman, Marco Antonio Casanova and Walter Truszowski, "Semantic Web Concepts: Technologies and Applications", Springer, 2013.
- T2. Grigoris Antoniou, Frank Van, "Semantic Web Primer", MIT Press, 2010.

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, 2nd edition 2013.
- 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, 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: Evaluate different data pre-processing techniques and choose appropriate methods for data quality improvement and transformation.	Evaluate
CO4: Create data visualizations using established charts and graphs for data analysis.	Create

Text Book(s):

- T1. R. V. Hogg, J. W. McKean and A. Craig, "Introduction to Mathematical Statistics", 8th Edition.
T2. Avrim Blum, John Hopcroft, Ravindran Kannan, "Foundations of Data Science", Cambridge University Press, Pearson Education India, 2019.

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, 2013.
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: Determine the role of data, information, and knowledge in business intelligence to solve business problems.	Apply
CO2: Illustrate existing business intelligence architectures and identify optimal solutions based on specific business needs.	Analyze
CO3: Analyze knowledge delivery systems using various techniques to effectively communicate insights and support decision-making.	Analyze
CO4: Evaluate pattern matching and other analytical techniques to extract valuable insights from business data.	Evaluate
CO5: Evaluate business intelligence technologies to optimize decision-making in the rapidly evolving field of data-driven intelligence.	Evaluate

Text Book(s):

T1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson Education, 2014.

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

Reference Book(s):

R1. Carlo Verzellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.

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

R3. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 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 andMultidimensional 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 Accuracy of 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: Apply knowledge of data warehousing components to design and construct the data warehouse architecture.	Apply
CO2: Analyze data preprocessing techniques such as cleaning, integration, and transformation to prepare data for mining.	Analyze
CO3: Analyze the issues and challenges related to classification and prediction tasks in data mining.	Analyze
CO4: Evaluate clustering models using density-based methods like DBSCAN.	Evaluate
CO5: Evaluate the effectiveness of spatial data analysis and mining methods in solving real-world problems.	Evaluate

Text Book(s):

- T1. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Third Edition, Morgan Kaufmann Publishers, 2014.
- T2. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, TataMcGrawHill, 2009.

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”, 2013.
- R3. I. A. Dhotre, “Data Mining and Data Warehousing”, 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: Apply principles of data center design and layout to optimize storage system efficiency.	Apply
CO2: Analyze the components and evolution of Fibre Channel SAN for efficient data transmission.	Analyze
CO3: Evaluate RAID configurations based on different RAID levels to meet specific data storage requirements.	Evaluate
CO4: Assess the benefits of NAS file systems and network file sharing	Evaluate
CO5: Explore file-level virtualization and its role in storage management	Evaluate

Text Book(s):

T1. Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and Management", EMC2 John Wiley & Sons, Inc., Second Edition, 2016.

T2. Marc Farley, "Building Storage Networks" Tata McGraw Hill , Osborne, 2010.

Reference Book(s):

R1. Robert Spalding, "Storage Networks: The Complete Reference" Tata McGraw Hill, 2010.

R2. John Watsonoca, "Oracle Database 11G: Administration 1 Exam guide", Tata McGraw Hill, Editon 2012.

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

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the fundamental concepts of information retrieval in the context of classic models.	Apply
CO2: Apply query languages for information retrieval, emphasizing keyword-based approaches.	Apply
CO3: Analyze clustering methods for organizing and categorizing large volumes of text data.	Analyze
CO4: Evaluate parallel information retrieval systems that can handle large-scale data efficiently.	Evaluate
CO5: Evaluate different data models used in multimedia information retrieval	Evaluate

Text Book(s):

- T1. Ricardo Baeza-Yates, Bethier Ribeiro - Neto,"Modern Information Retrieval“, Second Edition, ACM Press Books, 2019.
- T2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze," Introduction to Information Retrieval”, Cambridge University Press, 2012.

Reference Book(s):

R1. D.A.Grossman,O.Frieder,"InformationRetrieval: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

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: Analyze the XP lifecycle, emphasizing the iterative and customer-centric nature of development.	Analyze
CO3: Analyze the commonalities between XP values and Agile principles for successful project.	Analyze
CO4: Evaluate effective pair programming practices within a development team.	Evaluate
CO5: Evaluate the concept of team responsibility and its influence on project success.	Evaluate

Text Book(s):

T1. James Shore and Shane Warden, “The Art of Agile Development”, O’Reilly Media, 2008.

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”, Cockburn – 2007.

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

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: Analyze the structure and significance of segments, extents, and blocks in Oracle	Analyze
CO3: Analyze the impact of SQL query optimization on database efficiency	Analyze
CO4: Evaluate the overview of RMAN commands and their significance in backup management.	Evaluate
CO5: Create and implement data pump export and import procedures for data migration	Create

Text Book(s):

T1. Bob Bryla , Kevin Loney, “Oracle Database 11G DBA Handbook”, Oracle Press, McGraw-Hill Edition 2013.

Reference Book(s):

R1.Loney Kevin, “Oracle Database 11G: The Complete Reference”, Apress, 2013.

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

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 - To 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: Analyze the importance of contract management in the context of software projects	Analyze
CO2: Analyze cost-benefit analysis techniques to make informed project investment decisions.	Analyze
CO3: Create cash flow forecasts for software projects.	Create
CO4: Create a risk management framework, incorporating data collection and visualization techniques.	Create
CO5: Create the application of pragmatic metrics in project control	Create

Text Book(s):

T1. Bob Hughes & Mike Cotterell, “Software Project Management”, Tata McGraw- Hill Publications, Fifth Edition, 2015.

Reference Book(s):

R1. Walker Royce, “Software Project Management–A unified Framework”, Pearson Education, 2007.

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, Seventh 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

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: Analyze various Software Development methodologies and their impact on quality assurance activities	Analyze
CO3: Evaluate the CASE tools for software quality improvement	Evaluate
CO4: Evaluate the comparison of different quality assurance techniques on software development processes.	Evaluate
CO5: Create quality metrics for evaluating software performance	Create

Text Book(s):

- T1. R. Chopra , “ Software Quality Assurance: A Self-Teaching Introduction Paperback – Import, 13 April 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 , “SoftwareQuality Assurance” Morgan Kaufmann , 2015.
- R2. Software Quality Assurance, Milind Limaye, 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

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: Analyze the properties and characteristics of various multimedia elements and apply them to design effective multimedia systems.	Analyze
CO2: Analyze and explain hypermedia concepts to create well-structured interactive multimedia experiences.	Analyze
CO3: Evaluate the multimedia database technology and create the multimedia database for real time application.	Evaluate
CO4: Evaluate different multimedia compression techniques and choose appropriate methods for optimizing storage and transmission.	Evaluate
CO5: Implement interactive user interfaces for multimedia applications, incorporating real-time protocols and synchronization mechanisms	Create

Text Book(s):

- T1. Ralf Steinmetz, Klara Nahrstedt, "Multimedia Computing, Communications, and Applications", Pearson India, 2009.
- T2. Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw Hill Education, 2017.

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, Dave Lindergh, Richard L. "Baker Digital Compression for Multimedia: Principles and Standards", Elsevier, 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

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’s Argument – 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 BenefitAnalysis — 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 principles of intellectual property and access to critically assess software piracy and advocate for ethical development practices in computing fields.	Apply
CO2: Analyze ethical theories and frameworks to identify and resolve moral dilemmas related to engineering and computer technology.	Analyze
CO3: Evaluate the ethical implications of emerging technologies and formulate responsible solutions based on professional codes and legal considerations	Evaluate
CO4: Interpret ethical positions on technology and privacy construct arguments promoting responsible use of computer applications and ensuring data security.	Evaluate
CO5: Design and implement ethically-sound solutions to address current challenges in technology access, workplace automation, and artificial intelligence.	Create

Text Book(s):

- T1.M.Govindarajan, S.Natarajan and V.S.SenthilKumar, "Professional Ethics and Human Values", PHI Learning Pvt. Ltd, 2013.
- 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", McGraw-Hill, New York, 1996
- R2.George Reynolds,"Ethics in Information Technology", 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.htm

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 techniques **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-filing, 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 techniques for defining and illustrating research problems.	Apply
CO2: Apply important parametric tests for hypothesis testing.	Apply
CO3: Analyze research tools and techniques for recognizing their strengths and limitations.	Analyze
CO4: Examine the types of patent applications and registration of patent agents.	Evaluate
CO5: Develop a comprehensive understanding of Intellectual Property Rights (IPR) including plagiarism detection software.	Create

Text Book(s):

T1. Research Methodology: Methods and Techniques by C.R.Kothari, GauravGarg, New Age International 4th Edition 2018.

Reference Book(s):

R1. Research Methodology a step-by-step guide for beginners by Ranjit Kumar, SAGE publications Ltd 3rd Edition 2011 (For the topic Reviewing the Literature under Unit I).

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

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

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) : : 0:0:3	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 the concepts of booleans, tuples, and optionals in Swift programming.	Apply
CO2: Analyze the functionality and application of various operators in Swift	Analyze
CO3: Create Swift Programs with Advanced Control Flow and Optional Binding	Create
CO4: Evaluate the effectiveness of Automatic Reference Counting (ARC) in managing memory and preventing memory leaks.	Evaluate

Text Book(s):

T1. Lee Wei Meng, "Beginning SWIFT Programming", 2015

Reference Book(s):

R1. The Swift Programming Language, Swift 5.2, Apple Inc, Swift Programming series,2014

R2. Brad Lees, Gary Bennett, Stefan Kaczmarek," Swift 5 for Absolute Beginners",5th Edition,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) : : 0:0:3	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

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: Implement styles for various UI elements, including toggle buttons and list items in React Native	Apply
CO2: Analyze the design considerations for tablets and iPads, incorporating custom fonts and icons for an enhanced user experience	Analyze
CO3: Create a simple React Native app with a focus on building a flexible and responsive layout using Flexbox.	Create
CO4: Create and manipulate tuples within the Redux paradigm to organize and structure data efficiently, facilitating seamless state handling.	Create

Text Book(s):

T1. React Native for Mobile Development by Akshat Paul , Abhishek Nalwaya, Second edition by Apress

T2. Learning React Native- Building Native Mobile Apps with JavaScript by O'Reilly , 2nd edition
Bonnie Eisenman

Reference Book(s):

R1. React and React Native- A Complete Hands-on Guide to Modern Web and Mobile Development with React.js by Adam Boduch and Roy Derks, 3rd Edition, Packt

R2. React Native in Action- The best book for cross-platform React development by Nader Dabit

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 Courses		Course Level: Mastery	
L:T:P(Hours/Week): : 0:0:3	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: Utilize DartPad for hands-on experience in writing and executing Dart code snippets.	Apply
CO2: Analyze the role of Booleans in decision-making within Dart programs	Analyze
CO3: Create a new Flutter project using Flutter SDK and Android Studio	Create
CO4: Create mechanisms to send and receive data between different screens in a Flutter app.	Create

Text Book(s):

T1. Begging Flutter A Hands on guide to App development by Macro L Napoli- 1st Edition
Wrox.

T2. Beginning App Development with Flutter by Rap Payne- Apress

Reference Book(s):

R1. Flutter for Beginners by Thomas Bailey , Alessandro Biessek - Packt Publishing
Limited.

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): : 0:0:3	Credits: 1	Total Contact Hours: 45	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 knowledge of Spring Framework architecture to design and develop robust Java applications.	Apply
CO2: Analyze the role of Spring Boot Runners and their significance in the execution flow of a Spring Boot application.	Analyze
CO3 : Create web forms using Spring Web MVC and integrate Thymeleaf for efficient server-side templating.	Create
CO4: Create Rest API documentation using tools like POSTMAN & Swagger.	Create

Text Book(s):

- T1. “Mark Heckler”, Spring Boot: Up and Running, O’Reilly, February 2021
- T2. “Alex Antonov ”,Spring Boot 2.0 Cookbook, second edition

Reference Book(s):

- R1. Balaji Varanasi , Maxim Bartkov, “Spring REST: Building Java Microservices and Cloud Applications”, second edition, 28 November 2021
- R2. <https://www.coursera.org/learn/spring-mvc-rest-controller>

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): : 0:0:3	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 the WebSocket protocol in Node.js to establish real-time communication between the server and clients in web applications.	Apply
CO2: Implement event directives effectively to handle user interactions and trigger appropriate actions within the application	Apply
CO3: Create and consume RESTful services using Express.js.	Create
CO4: Explore JSON and dynamic schema in MongoDB.	Evaluate

Text Book(s):

- T1. “Jonathan Wexler”, Get programming with Node.js, first edition (March 15, 2019)
- T2. “Shelley Powers”, Learning Node: Moving to the Server-Side, second edition (June 28, 2016)

Reference Book(s):

- R1. “Ethan Brown”, Web Development with Node & Express: Leveraging the JavaScript Stack, second edition (December 3, 2019)
- R2. “David Herron”, Node.js Web Development, fifth edition (July 31, 2020)

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): : 0:0:3	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:	
CO 1: Apply React Bootstrap to enhance the styling and responsiveness of React applications.	Apply
CO 2: Apply synchronous and asynchronous programming techniques in Node.js development.	Apply
CO 3: Analyze the differences between MongoDB (NoSQL) and traditional SQL databases.	Analyze
CO 4: Evaluate the use of embedded documents in MongoDB for structuring and organizing data efficiently.	Evaluate

Text Book(s):

T1. “Harmeet Singh, Mehul Bhatt ”, Learning Development with react and Bootstrap, 20dec 2016

T2. “Shannon Bradshaw, Eoin Brazil”, MongoDB:The defective guide,third edition, 19 January 2020

Reference Book(s):

R1. “Dewailly”, Building a RESTful Web Service with Spring,oct 14,2015

R2. “Greg Lim”, Beginning MERN Stack Development

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): : 0:0:3	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 and finally

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:	
CO 1: Examine the role of visual communication design components in the overall UI design process.	Analyze
CO 2: Create UI elements based on formal and active design principles	Create
CO 3: Evaluate the effectiveness of the interface in meeting user needs and goals.	Evaluate
CO 4: Evaluate the efficiency of using prototyping tools to create working prototypes in the design process.	Evaluate

Text Book(s):

T1. “Westley Knight”, UX for developers, Apress

T2. “Amolendu H”, The golden ratio in Ux design, first edition

Reference Book(s):

R1. “Jon Yablonski”, laws of UX, first edition, 11 July 2020

R2. “Jeff Gothelf”, Lean UX: Applying Lean principles to improve user experience, first edition, 1 Jan 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) : : 0:0:3	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:	
CO 1: Apply Bash fundamentals for efficient scripting and automation in a Linux environment.	Apply
CO 2: Analyze analytics and cost metrics to optimize cloud solutions for efficiency.	Analyze
CO 3: Implement automation for infrastructure on the cloud, utilizing services like ECS, ECR, and EKS.	Create
CO 4: Evaluate security measures in Azure and GCP, focusing on networking and access control.	Evaluate

Text Book(s):

- T1. “Buyya,Vecchiola,Selvi”, Mastering Cloud Computing, McGraw Hill Education,first edition,1 july 2017
- T2. “Steve Swoyer”. Migrating Applications to the Cloud, O'Reilly, April 2021

Reference Book(s):

- R1. “Saurabh Shrivastava”, Solutions Architect’s Handbook, Packt Publishing Limited, second edition, 17 January 2022.
- R2. “Rajkumar Buyya”, Mastering cloud Computing: Foundations and Applications Programming, Morgan Kaufmann, 31 May 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): : 0:0:3	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: Evaluate the integration of various electronic components, ensuring effective communication and collaboration within the IoT ecosystem.	Evaluate

Text Book(s):

T1. Bahga, Vijay Masdisetti. Internet of thing A Hands-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): : 0:0:3	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: Analyze the impact of routing on user experience and the efficiency of remote access mechanisms.	Analyze
CO 3: Develop forms for data input, implementing authentication mechanisms for secure access.	Create
CO 4: Evaluate the thoroughness of unit testing in identifying and addressing potential issues.	Evaluate

Text Book(s):

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

Reference Book(s):

R1. “Doguhan Uluca”,Angular for Enterprise-Ready Web applications,Second edition.

R2. “Asim Hussain”, Angular: From theory to practice, Kindle edition

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): : 0:0:3	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: Analyze the historical evolution of IoT and its impact on various industries.	Analyze
CO2: Implement an open-source IoT platform on a local machine.	Apply
CO3: Gain practical experience working with General Purpose Inputs/Outputs (GPIOs) and Analog I/Os.	Evaluate
CO4: Examine the building blocks of IoT cloud infrastructure.	Evaluate

Text Book(s):

T1. Bahga, Vijay Masdisetti. Internet of thing A Hands-On Approach, Univetsity Press, 2015

Reference Book(s):

R1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, John Wiley & Sons Ltd 2014

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): : 0:0:3	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.	Create

Reference Book(s):

R1. “Jennifer Davis & Ryn Daniels” Effective DevOps

R2. “Micro Hering” DevOps for the Modern Enterprise, IT Revolution Press, April 5,2018

Web References:

1. <https://www.coursera.org/learn/intro-to-devops>

2. <https://www.udemy.com/course/valaxy-git/>

**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)::2: 0: 0	Credits: 1	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 interpretation.

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
At the end of this course, students will be able to:	Level
CO1: Enhance their problem solving skills & Logical thinking Skills	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”, Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

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)::2:0:0	Credits: 1	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

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

Textbook(s):

T1. Ashraf Rizvi, "Effective Technical Communication" 2nd Edition, McGraw-Hill India, 2018

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 (1 January 2017), Wadsworth Publishing Co Inc.

R2. Whitcomb, Susan Britton. Resume Magic: Trade Secrets of a Professional Resume Writer. JIST Works, 2010.

R3. Carnegie, D. (2009). The Quick and Easy Way to Effective Speaking. Pocket Books.

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
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.

7 Hours

Module I

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 (20012), Operating System Principles, 9th edition, Wiley India Private Limited, New Delhi.
- T2. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

Reference Book(s):

- R1. Andrew S. Tanenbaum (2009), Modern Operating Systems, 3rd edition, Prentice Hall of India, India.
- R2. Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India.

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, 2019, McGraw Hill Education.
R3. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, Oxford University Press.

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, 2019.

Reference Book(s):

R1. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.

R2. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018.

R3. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018.

R4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, Narosa Publishing House, 2018

Web References:

1. <http://nptel.ac.in/courses/106105087/>

Semester II

Course Code: 24CAC202		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: 24CAC203		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,2015.

Reference Book(s):

R1. William Stallings, Data and Computer Communications, 9th Edition, Prentice Hall, 2011.

R2. Larry L. Peterson & Bruce S. Davie, Computer Networks — A systems Approach", 4th Edition, Harcourt Asia / Morgan Kaufmann, 2008.

Web References:

1.<https://nptel.ac.in/courses/106/106/106106091/>

2.<https://www.classcentral.com/course/fundamentals-network-communications-9267>

Course Code: 24CAC204	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.

T2. Web Technologies, Black Book, dreamtech Press.

Reference Book(s):

R1. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India.

R2. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel. Pearson.

Web References:

1. <https://nptel.ac.in/courses/106105084>

Course Code: 24CAC205		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, Looping 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, 2006, Tata McGraw Hill

Reference Book(s):

R1.Bjarne Stroustrup, “The C++ Programming language”, Third edition, Pearson Education.

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>