

Code: CA-201		Paper: Principles of Operating System											Credit: 4			
Contacts Hours/Week: 4		Total Contact Hours: 40														
Course Objectives:																
This course enables the students to:																
1	Learn the components of OS and their working; structure of the OS, the concepts of Virtual Machine.															
2	Understand processes, threads, CPU scheduling, synchronization, and deadlocks.															
3	Learn knowledge of Memory Managements and evaluate the concepts of Virtual Memory															
4	Learn File System and Storage Management concepts.															
5	Learn the concept of Security and Protection plans for Operating system, authentication process etc.															
Course Outcome:																
After the completion of this course, students will be able to:																
CO1	Outline OS components, structure, Virtual Machines, and Unix/Windows architectures.														[BL2]	
CO2	Understand processes, threads, scheduling, synchronization, and deadlocks. Analyze scheduling cases.														[BL4]	
CO3	Understand memory management and analyze virtual memory with case studies.														[BL4]	
CO4	Understand file system and I/O management concepts and evaluate with the help of the case studies.														[BL5]	
CO5	Understand OS security, protection plans, and authentication in Unix and Windows.														[BL2]	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2										2	3	2		
CO2	3	3	3	2	3							2	3	3		
CO3	3	3	3	3	3							2	3	3		
CO4	3	3	3	3	3				2			2	3	3		
CO5	3	2	2	3	3	2	2	3	2	2	2	3	3	3	2	
CA-201	3.00	2.60	2.20	2.20	2.40	0.40	0.40	0.60	0.80	0.40	0.40	2.20	3.00	2.80	0.40	
Module	COURSECONTENT															
1	Basics of Operating System (6L) Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security. Case Study: Unix and Windows Architecture.															
2	Process Management (14L) Processes and Threads: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues. Process Synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: System model, Characterization, Methods for Handling, Prevention, Avoidance, Detection, Recovery. Case Study: Scheduling on Unix and Windows Operating Systems.															
3	Memory Management (9L) Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing. Case Study: Unix Virtual Memory, Windows Virtual Memory.															
4	File Systems and Storage Management (7L) File System: File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, and Free-Space Management. Storage Management: Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, RAID Structure. Case Study: Unix & Windows File Systems.															
5	Security and Protection: (4L) Goals, Principles, Domain of Protection, Access Matrix, Access Control. Case Study: Unix Security, Windows Security.															
Reference Books:																
<ul style="list-style-type: none"> Operating System Concepts Essentials, 10th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley. Modern Operating Systems, 2nd edition, Andrew S. Tanenbaum, Prentice Hall of India. Operating systems, 3rd edition, Deitel & Deitel, Pearson Education, India. 																

Code:CA-202		Paper: Relational Database Management System										
Contacts Hours/Week:4		Total Contact Hours: 40								Credit:4		
Course Objectives:												
This course enables the students to:												
1	Learn database architecture, models, and advantages.											
2	Design E-R diagrams and relational schemas.											
3	Apply normalization and integrity constraints.											
4	Perform data operations using DDL, DML, DCL, and TCL.											
5	Manage transactions and concurrency control.											
Course Outcome:												
After the completion of this course, students will be able to:												
CO1	Understand fundamental concepts of DBMS, database architecture, and data models.(L2)											
CO2	Design relational models using E-R diagrams, relational constraints, and normalization techniques.(L3 & L4)											
CO3	Implement data integrity & minimize redundancy through normalization and dependency analysis.(L4& L5)											
CO4	Implement SQL queries for data definition, manipulation, and control operations.(L3 & L6)											
CO5	Apply transaction management and concurrency control techniques for database consistency.(L3 & L4)											
CO-PO Mapping for CA-202 (Relational Database Management System)												
COs\ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	0	2	0	0	0	0	0	0	1
CO2	2	2	3	0	3	1	0	0	1	0	0	1
CO3	2	1	2	2	2	2	1	0	1	1	0	2
CO4	1	1	2	1	3	1	0	0	1	3	0	1
CO5	1	1	1	2	2	1	3	1	2	0	2	1
Module	COURSECONTENT											
1	Introduction to DBMS (5L) Introduction to Database and DBMS, Database concepts, characteristics, and advantages, Comparison between file systems and databases, Database users and administrators, Database Schema and Instances. Data Models, Relational Data Model, Structure of Relational DB, Various Constraints, Data Independence, Data abstraction, DB architecture with 3 level of abstraction, Client-Server Architecture, Mappings.											
2	Relational Model (5L) Data Modeling: E-R Model, Entity and their types, Attribute, Different Types of Attributes, Relationship and their Types, E-R Diagram, Enhanced E-R Model, Specialization, Generalization, Relational Constraints, Domain Constraint, Key Constraint, Integrity Constraint, Update Operations and Dealing with Constraint Violations, Relational Operations.											
3	Database Integrity And Normalization(10L) Relational Database Integrity, The Keys, Referential Integrity, Entity Integrity, Redundancy and Associated Problems, Single Valued Dependencies, Functional Dependency, Normalization, Rules of Data Normalization, The First Normal Form, The Second Normal Form, The Third Normal Form, Boyce CODD Normal Form. Introduction to The Fourth Normal Form, The Fifth Normal Form, Multi-valued, Lossless join Decomposition.											
4	Relational Model & Structured Query Language (SQL) (10L) Relational algebra and calculus, SQL commands, Data Definition Language(DDL), Data Manipulation Language(DML), Data Control Language(DCL), Transaction Control Language, Queries using Order by, Where, Group by, Nested Queries. Joins, Views.											

5	<p>Transaction and Concurrency Management(6L) Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.</p> <p>Introduction to Concurrency Control in Databases, Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multi-version Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.</p>
6	<p>Introduction to PL/SQL(4L) Introduction to PL/SQL, Variables & Data types, Basic blocks, Conditional & branching statement, Introduction of Cursor, Trigger.</p>
<p>Reference Books:</p> <ul style="list-style-type: none"> • Silverchatz, Korth & Sudarshan-Data Base System Concepts, TMH. • Elmasri, Navathe-Fundamentals of Database Systems, Pearson • CJ date-An Introduction to Database, Addison-Wesley Publishing Company 	

Code: CA-203		Paper: Artificial Intelligence and Machine Learning	
Contact Hours/week: 4		Total Hours: 40Credits: 4	
Course Objectives			
1	Understand the fundamentals, scope, and applications of AI.		
2	Apply problem-solving and search strategies in AI.		
3	Analyze knowledge representation techniques and expert systems.		
4	Implement machine learning models for classification, regression, and clustering.		
5	Evaluate neural networks, reinforcement learning, and ethical AI considerations.		
Course Outcomes (COs)			
Upon successful completion of this course, students will be able to:			
1.	Explain AI concepts, scope, and applications. (L2)		
2.	Apply search strategies and AI problem-solving techniques. (L3)		
3.	Implement machine learning models for various real-world problems. (L3)		
4.	Analyze neural networks and reinforcement learning techniques. (L4)		
5.	Evaluate ethical challenges in AI and ML, including bias and fairness. (L5)		
UNIT 1: Introduction to Artificial Intelligence (8 Hours)			
➤ Definition and Scope of AI			
➤ Applications of AI in Various Domains			
➤ Intelligent Agents: Types and Environments			
➤ AI Problem-Solving: State Space Representation and Problem Formulation, Tic-Tac-Toe			
UNIT 2: Search Strategies and Knowledge Representation (10 Hours)			
➤ Uninformed Search: BFS, DFS, Iterative Deepening Search			
➤ Informed Search: Hill Climbing, A*, Min-Max algorithm, Alpha-Beta pruning, Heuristic Functions			
➤ Knowledge Representation: Propositional Logic, First-Order Predicate Logic (FOPL)			
➤ Expert Systems and Rule-Based Systems			
UNIT 3: Introduction to Machine Learning (6 Hours)			
➤ Basics of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning			
➤ Regression and Classification basics			
➤ Over fitting and Under fitting			
UNIT 4: Supervised & Unsupervised Learning (10 Hours)			
➤ Supervised Learning: Regression : Linear, Polynomial, Logistic Regression			
➤ Classification & Prediction: Decision Trees, k-NN, SVM, Random Forest			
➤ Clustering: k-Means, Hierarchical Clustering			
➤ Dimensionality Reduction			
UNIT 5: Introduction to Neural Networks & Ethical AI-ML Application (6 Hours)			
➤ Basics of Neural Networks (ANN, RNN, BPNN)			
➤ AI in Natural Language Processing (NLP)			
➤ Reinforcement Learning Basics			
➤ Bias and fairness in AI			
Reference Books			
<ul style="list-style-type: none"> • Stuart Russell & Peter Norvig – Artificial Intelligence: A Modern Approach (3rd Edition), Pearson. • Tom M. Mitchell – Machine Learning, McGraw Hill. • Ian Goodfellow, YoshuaBengio, Aaron Courville – Deep Learning, MIT Press. • Sebastian Raschka, VahidMirjalili – Python Machine Learning, Packt Publishing. • Christopher M. Bishop – Pattern Recognition and Machine Learning, Springer. • François Chollet – Deep Learning with Python, Manning Publications. 			

Code: CA-204		Paper: Probability & Statistics								Credit:4		
Contacts Hours/Week:4		Total Contact Hours:40										
Course Objectives:												
This course enables the students to:												
1	Introduce fundamental concepts in probability, including axioms, conditional probability, and Bayes' theorem.											
2	Understand different probability distributions and apply them to real-world problems.											
3	Compute and interpret the central tendency, dispersion, skewness, and kurtosis in datasets.											
4	Develop skills in correlation and regression analysis, including fitting curves using the least squares method.											
5	Learn and apply sampling techniques and statistical hypothesis testing methods in inferential statistics.											
Course Outcome:												
After the completion of this course, students will be able to:												
CO1	Understand and apply the basic concepts of probability, probability theorems, and Bayes' theorem to solve real-world problems.											
CO2	Analyze and solve problems using various probability distributions, including binomial, Poisson, exponential, and normal distributions.											
CO3	Calculate and interpret measures of central tendency, dispersion, skewness, and kurtosis in statistical data.											
CO4	Perform correlation and regression analysis, including the use of the least squares method for curve fitting and model prediction.											
CO5	Understand and apply sampling theory and hypothesis testing methods, including the use of t-tests, chi-square tests, and Student's t-distribution.											
CO-PO Mapping for CA-204 (Probability & Statistics)												
COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	0	0	0	1	1	0	1
CO2	3	3	2	3	2	1	0	0	1	0	1	1
CO3	3	2	2	2	2	2	1	0	1	1	1	2
CO4	2	2	2	2	3	1	1	0	2	2	1	1
CO5	2	2	1	2	3	2	2	1	2	1	2	1
Module												
COURSECONTENT												
1	Introduction to Probability: (8L) Introduction to probability and its importance, Sample space, events, and their types, Axioms of probability, Addition and multiplication theorems, Conditional probability and Bayes' Theorem.											
2	Probability Distributions: (8L) Discrete and continuous random variables, Probability mass function (PMF) and probability density function (PDF), Properties and applications of (Binomial, Poisson, Exponential, Normal distribution).											
3	Basic Statistics: (8L) Measures of Central Tendency: (Mean, median, and mode: Definition, properties, and applications) Measures of Dispersion: (Range, quartile deviation, mean deviation, standard deviation, variation and Coefficient of variation) Skewness and Kurtosis: (Definitions and interpretations).											
4	Statistical Methods: (8L) Correlation (Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient). Regression Analysis (Concept of regression lines (least squares method), Lines of regression (X on Y, Y on X)) Curve Fitting (Fitting curves by the method of least squares).											
5	Sampling Theory: (8L) Sampling Distributions: (Introduction to sampling distributions and the importance in statistical inference, Standard error and its significance, Type-I and Type-II errors: Definitions and impact on hypothesis testing). Hypothesis Testing: (Test of hypothesis for means (Z-test, t-test), Use of Student's t-distribution in hypothesis testing, Chi-square distribution: Test of goodness of fit).											

Reference Books:

- Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
- Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia
- Manish Sharma & Amit Gupta, The Practice of Business Statistics, Khanna Publishing House, New Delhi

Code: CA-E205A(Old)/CA-205 Paper: Web Enabled JAVA Programming		Credit:3
Contacts Hours/Week: 3	Total Contact Hours: 30	
Course Objectives: This course enables the students to:		
1	Provide knowledge and expertise to become a proficient data scientist.	
2	Demonstrate an understanding of data collection and management techniques.	
3	Apply statistical and machine learning concepts for data science.	
4	Critically evaluate data visualizations to communicate insights.	
5	Explore applications and recent trends in data science.	

Course Outcome: After the completion of this course, students will be able to:		
CO1	Explain how JSP, Servlets, and JSF frameworks work.	[BL5]
CO2	Build dynamic web applications using JSP, Servlets, and databases.	[BL6]
CO3	Create interactive websites using AJAX.	[BL3]
CO4	Find and fix errors in programs using debugging techniques.	[BL1]
CO5	Analyze real-world problems using data science techniques	[BL4]

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2							1	2	3	
CO2	3	2	2	1	2				1		1	1	2	3	2
CO3	3	3	3		2							1	3	2	
CO4	3	2	3	2	2					1	1	1	3	2	1
CO5	3	2	3	2	3				1	2	1	1	2	3	2
CA-E205A	3	2	3	2	2				1	2	1	1	2	3	2

Module	COURSE CONTENT
1	<p>Unit-1 Core Java Overview: (6L) Object oriented concepts, Exception Handling, Multi-Threading Introduction to JDBC: Overview of JDBC API, The Java.sql package, JDBC Drivers, Executing SQL commands using JDBC Drivers, static and dynamic Execution of SQL statements, Execution of Stored Procedures using JDBC. Introduction to Transactions and Transaction Methods. Introduction to JNDI, Introduction to Data Source and Connection pooling, Introduction to Web Applications, Web Servers Overview of J2EE Technologies.</p>
2	<p>Unit-2: JDBC Programming (6L) The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQL Exception Class, The SQL Warning Class, The Statement Interface, Prepared Statement, Callable Statement The Result Set Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, Result Set Meta Data, Executing SQL Updates, Transaction Management.</p>

3	<p>Unit-3: Servlet API and Overview (8L) Servlet Model: Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor Servlet Context and Servlet Config interface, Attributes in Servlet, Request Dispatcher interface The Filter API: Filter, Filter Chain, Filter Config Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting</p>
4	<p>Unit-4: Java Server Pages (8L) JSP Overview: The Problem with Servlets, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling, JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing.</p>
5	<p>Unit-5: Java Server Faces2.0 (7L) Introduction to JSF, JSF request processing Life cycle, JSF Expression Language, JSF Standard Component, JSF Face lets Tag, JSF Convertor Tag, JSF Validation Tag, JSF Event Handling and Database Access, JSF Libraries: Prime Faces</p>
6	<p>Unit-6: Hibernate 4.0 (4L) Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language</p>
7	<p>Unit-7: Java Web Frameworks: Spring MVC (3L) Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, Managing Transaction</p>

Reference Books:

- Black Book “Java server programming” J2EE, Kathy walrath, Dream Tech
- Complete Reference J2EE, - James Keogh McGraw publication
- Professional Java Server Programming, - Subrahmanyam Allamaraju, Cedric Buest Wiley
- Core Java, Volume II: Advanced Features - Cay Horstmann and Gary Cornell Pearson
- Java Persistence with Hibernate - Christian Bauer, Gavin King
- Spring in Action - Craig wallsManning Publication
- Hibernate - Jeff Linwood and Dave Minter Beginning Après publication
- Java Server Faces in Action Kito D. Mann Manning Publication
- JDBC™ API Tutorial and Reference, Maydene Fisher, Jon Ellis, Jonathan Bruce Addison Wesley
- Beginning JSP - JSF and Tomcat, Giulio Zambon - Apress
- JSF2.0 CookBook - Anghel Leonard PACKT publication.
- Mining of Massive Datasets, Jure Leskovek, Anand Rajaraman & Jeffrey Ullman, 3rd Edition, Cambridge University Press, 2020

Code: CA-E205B(Old)/CA-206 Paper: Web Technology using PHP															
Contacts Hours/Week: 3 Total Contact Hours: 30 Credit:3															
Course Objectives:															
This course enables the students to:															
1	Introduce the importance of PHP in web page design.														
2	Understand the features like functions, forms in PHP.														
3	Understand Files, OOPs concepts, Cookies, Sessions and Data base.														
4	handle requests on the server with JavaScript and jQuery														
Course Outcome:															
After the completion of this course, students will be able to:															
CO1	Understand web technology using PHP and apply PHP knowledge to handle HTML form.														
CO2	Understand and apply Decision, Loops, Functions, Array and Exception Handling concepts using PHP server concept.														
CO3	Analyze and create database connectivity with MySQL Server and other DBMS operation.														
CO4	Apply JavaScript & jQuery in web program.														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	3	2
CO2	3	3	3	2	1	1	1	1	2	2	2	2	3	3	2
CO3	3	3	3	3	2	2	2	1	1	2	2	3	3	3	2
CO4	3	3	3	3	2	2	2	1	1	2	2	3	3	3	2
CA-E 205B	3	3	3	3	2	2	2	2	1	1	2	2	3	3	3
Module	COURSECONTENT														
1	Introduction to Web Technology & implementation of PHP Programs: (7L) Evaluation of PHP. Basic Syntax. Defining variables and constants. PHP Data type Operator and Expression. Basics of HTML: Form Creation, Handling of Forms, Submission of Forms. POST & GET method.														
2	Handling Html Form With PHP: (6L) Capturing Form. Data Dealing with Multi-value files. Generating File uploaded form. Redirecting a form after submit.														
3	Decisions, Functions, String, Array & Exception Handling: (12L) Making Decisions. Doing Repetitive task with looping. Mixing Decisions and looping with Html What is a function? Cookies, Session and in-built functions. Creating and accessing String. Searching & Replacing String. Formatting String. String Related Library function. PHP Array. Creating index based and Associative array. Accessing array Element. Looping with Index based array. Looping with associative array using each () and foreach(). Some useful Library function. Understanding Exception and error. Try, catch, and throw.														
4	Database Connectivity with MySQL: (7L) Introduction to RDBMS. Connection with MySQL Database. Performing basic database operation (DML) (Insert, Delete, Update, Select). Setting query parameter. Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.).														

5	<p>Java Script & jQuery: (8L) Introduction to JavaScript. Three ways to use JavaScript. Working with events Client-side Validation. Introduction to jQuery. Validation using jQuery. JQuery Forms. JQuery Examples.</p>
<p>Reference Books:</p> <ul style="list-style-type: none"> • The Joy of PHP Programming: A Beginner’s Guide to Programming Interactive Web Applications with PHP and MySQL. Alan Forbes, Fifth Edition, Plum Island • Beginning Web Programming, Jon Duckett, WROX • Open Source for the Enterprise: Managing Risks, Reaping Rewards, DanWoods and Gautam Guliani, O’Reilly, Shroff Publishers and Distributors, 2005. • The Complete Reference PHP Covers PHP 5.2, Steven Holzner, Tata McGraw-Hill Edition 2008. 	

Code: CA-E205C(Old)/CA-207 Paper: Android Application Development															
Contacts Hours / Week: 3												Total Contact Hours: 30			Credit: 3
Course Objectives: This course enables the students to:															
1	Provide a foundation in Android architecture and activity lifecycle for effective app component management.														
2	Enable students to design interactive and visually appealing UIs using Android's UI components and layouts.														
3	Teach students to manage databases, interact with web services, and integrate Firebase for real-time data.														
4	Equip students to integrate maps, location, graphics, and background services to enhance apps.														
5	Guide students in preparing, publishing, and maintaining Android apps on the Google Play Store.														
Course Outcome: After the completion of this course, students will be able to:															
CO1	Understand Android architecture, activities and their life cycle.														[BL2]
CO2	Apply the knowledge to design user interface using Android UI and Component.														[BL3]
CO3	Manage system database, remote database operations using web services and Firebase.														[BL3]
CO4	Apply knowledge of map, location services, Graphics, android system and background services.														[BL6]
CO5	Publish and distribute Android Application.														[BL6]
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3							2	3	2	
CO2	3	3	3		3				2	2		3	3	3	
CO3	3	3	3	2	3				2	2		3	3	3	
CO4	3	3	3	3	3				2	2		3	3	3	
CO5	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CA-E205C	3.00	2.80	2.40	1.60	3.00	0.40	0.40	0.40	1.80	1.80	0.60	2.80	3.00	2.80	0.60
Module	COURSE CONTENT														
1	Introduction to Android Architecture and Activities Lifecycle (6L) Overview of Android Architecture: Components of Android System (Linux Kernel, Libraries, Application Framework, etc.), Android SDK and development tools (Android Studio, AVD); Activities and their Role in an Android Application; Activity Lifecycle: onCreate(), onStart(), onResume(), onPause(), onStop(), onDestroy(); Managing Multiple Activities and Intents; Application Components: Activities, Services, Broadcast Receivers, and Content Providers; Application Context and Managing Application State.														
2	Designing User Interfaces with Android UI Components (7L) Introduction to Android UI Components: Views, View Groups; Layouts: Linear Layout, Relative Layout, Constraint Layout, Table Layout; UI Widgets: Text View, Button, Edit Text, Image View, List View, RecyclerView; Event Handling: Handling Button Clicks, Touch Events, Gesture Detection; Customizing UI Components with Styles and Themes; Android UI Design Best Practices; Android Material Design Guidelines														
3	Database Management and Web Services Integration (7L) Local Database: SQLite in Android: Database Creation, Insertion, and Retrieval, Cursor, Content Providers; Using Shared Preferences for Simple Data Storage; Introduction to Remote Databases: Connecting to Web Services (REST ful APIs); Working with JSON and XML Data Formats; Firebase Integration: Firebase Authentication, Firebase Real time Database, Cloud Fire store; Syncing Data with Remote Databases.														
4	Location Services, Graphics, and Background Services (6L) Google Maps API: Integrating maps, adding markers, and map navigation; Location Services: Getting current location, Geofencing; Working with Graphics: Bitmap, Canvas, and Drawing APIs; Background Services and their Use Cases: Async Task, Services, and Work Manager; Notifications: Creating and displaying notifications; Multithreading and Async Programming in Android.														

5

Publishing and Distributing Android Applications

(4L)

Preparing Android Applications for Release: Signing APK, optimizing code; Configuring App Permissions and Proguard for Obfuscation; Publishing on Google Play Store: Account setup, app description, and APK upload; App Monetization Strategies: Ads, In-App Purchases; Updating and Maintaining Android Applications; Handling User Feedback and Analytics Integration.

Reference Books:

- Android Programming: The Big Nerd Ranch Guide, 7th Edition, Bill Phillips, Chris Stewart, and Kristin Marsicano, Big Nerd Ranch Guides, 2019.
- Professional Android, 4th Edition, Reto Meier, Ian Lake, Wrox, 2018.
- Beginning Android Programming with Android Studio, 4th Edition, J.F. DiMarzio, Wiley, 2016.
- Android Cookbook: Problems and Solutions for Android Developers, 2nd Edition, Ian F. Darwin, O'Reilly Media, 2017.

Code: CA-E205D(Old)/CA-208 Paper: Web Technology using ReactJS	
Contacts Hours/Week:3	Total Contact Hours:30
Credit:3	
Course Objectives:	
This course enables the students to:	
1	Be familiar with the basic HTML & CSS
2	Be familiar with the basic of JavaScript
3	Be familiar with the basic implementation of REACT JS
Course Outcome:	
After the completion of this course, students will be able to:	
CO1	Understand the functionalities of HTML, CSS.
CO2	Understand the functionalities of client-side Javascript application development and the React library
CO3	Create a responsive web application
Module	COURSECONTENT
1	FRONT END TECHNOLOGY Introduction to Front End - HTML & CSS - HTML Forms & Inputs
2	JAVASCRIPT BASICS Introduction to Programming in JavaScript - Variables and Data Types - Functions in JavaScript - Working with Strings & Numbers - Application Logic & Loops Introduction to Arrays & Objects - Working with Arrays - Working with Objects - Variable Types & Scoping - Error Handling - Asynchronous JavaScript
3	REACT JS Setting up React environment, Create React App & Introduction to JSX - Organizing Code & Creating a Hello World Application,
4	REACT COMPONENTS AND STATES React Basics: Components with States & Props - Passing Static & Dynamic Data between Components - Event Handling, Forms – controlled components, submission, validation, Conditional rendering – if, ternary, && Lists and keys. Importance of keys
5	WORKING WITH DATA Introduction to AJAX & Asynchronous Calls - Introduction to Axios& Service Calls - Fetching Data using API Calls - Brief Introduction to Redux - Redux Purpose and Core Concepts (Store, Actions, Reducers)
Reference Books:	
<ul style="list-style-type: none"> • Anthony Accomazzo, Nate Murray, Ari Lerner .Fullstack React The Complete Guide to ReactJS and Friends,Paperback • HTML and CSS Design and Build WebsitesBy Jon Duckett,Paperback 	

Code: CA-292		Paper: Relational Database Management System Lab								Credit: 2	
Contacts Hours/Week: 4		Total Contact Hours: 40									
Course Objectives: This course enables the students to:											
1	Learn database schema creation, SQL data types, and constraints.										
2	Apply DDL, DML, DCL, and TCL commands for database management.										
3	Use filtering, joins, and nested queries to retrieve and manipulate data.										
4	Implement relational algebra, SQL functions, and complex query structures.										
5	Create stored procedures, triggers, and cursors for database automation.										
Course Outcome: After the completion of this course, students will be able to:											
CO1	Understand fundamental SQL concepts, database schema creation, and data definition using DDL. (L2)										
CO2	Apply DML and DCL commands to manipulate, retrieve, and control database access. (L3)										
CO3	Write efficient SQL queries using filtering, joins, and nested queries to retrieve meaningful data. (L4)										
CO4	Implement relational algebra operations, advanced SQL functions, and complex query structures. (L5)										
CO5	Develop PL/SQL programs with cursors, triggers, and stored procedures for efficient database management. (L6)										
CO-PO Mapping for CA-292 (RDBMS Lab)											
COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	0	3	1	0	0	0	0	1
CO2	2	2	2	1	3	1	0	0	1	1	1
CO3	2	1	2	3	3	2	1	0	1	2	1
CO4	1	1	2	2	3	1	0	0	1	3	1
CO5	1	1	1	2	3	2	2	1	2	1	2
Module											
COURSECONTENT											
1	Introduction to SQL & Data Definition Language (DDL): (8L) Basics of SQL and its importance in DBMS, Database creation and schema definition, SQL data types and constraints. Creating tables (CREATE TABLE), Modifying tables (ALTER TABLE), Dropping tables (DROP TABLE), Creating and managing views.										
2	Data Manipulation & Control in SQL: (8L) Inserting data (INSERT INTO), Updating data (UPDATE), Deleting data (DELETE FROM), Retrieving data (SELECT) Granting and revoking permissions (GRANT, REVOKE), Managing transactions (COMMIT, ROLLBACK, SAVEPOINT)										
3	Querying and Filtering Data: (10L) Filtering data using WHERE, ORDER BY, and GROUP BY, Aggregation functions (COUNT, SUM, AVG, MIN, and MAX), Using HAVING for group filtering. Types of joins: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN, SELF JOIN, CROSS JOIN, Writing nested and correlated sub-queries.										

4	<p>Relational Algebra & Advanced SQL Operations: (7L) Mapping relational algebra operations to SQL queries, Implementing UNION, INTERSECT, and EXCEPT. String functions (UPPER, LOWER, SUBSTRING, REPLACE), Date and time functions (NOW, DATEADD, DATEDIFF).</p>
5	<p>PL/SQL Programming: (7L) Basics of PL/SQL programming, Writing PL/SQL blocks (DECLARE, BEGIN, EXCEPTION, END), Case statements and conditional expressions (CASE, IF), Looping. Cursors (Implicit & Explicit), Triggers and stored procedures.</p>
<p>Reference Books:</p> <ul style="list-style-type: none"> • Feuerstein-Oracle PL/SQL Programming, SPD/O'REILLY • Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publications 	

Code: CA-293		Paper: Artificial Intelligence with Machine Learning Lab		
Contacts Hours/Week: 4		Total Contact Hours: 40		Credit:2
Course Objectives:				
1.	Understand Python programming fundamentals and essential libraries for AI & ML.			
2.	Apply AI problem-solving techniques and search algorithms using Python.			
3.	Analyze machine learning concepts, data preprocessing and model building techniques.			
4.	Implement classification, regression, and clustering models for real-world applications.			
Course Outcomes (COs)				
1.	Demonstrate proficiency in Python for AI & ML, including data manipulation using NumPy and Pandas.			(L3)
2.	Implement AI search algorithms to solve basic problem-solving tasks.			(L3)
3.	Analyze machine learning models, preprocessing techniques, and performance metrics.			(L4)
4.	Evaluate supervised and unsupervised learning models, including hyper-parameter tuning and clustering techniques.			(L5)
Syllabus module wise:				
Introduction to Python for AI & ML (6 hours) [CO1]				
<ul style="list-style-type: none"> • Python basics: Variables, data types, control structures, functions • Introduction to NumPy, Pandas for data manipulation 				
Introduction to AI Concepts (8 hours) [CO2]				
<ul style="list-style-type: none"> • Overview of AI, Intelligent Agents, Problem-solving paradigms • Search algorithms: Breadth-First Search, Depth-First Search • Basic search problems and solving them using Python 				
Machine Learning Overview (6 hours) [CO3]				
<ul style="list-style-type: none"> • Overview of ML: Types of learning (Supervised, Unsupervised, Reinforcement Learning) • Introduction to classification and regression • Dataset preparation and pre processing 				
Supervised Learning – Classification & Regression Techniques (10 hours) [CO4]				
<ul style="list-style-type: none"> • Logistic Regression, K-Nearest Neighbors (KNN), Naive Bayes Classifier • Model evaluation techniques (Accuracy, Precision, Recall, F1-Score, Confusion Matrix) • Hyper parameter tuning and cross-validation 				
Unsupervised Learning and Clustering (10 hours) [CO5]				
<ul style="list-style-type: none"> • Introduction to clustering: K-Means, DBSCAN, Hierarchical clustering • Dimensionality reduction techniques (PCA) • Applications of clustering in real-world scenarios 				

Code: CA-295	Paper: Web Enabled JAVA Programming Lab	Credit: 3
Contacts Hours/Week: 3	Total Contact Hours: 30	
Course Objectives:		
This course enables the students to:		
1	Provide knowledge and expertise to become a proficient data scientist.	
2	Demonstrate an understanding of data collection and management techniques.	
3	Apply statistical and machine learning concepts for data science.	
4	Critically evaluate data visualizations to communicate insights.	
5	Explore applications and recent trends in data science.	

Course Outcome:		
After the completion of this course, students will be able to:		
CO1	Explain how JSP, Servlets, and JSF frameworks work.	[BL5]
CO2	Build dynamic web applications using JSP, Servlets, and databases.	[BL6]
CO3	Create interactive websites using AJAX.	[BL3]
CO4	Find and fix errors in programs using debugging techniques.	[BL1]
CO5	Analyze real-world problems using data science techniques.	[BL4]

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2							1	2	3	
CO2	3	2	2	1	2				1		1	1	2	3	2
CO3	3	3	3		2							1	3	2	
CO4	3	2	3	2	2					1	1	1	3	2	1
CO5	3	2	3	2	3				1	2	1	1	2	3	2
CA-E205A	3	2	3	2	2				1	2	1	1	2	3	2

Module	COURSE CONTENT
1	Module I: Core Java and JDBC (6 Hours) <ul style="list-style-type: none"> Introduction to Java-based web technologies. Implementing JDBC for database connectivity. Executing SQL queries using JDBC and handling exceptions.
2	Module II: Servlets and Web Application Development (6 Hours) <ul style="list-style-type: none"> Creating and deploying Servlets. Implementing session tracking techniques (Cookies, URL Rewriting, and Session Management). Developing dynamic content generation using Servlets.
3	Module III: Java Server Pages (JSP) (6 Hours) <ul style="list-style-type: none"> Implementing JSP for dynamic web applications. Handling user inputs and form processing in JSP. Integrating JSP with database operations.
4	Module IV: Java Server Faces (JSF) and AJAX (6 Hours) <ul style="list-style-type: none"> Introduction to JSF components and navigation. Using AJAX with JSP and Servlets for asynchronous updates. Validating user inputs using JSF and Expression Language.

5	<p data-bbox="264 85 778 114">Module V: Hibernate and Spring MVC</p> <p data-bbox="1329 85 1453 114">(6 Hours)</p> <ul data-bbox="312 159 1254 259" style="list-style-type: none">• Setting up Hibernate for ORM (Object-Relational Mapping).• Implementing Spring MVC for enterprise web applications.• Managing transactions and database connections using spring and Hibernate.
<p data-bbox="113 349 236 378">Textbooks:</p> <ol data-bbox="145 387 1114 450" style="list-style-type: none">1. Black Book “Java Server Programming” J2EE, Kathy Walrath, Dream Tech.2. Complete Reference J2EE—James Keogh, McGraw-Hill Publication. <p data-bbox="113 495 308 524">Reference Books:</p> <ol data-bbox="145 533 1267 669" style="list-style-type: none">1. Professional Java Server Programming—Subrahmanyam Allamaraju, Cedric Buest, Wiley.2. Java Persistence with Hibernate—Christian Bauer, Gavin King.3. Spring in Action—Craig Walls, Manning Publication.4. JSF 2.0 Cookbook—Anghel Leonard, PACKT Publication.	

Code: CA 296		Paper: Web Technology using PHP Lab										Credit: 2			
Contacts Hours/Week: 4		Total Contact Hours: 40													
Course Objectives:															
This course enables the students to:															
1	Design and develop static and dynamic web pages.														
2	Familiarize with Client-Side Programming, Server-Side Programming.														
3	Learn Database Connectivity to web applications.														
4	Learn with handle requests on the server with JavaScript, jQuery and AJAX														
Course Outcome:															
After the completion of this course, students will be able to:															
CO1	Ability to understand web design using HTML & CSS and apply in different application using PHP programming.														
CO2	Ability to create and apply the connectivity with MySQL server and other DBMS activity, ability to evaluate web pages using JavaScript & jQuery and ability to create connection of forms using AJAX.														
CO PO Mapping:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO1	PSO2	PSO 3
CO1	2	3	3	3	2	0	1	0	0	0	0	3	2	0	0
CO2	2	3	3	3	2	0	1	0	0	0	0	3	2	0	0
Module															
COURSECONTENT															
1	Fundamental of Web Design: HTML: Introduction, Editor(Macromedia Dreamweaver, VS Code/ Sublime), Element, Attribute, Head, Heading, Paragraph, Style, Formatting, Quotation, Comment, Color, CSS, Link, Image, Table, List, Block & Inline, Class, ID, Iframe, Script, File path, Layout, Code, Entity, Symbol, Emoji, Charset, Forms, Form Attributes, Elements, Input types, Input Attributes. CSS: Introduction, Selector, External-Internal-Inline CSS, Comments, Color, Background, Border, Margin, Padding, Height, Width, Box model, Outline, Text, Font, Icon, Link, List, Table, Display, Max width, Position, Overflow, Float, Inline-bock, Align, Pseudo-class, Pseudo-element, Opacity, Navigation Bar, Dropdowns, Image gallery, Image sprites, Text Effect, Web Fonts, Transition, Animation, Tooltip, Style Image, Button etc.														
2	Introduction to Web Technology & implementation of PHP Programs &Knowing about Connection Strings and Functions: Implementing basic PHP programs with Form, Loop, Functions Array and Strings.														
3	Handling Html Form With PHP: Capturing Form. Data Dealing with Multi-value files. Generating File uploaded form. Redirecting a form after submission.														
4	Database Connectivity with MySQL: Programs implementing insert, display, update and delete data and other DBMS query in MYSQL table by HTML forms using PHP.														
5	JavaScript and jQuery: Validating forms using JAVASCRIPT and Fetching data from one form to another form using jQuery.														

Code: CA-297		Paper: Android Application Development Lab													
Contacts Hours / Week: 4		Total Contact Hours: 40											Credit: 2		
Course Objectives: This course enables the students to:															
1	Introduce students to Android development, including core components, architecture, and app lifecycle.														
2	Teach students to design and implement UIs using Android's native components and layouts.														
3	Enable students to manage databases, work with web services, and integrate Firebase into Android apps.														
4	Help students integrate location services, maps, graphics, and background services into apps.														
5	Guide students in publishing and distributing apps on the Google Play Store.														
Course Outcome: After the completion of this course, students will be able to:															
CO1	Understand and implement Android architecture, activities, and lifecycle in apps.													[BL3]	
CO2	Design and implement UIs with Android's native components in real-world scenarios.													[BL6]	
CO3	Implement database management, integrate web services, and use Firebase for real-time storage.													[BL3]	
CO4	Apply location services, map integration, graphics, and background services in apps.													[BL6]	
CO5	Prepare and publish Android applications to the Google Play Store.													[BL6]	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3							2	3	2	
CO2	3	3	3		3				2	2		3	3	3	
CO3	3	3	3	2	3				2	2		3	3	3	
CO4	3	3	3	3	3				2	2		3	3	3	
CO5	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CA-E295C	3.00	2.80	2.40	1.60	3.00	0.40	0.40	0.40	1.80	1.80	0.60	2.80	3.00	2.80	0.60
Module	COURSE CONTENT														
1	Understanding Android Architecture and Activity Lifecycle (6L) Exercise 1: Create a basic Android app with multiple activities. Implement Intents for navigation between activities. Exercise 2: Implement the activity lifecycle by overriding methods (onCreate(), onStart(), onPause(), etc.) and demonstrating activity state transitions. Exercise 3: Use Logcat to monitor and debug activity lifecycle transitions.														
2	Designing User Interfaces with Android UI Components (8L) Exercise 1: Design a login screen using Edit Text, Button, and Text View. Exercise 2: Create a simple registration form with various UI components like Radio Button, Check Box, Spinner, and Date Picker. Exercise 3: Build a dashboard screen with RecyclerView to display dynamic lists of items. Exercise 4: Implement event handling in UI components (Button click, Text Input change).														
3	Database Management and Web Services Integration (10L) Exercise 1: Create a SQLite database in an Android app and perform CRUD operations (Create, Read, Update, Delete) using SQLite Open Helper. Exercise 2: Use Shared Preferences to store and retrieve simple user data (e.g., username). Exercise 3: Fetch data from a public API (using Async Task or Retrofit) and display it in a List View. Exercise 4: Integrate Firebase Real time Database and perform operations like adding, reading, and updating data in Firebase. Exercise 5: Set up Firebase Authentication for user login and registration.														

4	<p>Location Services, Graphics, and Background Services (10L)</p> <p>Exercise 1: Implement Google Maps in an Android app, adding markers for specified locations.</p> <p>Exercise 2: Use Android's location service (Fused Location Provider) to get the user's current location and display it on the map.</p> <p>Exercise 3: Create a background service that performs periodic tasks like fetching data in the background and sending notifications.</p> <p>Exercise 4: Develop a simple animation (e.g., moving an object across the screen) using Android's Canvas API.</p> <p>Exercise 5: Use Work Manager to schedule and handle background tasks such as uploading data in the background.</p>
5	<p>Publishing and Distributing Android Applications (6L)</p> <p>Exercise 1: Prepare an Android app for release by signing the APK and optimizing the app for performance.</p> <p>Exercise 2: Publish a sample app on the Google Play Store, setting up the app's description, screenshots, and other metadata.</p> <p>Exercise 3: Implement app updates by modifying existing apps and pushing updates to the Play Store.</p> <p>Exercise 4: Add Firebase Analytics to track user events and app performance metrics.</p>
<p>Reference Books:</p> <ul style="list-style-type: none"> • Android Programming: The Big Nerd Ranch Guide, 7th Edition, Bill Phillips, Chris Stewart, and Kristin Marsicano, Big Nerd Ranch Guides, 2019. • Professional Android, 4th Edition, Reto Meier, Ian Lake, Wrox, 2018. • Beginning Android Programming with Android Studio, 4th Edition, J.F. DiMarzio, Wiley, 2016. • Android Cookbook: Problems and Solutions for Android Developers, 2nd Edition, Ian F. Darwin, O'Reilly Media, 2017. 	

Code: CA-298		Paper: Web Technology using ReactJS Lab	
Contacts Hours/Week:4		Total Contact Hours:40	
Credit:2			
Course Objectives:			
This course enables the students to:			
1	Be familiar with the basics of HTML & CSS.		
2	Be familiar with the fundamentals of JavaScript.		
3	Implement ReactJS for building modern web applications.		
Course Outcome:			
After the completion of this course, students will be able to:			
CO1	Understand the functionalities of HTML and CSS.		
CO2	Develop client-side JavaScript applications using the React library.		
CO3	Create a responsive web application using ReactJS.		
Module	COURSECONTENT		
1	Front-End Technology (4 Hours): Introduction to Front-End Development, HTML Basics: Structure, Forms, and Inputs, CSS Styling and Layouts, Hands-on: Creating a simple responsive webpage		
2	JavaScript Basics (7 Hours): Introduction to JavaScript, Variables, Data Types, and Operators, Functions in JavaScript, Working with Strings & Numbers, Loops, Conditionals, and Application Logic, Arrays & Objects, Error Handling, Asynchronous JavaScript, Hands-on: Form validation using JavaScript		
3	Getting Started with ReactJS (5 Hours): Setting up the React Environment (Node.js, npm, Create React App), Introduction to JSX and Virtual DOM, Organizing Code & Creating a "Hello World" React Application, Hands-on: Creating and rendering React components		
4	React Components and States (7 Hours): Functional vs. Class Components, States and Props in React, Passing Static & Dynamic Data between Components, Event Handling in React, Forms in React: Controlled Components, Submission, Validation, Conditional Rendering (if, ternary, && operators), Lists, and Keys, Hands-on: Building a simple interactive form with state management		
5	Working with Data & APIs (7 Hours): Introduction to AJAX & Asynchronous Calls, Introduction to Axios & Fetch API for Service Calls, Fetching and Displaying Data using API Calls, Introduction to Redux: Purpose and Core Concepts (Store, Actions, Reducers), Hands-on: Fetching user data from a public API and displaying it in a React component		
Reference Books:			
<ul style="list-style-type: none"> • Anthony Accomazzo, Nate Murray, Ari Lerner Fullstack React The Complete Guide to ReactJS and Friends Paperback • HTML and CSS Design and Build Web sites By Jon Duckett ,Paperback 			