MCA I ,II & III SEM SYLLABUS (2024-2026 BATCH)

Course Code: PCAA101C	**Programming and Problem Solving in C**	**Credits : 04**
Hours/Week (L:T:P) : 2:0:2		**CIE Marks : 50**
Total Hours of Pedagogy (Theory + Lab): 40 hours Theory + 10 hours Lab		**SEE Marks : 50**
Course Type: Integrated(IPCC)		

Course Objectives:

1. Implement the constructs of C Language.
2. Construct C Programs using basic programming constructs
3. Develop C programs using arrays and strings
4. Organize modular applications in C using functions

Integrate pointers and structures in C applications and Execute input/output and file handling in C

Module-1	**8 Hrs.**
BASICS OF C PROGRAMMING: Problem solving using Algorithm and flowchart, Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associatively - Expressions - Input/ Output statements, Assignment statements – Decision making statements - Switch statement.	
Module-2	**8Hrs.**
Jumping and Looping statements – Preprocessor directives - Compilation process. **ARRAYS** Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays .	
Module-3	**8 Hrs.**
STRINGS: String operations: length, compare, concatenate, copy –**FUNCTIONS:** Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) Recursion, Binary Search using recursive functions –	
Module-4	**8 Hrs.**
POINTERS: Pointer operators Pointer arithmetic Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference. **STRUCTURES:** Structure - Nested structures – Pointer and Structures – Array of structures Self referential structures typedef	
Module-5	**8 Hrs.**
Union - Storage classes and Visibility. **FILE PROCESSING** Files Types of file processing: Sequential access, Random access Sequential access file - Random access file - Command line arguments.	

Practical Module

Sl. NO	**Experiments**
1	Simulation of a Simple Calculator.
2	Implement Binary Search on Integers
3	Sort the given set of N numbers using Bubble sort.
4	Implement Matrix multiplication and validate the rules of multiplication.
5	An electricity board charges the following rates for the use of electricity: for the first 200 units 80 paisa per unit for the next 100 units 90 paisa per unit: beyond 300 units Rs 1 per unit. All users are charged a minimum of R 100 as meter

	charge. If the total amount is more than Rs 400, then an additional surcharge of 15% of total Amount is charged. Write a program to read the name of the user, number of units consumed and print out the charges.
6	Write functions to implement string operations such as compare, concatenate, and find string length. Use the parameter passing techniques.
7	Implement structures to read, write and compute average- marks of the students, list the students scoring above and below the average marks for a class of N students.
8	Write a C program to copy a text file to another, read both the input file name and target file name.

Suggested Learning resources

TEXT BOOKS:

1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016
2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.

2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.

3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second 5. Edition, Oxford University Press, 2013.

5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

Course Outcomes:

CO1: Demonstrate knowledge on C Programming constructs
CO2: Develop simple applications in C using basic constructs
CO3: Design and implement applications using arrays and strings
CO4: Develop and implement modular applications in C using functions
CO5: Develop applications in C using structures and pointers

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3							
CO2			2					
CO3								2
CO4								2
CO5				3				

Course Code: PCAA102C	**Discrete Mathematics and Graph Theory**	**Credits : 03**
Hours/Week (L:T:P) : 2:1:0		**CIE Marks : 50**
Total Hours of Pedagogy (Theory + Lab): 40		**SEE Marks : 50**
Course Type: Theory		

Course Objectives:

1. Analyze basic concepts of mathematical logic for analyzing propositions and proving theorems
2. Apply sets and their operations algebraically to solve real-world problems.
3. Examine the basics of graph theory and their various properties.
4. Model problems using graphs and to solve these problems algorithmically.
5. Apply graph theory concepts to solve real world problems in Computer Networking, Telecommunication Infrastructure, Transportation etc.

Module-1	**8 Hrs.**
Basic Structures: Sets, Principle of Inclusion, Exclusion and Pigeonhole principle Functions and Matrices: Eigen values and Eigenvectors.	
Module-2	**8 Hrs.**
Mathematical Logic, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs	
Module-3	**8 Hrs.**
Introduction to Graphs: Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.	
Module-4	**8 Hrs.**
Eulerian and Hamiltonian graphs: Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation.	
Module-5	**8 Hrs.**
Graph Colouring: Colouring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problems and Five colour problem. Greedy colouring algorithm.	

Suggested Learning resources

Text Books :

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill publications 7th edition.
2. Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dovers Publications, 2016
3. J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 1 st edition, 2008.

References Books

1. J.K Sharma "Discrete Mathematics", Mac Millian Publishers India, 3rd edition,2011
2. Garry Chartand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.

Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.

Course Outcomes:

CO1: Apply the fundamentals of set theory and functions to perform various set operations to the real world problems.

CO2: Understand basic concepts of mathematical logic for analyzing propositions and proving theorems and its operations. Algebraically for solving real world problems.

CO3: Understand the basics of graph theory and their various properties

CO4: Model problems using graphs and to solve these problems algorithmically

CO5: Apply graph theory concepts to solve real world problems in Computer Networking, Telecommunication Infrastructure, Transportation etc

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3							
CO2		2						
CO3			2					
CO4		2						
CO5	2							

Course Code: PCAA103C	**Database Management Systems (DBMS)**	**Credits : 03**
Hours/Week (L:T:P) : 3:0:0		**CIE Marks : 50**
Total Hours of Pedagogy (Theory + Lab): 40		**SEE Marks : 50**
Course Type: Theory		

Course Objectives:

1. Analyze the basic concepts and the applications of database systems.
2. Evaluate the different issues involved in the design and implementation of Database System.
3. Explain the basic concepts of relational data model, entity relationship model, relational database design, relational algebra and database language SQL.
4. Design and build simple applications using database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS

Module-1	8 Hrs.

Databases and Database Users: Introduction, Characteristics of the Database Approach, Actors on the scene, Workers behind the scene, Advantages of using the DBMS approach, When not to use a DBMS, **Database System Concepts and Architecture**: Data models, schemas and instances, Three-schema architecture and data independence, Database language and interfaces, The database system environment.

Data Modelling Using the Entity-Relationship(ER) Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship Types, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues.

Module-2	8 Hrs.

The Relational Data Model and Relational Database Constraint: Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations. Relational Algebra and Relational Calculus: Unary Relational Operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, Additional Relational Operations, Overview of Tuple Relational Calculus and Domain Relational Calculus; Examples of Queries in Relational Algebra. **Relational Database Design Using ER and EER to-Relational Mapping:** Relational Database Design Using ER to Relational Mapping.

SQL-99: Schema Definition, Constraints, Queries and Views: SQL Data Definition and Data types, Specifying Constraints in SQL, Schema Change statement in SQL, Basic Queries in SQL, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Triggers, Views in SQL.

Module-3	8 Hrs.

Functional Dependencies and Normalization for Relational Database: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. **Relational Database Design Algorithms and Further Dependencies:** Multi-valued Dependencies and fourth normal form, Join Dependencies and fifth normal form.

Module-4	8Hrs.

Overview of Transaction Management: The ACID Properties: Consistency and Isolation, Atomicity and Durability; Transactions and Schedules; Concurrent Execution of Transactions: Motivation for Concurrent Execution, Serializability, Anomalies due to Interleaved Execution, Schedules Involving Aborted Transactions; Lock- Based Concurrency Control: Strict Two-Phase Locking, Deadlocks; Performance of Locking; Timestamp Based Protocols- Validation- Based Protocols, Multiple Granularity. Transaction Support in SQL: Creating and Terminating Transactions, What Should We Lock? Transaction Characteristics in SQL.

Module-5	8 Hrs.

Introduction to Crash Recovery: Stealing Frames and Forcing Pages, Recovery - Related Steps during Normal Execution, Overview of ARIES recovery algorithm, Atomicity: Implementing Rollback. Check Points Buffer Management, Failure with loss of nonvolatile storage.

Database Security: Introduction to Database Security; Access Control; Discretionary Access Control: Grant and Revoke on Views and Integrity Constraints; Mandatory Access Control: Multilevel Relations and Poly instantiation, Covert Channels, DoD Security Levels.

Suggested Learning resources

Text Books:

1. Elmasri and Navathe, Fundamentals of Database Systems, 6th Edition, Pearson Education, 2011.
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, , TATA McGrawHill.
3. Silberschatz and Korth, Database System Concepts, 7th edition, Mc Graw hill.

Reference Books:

1. C.J. Date, A.Kannan, S.Swami Nadhan, An Introduction to Database systems, 8th Edition, Pearson.
2. M. L. Gillenson, Fundamentals of Database Management Systems, Wiley Student Edition.
3. S.Shah and V. Shah, Oracle for Professionals, The X Team, SPD.

Course Outcomes:

CO1: Demonstrate the basic elements of a relational database management system

CO2: Ability to identify and build the data models for relevant problems**.**

CO3: Design entity relationship and convert entity relationship diagrams into relations and formulate SQL queries to process the data.

CO4: Ability to analyze the relational model on rules of normal forms.

CO5: Build transaction with lock and unlock utility.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	3							
CO2		2						
CO3			2					
CO4		2						
CO5		1	2					

Course Code: PCAA104C	**Operating System**	**Credits : 03**
Hours/Week (L:T:P) : 2:1:0		**CIE Marks : 50**
Total Hours of Pedagogy (Theory + Lab): 40		**SEE Marks : 50**
Course Type: Theory		

Course Objectives:

1. Explain the need and services of the operating system
2. Explore how the operating system handles processes and manages memory.
3. Recognize deadlock condition and technique to handle deadlock situation.
4. Analyze various memory management strategies and file handling concepts.

Module-1	**8 Hrs.**

Introduction to Operating Systems, System Structure What operating systems do, Operating System Operations, Computing Environments, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure, System Boot.

Process Concept Process Concept, Process Scheduling, Interprocess Communication

Module-2	**8 Hrs.**

Process Scheduling Basic Concepts, Scheduling Criteria, Scheduling Algorithms. Synchronization Background, The Critical Section Problem, Mutex Locks, Semaphores, Classic Problems of Synchronization: Readers-Writers Problem, Dining Philosophers Problem using Semaphores

Module-3	**8 Hrs.**

Deadlocks: System model, Deadlock Characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock

Module-4	**8 Hrs.**

Memory Management Strategies Basic Hardware, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory Management Background, Demand Paging, Page Replacement

Module-5	**8 Hrs.**

File System File concept, Access methods, Directory overview Implementing File System Allocation methods, Free Space Management

Suggested Learning resources

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 10th Edition, Wiley – India, 2019.

Reference Books:

1. D M Dhamdhere: Operating Systems A Concept Based Approach, 3rd Edition, Tata McGraw Hill, 2017.
2. Harvey M Deital: Operating Systems, 3rdEdition, Addison Wesley, 1990.

Course Outcomes:

CO1: Describe the elements and various functionalities of the operating system

CO2: Apply the techniques of process management and demonstrate process synchronization. **CO3:** Recognize deadlock condition and technique to handle deadlock situation.

CO4: Analyze various memory management strategies.

CO5: Describe file handling concepts.

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1			3					
CO2								2
CO3		2		1				
CO4				2				2
CO5	2							

Course Code: PCAA105C	**Web Technologies**	**Credits : 03**
Hours/Week (L:T:P) : 3:0:0		**CIE Marks : 50**
Total Hours of Pedagogy (Theory + Lab): 40		**SEE Marks : 50**
Course Type: Theory		

Course Objectives:

1. Understand Internet, Web technology and Web Applications.
2. Creating the small web page using HTML5 and CSS.
3. Developing the interactive web pages using JavaScript
4. Create web pages using angular JS framework

Module-1	**8 Hrs.**

Web browsers, web servers, MIME, URL, HTTP Introduction to HTML5 tags, Basic syntax and structure, text markups, images, lists, tables, progress, Media tags-audio and video, forms, span and div tags.

Module-2	**8 Hrs.**

Introduction to CSS, Levels of CSS, Selectors, Font, color and Text Properties, BOX Model, Introduction to JavaScript, JavaScript variables, operators, Conditional and loop statements in JavaScript, Functions and Arrays in JavaScript

Module-3	**8 Hrs.**

Event Handling and Document Object model in JavaScript, Handling strings and working with window object

Module-4	**8 Hrs.**

Introduction to AngularJS, Expressions, Modules, Directives, Model, Data binding, Controllers,Scopes, Filters

Module-5	**8 Hrs.**

Services, Tables, Select box, Forms, Events, Validations

Suggested Learning resources

Books

1. Web Programming By Chris Bates , Wiley Publications
2. HTML5 Black Book by Dreamtech
3. Angular JS By Krishna Rungta

Course Outcomes:

CO1: Explain the fundamental concepts of web technologies
CO2: Create the web pages using HTML and CSS

CO3: Implement user interactive web pages

CO4: Demonstrate the single window applications using AngularJS

CO5: Apply advance web technology concepts to build web pages.

Course Outcomes	Programme Outcomes							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	1			3				
CO2		2						2
CO3				3	1			
CO4								2
CO5	2		1					2

Course Code: PCAA106L	**DBMS and Web Technologies Laboratory**	**Credits : 02**
Hours/Week (L:T:P) : 0:0:2		**CIE Marks : 50**
Total Hours of Pedagogy (Theory + Lab):		**SEE Marks : 50**

Course Type: Practical

Course Objectives:

1. Create database objects that include tables, constraints, Views and indexes.
2. Create SQL queries to read information form tables.
3. Design Web page.
4. Building interactive web pages.

Sl. No.	**Experiments**
01	Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries. BRANCH (Branchid, Branchname, HOD) STUDENT (USN, Name, Address, Branchid, sem) BOOK (Bookid, Bookname, Authorid, Publisher, Branchid) AUTHOR (Authorid, Authorname, Country, age) BORROW (USN, Bookid, Borrowed_Date) Execute the following Queries: i.List the details of Students who are all studying in 2nd sem MCA. ii. List the students who are not borrowed any books. iii. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2nd sem MCA Students who borrowed books. iv. Display the number of books written by each Author. v. Display the student details who borrowed more than two books. vi. Display the student details who borrowed books of more than one Author.vii.Display the Book names in descending order of their names. viii.List the details of students who borrowed the books which are all published by the same publisher.
02	Consider the following schema: STUDENT (USN, name, date_of_birth, branch, mark1, mark2, mark3, total, GPA) Execute the following queries: i. Update the column total by adding the columns mark1, mark2, mark3. ii. Find the GPA score of all the students. iii. Find the students who born on a particular year of birth from the date_of_birth column. iv. List the students who are studying in a particular branch of study. v. Find the maximum GPA score of the student branch-wise. vi. Find the students whose name starts with the alphabet “S” vii. Find the students whose name ends with the alphabets “AK” viii. Delete the student details whose USN is given as 1001
03	Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries. Consider a Cricket Tournament “ABC CUP” organized by an organization. In the tournament there are many teams are contesting each having a Teamid,Team_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers,age. A player represents

	only one team. There are many Stadiums to conduct matches. Each stadium is identified using Stadiumid, having a stadium_name,Address (involves city,area_name,pincode). A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man_of_the match award given to a player. Execute the following Queries: i. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament. ii. List the details of the stadium where the maximum number of matches were played. iii. List the details of the player who is not a captain but got the man_of _match award at least in two matches. iv. Display the Team details who won the maximum matches. v. Display the team name where all its won matches played in the same stadium.
04	A country wants to conduct an election for the parliament. A country having many constituencies. Each constituency is identified uniquely by Constituency_id, having the Name, belongs to a state,Number_of_voters. A constituency can have many voters. Each voter is uniquely identified by using Voter_id, having the Name, age, address (involves Houseno,city,state,pincode). Each voter belongs to only one constituency. There are many candidates contesting in the election. Each candidates are uniquely identified by using candidate_id, having Name, phone_no, age, state. A candidate belongs to only one party.Thereare many parties. Each party is uniquely identified by using Party_id, having Party_Name,Party_symbol. A candidate can contest from many constituencies under a same party. A party can have many candidates contesting from different constituencies. No constituency having the candidates from the same party. A constituency can have many contesting candidates belongs to different parties. Each voter votes only one candidate of his/her constituencty. Queries: i. List the details of the candidates who are contesting from more than one constituencies which are belongs to different states. ii. Display the state name having maximum number of constituencies. iii. Create a stored procedure to insert the tuple into the voter table by checking the voter age.if voter’s age is at least 18 years old, then insert the tuple into the voter else display “Not an eligible viter msg” iv. Create a stored procedure to display the number_of_voters in the specified constituency. Where the constituency name is passed as an argument to the stored procedure. v. Create a TRIGGER to UPDATE the count of “Number_of_voters” “VOTERS” of the respective constituency in “CONSTITUENCY” table, AFTER inserting a tuple into the “VOTERS” table.
05	Design an ER-diagram for the following scenario, Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries. A country can have many Tourist places . Each Tourist place is identified by using tourist_place_id, having a name, belongs to a

	state, Number of kilometers away from the 02.03.2021 updated 52/ 104 capital city of that state,history. There are many Tourists visits tourist places every year. Each tourist is identified uniquely by using Tourist_id, having a Name, age, Country and multiple emailids. A tourist visits many Tourist places, it is also required to record the visted_date in the database. A tourist can visit a Tourist place many times at different dates. A Tourist place can be visited by many tourists either in the same date or at different dates. Queries: i. List the state name which is having maximum number of tourist places. ii. List details of Tourist place where maximum number of tourists visited. iii. List the details of tourists visited all tourist places of the state "KARNATAKA" iv. Display the details of the tourists visited at least one tourist place of the state, but visited all states tourist places. v. Display the details of the tourist place visited by the tourists of all country.
06	Create an XHTML page that provides information about your department. Your XHTML page must use the following tags: a) Text Formatting tags b) Horizontal rule c) Meta element d) Links e) Images f) Tables (Use of additional tags encouraged).
07	Develop and demonstrate a XHTML file that includes Javascript script for the following problems: a) Input : A number n obtained using prompt Output : The first n Fibonacci numbers b) Input : A number n obtained using prompt Output : A table of numbers from 1 to n and their squares using alert
08	Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved from the top stacking position, it returns to its original position rather than to the bottom
	Demonstration Experiments (For CIE) if any
09	Consider the following database of student enrollment in courses and books adopted for each course. STUDENT (regno#: string, name: string, major: string, bdate: date) COURSE (course#: int, cname: string, dept: String) TEXT (book_ISBN#: int, book_title: string, publisher: string, author: string) ENROLL (regno#: string, course#: int, sem: int, marks: int) BOOK_ADOPTION (course#: int, sem: int, book_ISBN: int) • Create the above tables by properly specifying the primary keys and the foreign keys • Enter at least 7 to 10 records to each table. Execute SQL queries for the following requirements: 1. List out the student details, and their course details. The records should be ordered in a semester wise manner. 2. List out the student details under a particular department whose name is ordered in a semester wise 3. List out all the book details under a particular course 4. Find out the Courses in which number of students studying will be more than 2. 5. Find out the Publisher who has published more than 2 books. 6. Find out the authors who have written book for I semester, computer science course.

	7. List out the student details whose total number of months starting from their date of birth is more than 225 8. Find out the course name to which maximum number of students have joined
10	Develop, test and validate an XHTML document that has checkboxes for apple (59 cents each), orange (49 cents each), and banana (39 cents each) along with submit button. Each check boxes should have its own onclick event handler. These handlers must add the cost of their fruit to a total cost. An event handler for the submit button must produce an alert window with the message your total cost is $XXX where XXX is the cost of chose fruit, including 5% of sale tax. this handler must return false “(to avoid actual submission of the form data). Modify the document to accept quantity for each item using textboxes. **Course Outcomes (COs):** **After completion of the course student will be able to:** 1. Create database objects like table, constraint, view and index. 2. Design entity-relationship diagrams to solve given database applications. 3. Formulate SQL queries for the given problem. 4. Design simple web pages to demonstrate aspects of web application. 5. Develop, test and validate an XHTML document. ‘

II SEMESTER SYLLABUS

Course Code: PCAA201C	**Machine learning and Data analytics using Python**	**Credits : 04**
Hours/Week (L:T:P) : 2:2:0		**CIE Marks : 50**
Total Hours: 52		**SEE Marks : 50**

Course Type: Theory

Course Learning Objectives:

1. Understand foundational concepts in machine learning and data analytics.
2. Gain proficiency in Python for data analysis and machine learning tasks.
3. Learn and apply various machine learning algorithms and techniques.
4. Develop skills in data preprocessing, visualization, and model evaluation.
5. Prepare students for industry roles involving data-driven decision making and predictive modeling.

Module-1	**12 Hrs.**

Introduction to Machine Learning and Python:

Introduction to Machine Learning: Definition and importance of machine learning, Types of machine learning: Supervised, unsupervised, and reinforcement learning, Applications of machine learning in various domains.

Python for Data Analysis: Introduction to Python programming, Python libraries for data analysis: NumPy, Pandas, Matplotlib, Data manipulation and visualization using Pandas and Matplotlib.

Data Preprocessing: Data cleaning and transformation, Handling missing values and outliers, Feature scaling and normalization.

Module-2	**10 Hrs.**

Supervised Learning: Regression: Linear regression, Polynomial regression, Model evaluation metrics: MAE, MSE, RMSE. Classification: Logistic regression, K-Nearest Neighbors (KNN), Decision Trees and

Random Forests, Model evaluation metrics: Accuracy, precision, recall, F1-score, ROC-AUC.

Model Training and Evaluation: Train-test split and cross-validation, Hyper parameter tuning using GridSearchCV, Overfitting and underfitting..

Module-3	**10 Hrs.**

Unsupervised Learning:

Clustering: K-Means clustering, Hierarchical clustering, Evaluation of clustering results.

Dimensionality Reduction: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) t-Distributed Stochastic Neighbor Embedding (t-SNE).

Association Rule Learning: Apriori algorithm, Market Basket Analysis, Evaluation metrics for association rules

Module-4	**10 Hrs.**

Advanced Machine Learning Techniques:

Ensemble Methods: Bagging and Boosting, Gradient Boosting Machines (GBM), Extreme Gradient Boosting (XGBoost).

Support Vector Machines (SVM): Linear and non-linear SVM, Kernel trick, Model evaluation and tuning.

Neural Networks and Deep Learning: Introduction to neural networks, Building and training neural networks using TensorFlow and Keras, Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN).

Module-5	**10 Hrs.**

Data Analytics and Real-World Applications:

Exploratory Data Analysis (EDA): Data visualization techniques, Statistical analysis and hypothesis testing, Identifying patterns and insights from data.

Time Series Analysis: Introduction to time series data, Time series forecasting using ARIMA and Prophet, Evaluating time series models.

Integrating Machine Learning Models: Deployment of machine learning models, Building web applications with Flask and Django, Case studies on real-world applications of machine learning.

Suggested Learning resources

Text Books:

1.Practical Machine Learning for Data Analysis Using Python Abdulhamit Subasi.

2. Advance Machine Learning with Python by John Hearty.

Reference books:

1. "Python Machine Learning: Machine Learning and Deep Learning with Python, scikitlearn, and Tensor Flow " by Sebastian Raschka and Vahid Mirjalili.

2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.

3. "Introduction to Machine Learning with Python".

Sl.NO	Experiments
1	Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
4	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
6	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
7	Write a program to demonstrate Regression analysis with residual plots on a given data set.
8	Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
9	Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file.

Course Outcomes:

CO1: Demonstrate an understanding of machine learning concepts and techniques.
CO2: Perform data preprocessing and exploratory data analysis using Python.
CO3: Develop and evaluate machine learning models using Python libraries.
CO4: Apply machine learning algorithms to real-world data problems.
CO5: Integrate data analytics and machine learning models into practical applications.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	3	3						2
CO2	3	2						
CO3			2	2				
CO4		2		2				2
CO5			2					2

PCAA202C	**Object Oriented Programming using Java**	**Credits:04**
Hrs/Week:L:T:P:S **4:0:0:0**		CIEMarks:50
TotalHours/Week: 50Hrs		SEEMarks:50

MODULE-1	**08Hrs.**
Introduction: Object Oriented Programming: objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Virtual Machine, Java Source File Structure, and Compilation. **Fundamental Programming Structures in Java:** Defining classes in Java, constructors, methods, The this Keyword, Overloading Constructors. Access specifies, static members, Comments, Data Types, The Scope and Lifetime of Variables,, Operators, Control Flow, Arrays.	
MODULE-2	**08Hrs.**
Inheritance : Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Method Overriding, Overridden Methods support polymorphism, Why Overridden Methods, Using Abstract Classes, Using final. **String Handling:** String Constructor, String length, Special string Operations, Character Extraction, String comparison, Modifying a string, String Buffer	
MODULE-3	**08Hrs.**
Interface: Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces . **Packages :** Package Fundamentals, Packages and Member Access, Importing Packages Exception Handling : The Exception Hierarchy, Exception Handling Fundamentals, using Multiple catch clauses, **User defined exception**: Throwing an Exception, A Closer look at Throwable, using finally, System defined Exception using throws.	
MODULE-4	**08Hrs.**
Multithreaded Programming: Multithreading fundamentals, The Thread Class and Runnable Interface, Creating Thread, Thread Priorities, Synchronization, using Synchronization Methods, The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads.	
MODULE-5	**08Hrs.**
JDBC: Talking to Database, Types of JDBC, Essential JDBC program, using prepared Statement JDBC in Action Result sets, Batch updates, Mapping, Basic JDBC data types, Advanced JDBC data types, immediate solutions.	

Reference Books:

1) Introduction to JAVA Programming 9th Edition by Y. Daniel Liang , Pearson education, 2012

2) Programming in JAVA 5.0 1st Edition by James P Cohoon, Jack W Davidson, TATA McGraw hill,2006

Course Outcomes:

At the end of the course the student will be able to :

1. Understand the basic principles of the object-oriented programming
2. Demonstrate an introductory understanding of graphical user interfaces.
3. Apply the knowledge of Java concepts to find the solution for a given problem.
4. Analyse the given Java application for correctness/functionalities.
5. Develop Java programs / applications for a given requirement.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	3		3					
CO2			3					2
CO3	3			3				2
CO4			2					
CO5				3				2

Course Code: PCAA203C	Data Structures and Algorithms	Credits : 04
Hours/Week (L:T:P) : 4:0:0		CIE Marks : 50
Total Hours: 52		SEE Marks : 50

Course Type: Theory

Course Objectives:

1. To understand and implement fundamental data structures.
2. To develop efficient algorithms for solving problems.
3. To analyze the time and space complexity of algorithms.
4. To gain practical experience in applying data structures and algorithms to real-world problems.
5. To prepare students for industry roles requiring strong foundations in data structures and algorithmic thinking.

Module-1	**11 Hrs.**

Introduction to Data Structures and Algorithms:

Basic Concepts: Definition and importance of data structures, Abstract Data Types (ADTs), Algorithm analysis: Time and space complexity, Big O notation. **Arrays:** Definition and operations: Insertion, deletion, traversal, Multidimensional arrays, Applications of arrays. **Linked Lists**: Singly linked list: Creation, insertion, deletion, traversal, Doubly linked list and circular linked list, Applications of linked lists.

Module-2	**10 Hrs.**

Stacks and Queues,: Stacks: Definition and operations: Push, pop, peek, Applications: Expression evaluation, backtracking, function calls. **Queues:** Definition and operations: Enqueue, dequeue, front, rear, Types: Circular queue, priority queue, double-ended queue (deque), Applications of queues.

Module-3	**10 Hrs.**

Recursion: Definition and principles of recursion, Recursive algorithms: Factorial, Fibonacci series, Tower of Hanoi, Analysis of recursive algorithms. **Trees: Definition and terminology**: Root, leaf, internal node, height, depth, **Binary trees:** Traversal (preorder, inorder, postorder), creation, insertion, deletion, Binary search trees (BST), AVL trees, B-trees.

Module-4	**10 Hrs.**

Graphs: Definition and terminology: Vertices, edges, adjacency list, adjacency matrix, Graph traversal algorithms: Depth-first search (DFS), breadth-first search(BFS), **Shortest path Algorithms:** Dijkstra’s algorithm Floyd -Warshall algorithm.

Module-5	**11 Hrs.**

Sorting and Searching Algorithms: Sorting Algorithms: Basic concepts and classification, Comparison-based sorting: Bubble sort, selection sort, insertion sort, quicksort, mergesort, heapsort, Non-comparison-based sorting: Radix sort, counting sort. Searching Algorithms: Linear search and binary search, Search in linked lists, trees, and graphs, Hashing: Hash functions, collision resolution techniques (chaining, open addressing). Advanced Data Structures and Applications: Advanced Data Structures: Heaps: Definition, operations, heap sort, applications, Trie: Definition, operations, applications in dictionary and spell-checking.

Suggested Learning resources

Text Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities

Press, 2023.

2. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Reference books:

1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. A M Tenenbaum, Data Structures using C, PHI, 1989
3. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
4. Algorithms, Kenneth A Berman and Jerome L Paul, Cengage Learning India Pvt Ltd, 2002 edition.

Course Outcomes:

CO1: Demonstrate an understanding of fundamental data structures and algorithms

CO2: Implement and manipulate data structures such as arrays, linked lists, stacks, queues, trees, and graphs.

CO3: Develop algorithms for searching, sorting, and optimization problems.

CO4: Analyze the efficiency and correctness of algorithms.

CO5: Apply data structures and algorithms to solve complex problems in various domains.

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3	3	2	1				
CO2	3	3	2	2				
CO3	3	2	3	2				
CO4	3	3	2					
CO5	3	3						2

PCAA204C	**Software Engineering**	**Credits:03**
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
TotalHours/Week: 40Hrs		SEEMarks:50

MODULE-1 08Hrs.

Software Process & Software Development Methods: Professional Software Development, software engineering ethics, Software process models, Process activities, Coping with change. **Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, **Requirements Engineering**: Functional and non-functional requirements, The software requirements document, Requirements specification

MODULE-2 08Hrs.

Requirements engineering processes: Requirements elicitation and analysis, Requirements validation. Requirements change. System Models: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering, **Design and Implementation:** Introduction to RUP, Design Principles.

MODULE-3 08Hrs.

Object-oriented design using the UML Design patterns, Implementation issues, Open source development. Software testing: Development testing, Test-driven development, Release testing, User testing. **Project management:** Risk management, Managing people, Team work, Project planning, Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

MODULE-4 08Hrs.

Quality Management: Software quality, Software standards, Reviews and inspections, Software measurement and metrics. Scrum Framework Foundation of Scrum, pillars of empiricism, Scrum Values, Identifying a Scrum Team; **Scrum Events: Spring** planning, Implementation and review, Scrum Artifacts: Creating, Managing and refining product backlog. **Scrum in Action**: Planning and Estimating with Scrum: Estimation Scale, Bucket method

MODULE-5 08Hrs.

Envisioning the product journey with a product roadmap; **Sprint Journey**: Refining the Product Backlog, Tracking progress with a Scrum Board, Defects in Sprint; **Facets of Scrum**: software development practices for Scrum, Source control model for continuous integration, Continuous delivery and continuous deployment, Leveraging testing methods for Scrum, Applying Scrum to remote teams.

ReferenceBooks:

1. Ian Sommerville, Software Engineering, 10th Edition, Pearson India Education Services Pvt. Ltd., 2020.
2. RogerS.Pressman,SoftwareEngineering-APractitionersapproach,7thEdition,Tata McGrawHill.
3. PankajJalote, An Integrated Approach to Software Engineering,WileyIndia.
4. Fred heath, The Professional Scrum Master Guide, Packt Publishing,2021.

5. Stacia Viscardi, The Professional Scrum Master's Handbook,PacktPublishing,2013
6. Andrew T. Pham and David K. Pham, Business-Driven IT-Wide Agile (Scrum) and Kanban(Lean) Implementation, CRC Press.

Course Outcomes:

1. Comprehend software process and process models and decide which process model has to be adopted for the given scenarios.
2. For given case study List functional and nonfunctional requirements.
3. Ability to develop system model and architectural design.
4. Analyze the importance of various of software testing methods and the role of project planning and quality management in software development.
5. Understand Scrum frameworks and its utility in software development.

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1			2	2				
CO2			2					
CO3				2		2		1
CO4				3				
CO5		2						2

PCAA205C	**Web Application Development**	**Credits:03**
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
TotalHours/Week: 40Hrs		SEEMarks:50

MODULE-1	**08Hrs.**
Introduction to Web Development and HTML5: Web Development Basics: Introduction to web technologies and protocols, Client-server architecture, Overview of front-end and back-end development **HTML5 Fundamentals:** HTML5 elements and attributes, Semantic HTML5 tags, Forms and input types, Multimedia elements (audio, video) Advanced HTML5: Canvas and SVG for graphics, HTML5 APIs(Geolocation, Web Storage, Web Workers), Offline web applications using AppCache.	
MODULE-2	**08Hrs.**
CSS3 and Responsive Web Design: CSS3 Basics: Introduction to CSS3, Selectors, properties, and values, Box model, layout, and positioning, Flexbox and Grid layouts. **Responsive Web Design**: Media queries, Responsive design principles, Fluid grids and flexible images, Mobile-first design approach. **CSS Frameworks:** Introduction to Bootstrap, Bootstrap components and utilities, Customizing Bootstrap with Sass.	
MODULE-3	**08Hrs.**
JavaScript and DOM Manipulation: JavaScript Basics: Introduction to JavaScript, Variables, data types, and operators, Control structures (if-else, loops), **Functions and scope Document Object Model (DOM):** DOM structure and manipulation, Event handling and event listeners, Creating and modifying DOM elements, **Form validation using JavaScript Advanced JavaScript:** Asynchronous JavaScript (callbacks, promises, async/await), AJAX and Fetch API, Introduction to JavaScript libraries (e.g., jQuery).	
MODULE-4	**08Hrs.**
Front-End Frameworks and AngularJS: Introduction to Front-End Frameworks: Importance of front-end frameworks, **Overview of popular frameworks (React, Angular, Vue) AngularJS Basics:** Introduction to AngularJS, Modules, controllers, and scope, Directives, expressions, and filters Advanced AngularJS: Services and dependency injection, Routing and single-page applications (SPAs), Data binding and form handling, Custom directives and components.	
MODULE-5	**08Hrs.**
Back-End Integration and Deployment: Back-End Development: Introduction to server-side programming, Overview of server-side languages (Node.js, PHP, Python), RESTful web services and APIs, Database integration (SQL, NoSQL) Full-Stack Development: Integrating front-end and back-end technologies, Developing fullstack web applications, Case studies on full-stack applications Deployment and Security: Web application deployment (cloud platforms, hosting services), Security best practices for web applications, Authentication and authorization, Performance optimization.	

Reference Books:

1. Web Programming By Chris Bates , Wiley Publications
2. HTML5 Black Book by Dreamtech
3. Angular JS By Krishna Rungta
4. Bootstrap essentials by Snig by Packt-open source .

Course Outcomes:

At the end of the course the student will be able to :

1. Demonstrate an understanding of web technologies and protocols.
2. Develop and deploy web applications using HTML5, CSS3, JavaScript, and modern frameworks.
3. Apply responsive design principles using frameworks like Bootstrap.
4. Implement dynamic web applications using AngularJS.
5. Integrate front-end and back-end technologies to create full stack web applications.

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3							
CO2			3	3				2
CO3	1			2				2
CO4					2			
CO5			2			2		

Course Code: PCAA206L	**Object Oriented Programming using JAVA Laboratory**	**Credits : 02**
Hours/Week (L:T:P) : 0:2:0		**CIE Marks : 50**
Total Hours of Pedagogy : 30		**SEE Marks : 50**

Course Type: Practical

Course Objectives:

1. Using java programming to develop programs for solving real-world problems.
2. Reinforce the understanding of basic object-oriented programming concepts..

Sl. No.	**Experiments**
01	Write a Java program to print the following triangle of numbers 1 1 2 1 2 3 1 2 3 4 1 2 3 4 5
02	Write a Java program To find the area and circumference of the circle by accepting the radius from the user. To accept a number and find whether the number is Prime or not
03	Write a JAVA program to read 3 subjects marks, calculate the total and average marks. Display the grade based on the following criteria: Note: Percentage>=90% : Grade A Percentage>=80% : Grade B Percentage>=70% : Grade C Percentage>=60% : Grade D Percentage>=40% : Grade E Percentage.
04	Write a JAVA program to create a class called Person with p_name and age. Which includes constructor to initialize these fields and a method to display the person information. In the main method, an instance of the Person class will be created and Person information is displayed.
05	Define a class named Animal with two methods: eat() and sleep(). Create a class named Dog that extends the Animal which includes a method called bark() and also create a class called Cat that extends Animal which includes Meow() method. Create a class called MainClass to write main() method and demonstrate the following: Inside the main method: a. Create objects of the Dog and Cat classes (myDog and myCat). b. Demonstrate calling methods from the parent class (eat() and sleep()). c. Illustrate calling methods from the Dog class (bark()). d. Showcase calling methods from the Cat class (meow()).
06	Write a JAVA program calculate factorial of a given number n.
07	Write a JAVA program that prompts the user to enter a number between 1 and 7. The program then uses a switch case statement to determine the corresponding day of the week based on the user’s input and prints the result.
08	Create a Shape class serves as the base class for all shapes. It contains a method draw() that prints a generic message indicating the act of drawing a shape. The Circle class extends the Shape class and overrides the draw() method to provide a specialized implementation for drawing a circle. Similarly, the Square class extends the Shape class and provides its own implementation of the draw() method to handle drawing a square. Create MainClass contains the main method, serving as the entry point of the program. Two objects, shape1 and shape2, are declared of type Shape but instantiated as Circle and Square objects, respectively. This demonstrates the polymorphic behavior, allowing objects of derived classes to be treated as objects of the base class.
	Demonstration Experiments (For CIE) if any
09	Write java program to implement the concept of abstract class and interface.
10	Write a Java program to implement a Queue using user defined Exception Handling (also make use of

throw,
throws).

a. Complete the following:

b. Create a package named shape.

c. Create some classes in the package representing some common shapes like Square, Triangle, and Circle.

d. Import and compile these classes in other program.

Course Outcome

At the end of the course the student will be able to :

1. Demonstrate the fundamental data types and constructs of Java Programming by writing executable/interpretable programs.
2. Illustrate the object oriented principles with the help of java programs.
3. Develop reusable and efficient applications using inheritance concepts of java.
4. Learn the object oriented concepts and its implementation in Java..

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3	2						
CO2	2		2	2				2
CO3			2					
CO4	3				2			2

Course Code: PCAA207L	**Data Structures with Algorithms Laboratory**	**Credits : 02**
Hours/Week (L:T:P) : 0:2:0		**CIE Marks : 50**
Total Hours of Pedagogy : 30		**SEE Marks : 50**

Course Type: Practical

Course Objectives:

3. Evaluate the Expressions like postfix, prefix conversions.
4. Implementing various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs.

Sl. No.	**Experiments**
01	Implement a Program in C for converting an Infix Expression to Postfix Expression.
02	Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide)
03	Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display
04	Write a C program to simulate the working of a singly linked list providing the following operations: a. Display & Insert b. Delete from the beginning/end c. Delete a given element
05	Write a C program to Implement the following searching techniques a. Linear Search b. Binary Search.
06	Write a C program to implement the following sorting algorithms using user defined functions: a. Bubble sort (Ascending order) b. Selection sort (Descending order).
07	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm (C programming)
08	From a given vertex in a weighted connected graph, find shortest paths to other vertices Using Dijkstra's algorithm (C programming)
	Demonstration Experiments (For CIE) if any
09	Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.
10	Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).

Course Outcome

Course Outcomes:

At the end of the course the student will be able to :

1. Implement data structures (namely Stacks, Queues, Circular Queues, Linked Lists, Trees and Graphs), its operations and algorithms.
2. Implement sorting / searching techniques, and validate input/output for the given problem.
3. Implement the techniques for evaluating the given expression

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3		3	3				
CO2	2		2	3				
CO3	2		2	2				

III SEMESTER SYLLABUS

Course Code: PCAB301E	**Data Mining and Data Warehousing**	**Credits : 03**
Hours/Week (L:T:P) :3:0:0		**CIE Marks : 40**
Total Hours: 03		**SEE Marks : 50**

Corse Objectives:

1. To gain knowledge on data mining and the need for pre-processing.
2. To characterize the kinds of patterns that can be discovered by association rule mining.
3. To get exposed to the concepts of data warehousing architecture and implementation.
4. To implement classification techniques on large datasets.
5. To analyze various clustering techniques in real world applications.

UNIT-I	10 Hrs.

Introduction and Data Pre-processing :Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining .DBMS VS Data Mining. Data Pre-processing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.

UNIT -II	10 Hrs.

Need for Data Warehouse: basic model, characteristics, Data Warehouse Architecture, Database versus Data Warehouse Multidimensional Data Model– Schemas for Multidimensional Databases– OLAP operations, types of data warehouse, Data Warehouse components. OLAP versus OLTP, characteristics of OLAP, OLAP types.

UNIT -III	10 Hrs.

Association Analysis: Definition of Association Analysis, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item Sets. Alternate Method of Generating Item Sets, FP Growth Algorithms, Evaluation of Association Pattern.

UNIT -IV	10 Hrs.

Classification: Preliminaries, General Approach To Solving Classification Problem, Decision Tree Based Classifier, Rule Based Classifier, Nearest Neighbour Classifier. **Cluster Analysis**– Partitioning Methods: k-Means and k- Mediods– Hierarchical Methods: Agglomerative and Divisive. Density–Based Method: DBSCAN Model Based Clustering Methods Clustering High Dimensional Data Outlier Analysis. **Data mining trends and research frontiers**: Mining complex data types, other methodologies of data mining, Data mining applications, Data Mining and society.

Suggested Learning resources

Text Books:

1. **JiaweiHan, Micheline Kamber, JianPei, DataMining Concepts and Techniques, Morgan Kaufmann**
2. **Pang-ning tan, Michael Steinbach, Vipin Kumar, Introduction to data mining PearsonIN.**

Course Outcomes:

CO1: Explain the fundamental concepts, scope, and applications of data mining and the importance of data pre-processing.

CO2: Apply suitable data pre-processing techniques such as cleaning, integration, reduction, and transformation on real-world datasets.

CO3: Describe the architecture and design of data warehouses and differentiate OLTP and OLAP operations.

CO4: Implement and analyze data mining techniques such as association rule mining, classification, and clustering on large datasets.

CO5: Summarize emerging trends, research issues, and societal impacts of data mining applications.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	1							
CO2		2						
CO3	1		3					
CO4	1							
CO5	1			4				

Course Code: PCAB302E	**Big Data Analytics**	**Credits:03**
Hrs/Week:L:T:P:S **3:0:0:0**		CIE Marks:50
Total Hours/Week: 03 Hrs		SEE Marks:50

Course Objectives:

1. Understand and define digital data and types, business intelligence, big data and analytics.
2. Appreciate different techniques for big data analytics.
3. Comprehend HDFS architecture and programming environment.
4. Learn NoSQL and able to write statement to process unstructured data.
5. Study programming in Hive and Pig technologies.

UNIT -I	**10Hrs.**
Types of digital data: Classification of Digital Data, Structured Data, Semi-Structured Data, Unstructured Data. **Introduction to Big Data:** Characteristics, Evolution, Definitions and Challenges of big data, other characteristics of data which are not definitional traits of big data, Why big data? Are we just an information consumer or do we also produce information? Traditional Business Intelligence (BI) versus Big data, A typical Data Warehouse environment, A typical Hadoop environment, What is changing in the realms of big data? **Big data analytics** Where do we begin? What is big data analytics? What big data analytics isn't? Why this sudden hype around big data analytics? Classification of analytics, Top challenges facing big data, why is big data analytics important? Greatest challenges that prevent businesses from capitalizing on big data, what kind of technologies are we looking towards to help meet the challenges posed by big data? Data science, Data Scientist, Terminologies used in big data environment, BASE, Few top Analytics tools.	
UNIT -II	**10 Hrs.**
The big data technology landscape: NoSQL, Where is it used? What is it? Types of NoSQL databases, Why NoSQL? Advantages of NoSQL, What we miss with NoSQL? NoSQL Vendors, SQL Versus NoSQL , NewSQL, Comparison of SQL, NoSQL and NewSQL, **Hadoop:** Features of Hadoop, Key advantages of Hadoop,Versions of Hadoop, Overview of Hadoop Ecosystems, Hadoop Versus, SQL, Integrated Hadoop systems offered by leading market vendors, Cloud based Hadoop solutions. **Hadoop:** Introducing Hadoop, Why not RDBMS, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Hadoop Components, High Level Architecture of Hadoop, Hadoop Distributed File System(HDFS), HDFS Architecture, Daemons Related to HDFS, Working with HDFS Command, Special Features of Hadoop, Processing Data With Hadoop, Introduction, How Map Reduce Works? Map Reduce Example, Word Count Example using Java. Managing Resources and Applications with YARN, Introduction, Limitation of Hadoop 1.0, Hadoop 2: HDFS, Hadoop 2: YARN, Interacting with Hadoop EcoSystem, Hive,Pig, HBASE, Sqoop, Business Intelligence on Hadoop.	
UNIT -III	**10Hrs.**
NoSQL - MongoDB: What is MongoDB? Why MongoDB? Using JSON, Creating or generating a unique key, Support for dynamic queries, Storing binary data, Replication, Sharding, Updating information in-place, Terms used in RDBMS and MongoDB, Data types in MongoDB, MongoDB - CRUD (Insert(), Update(), Save(), Remove(), find()), MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations. NoSQL - **Cassandra**: What is Cassandra? Why Cassandra? Peer to peer network, Gossip and Failure detection, Anti-Entropy & Read Repair, Writes in Cassandra, Hinted handoffs, Tunable consistency, Cassandra- CQLSH - CRUD, Counter, List, Set, Map, Tracing.	
UNIT -IV	**10 Hrs.**
Hadoop Hive: Introduction to Hive - The Problem, Solution - Hive Use Case, Data Growth, Schema Flexibility and Evolution, Extensibility, What is Hive, History of Hive and Recent Releases of Hive, Hive	

Features, Hive Integration and Work Flow, Hive Data Units, Hive Architecture, Hive Primitive Data Types and Collection Types, Hive File Formats, Hive Query Language - Statements, DDL , DML, Hive Partitions, Bucketing, Views, Sub Query, Joins, Hive User Defined Function, Aggregations in Hive, Group by and Having, Serialization and Deserialization, Hive Analytic Functions. **Hadoop - Pig:** Introducing Pig, History and Anatomy of Pig, Pig on Hadoop, Pig Features, Pig Philosophy, Word count example using Pig, Use Case for Pig, Pig Primitive Data Types, Collection Types and NULL, Pig Latin Overview, Pig Latin Grammar - Comments, Keywords, Identifiers, Case sensitivity in Pig, Common Operators in Pig, Pig Statements, LOAD, STORE, DUMP, Interactive Shell -GRUNT, FILTER, SORT, GROUP BY, ORDER BY, JOIN, LIMIT, Pig Latin Script, Local Mode, Map Reduce Mode, Running Pig Script, Working with Field, Tuple, Bag, User Defined Function, Parameters in Pig.

Reference Books

1. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley Publications, 2nd Edition, 2019, ISBN:978-81-265-5478-2.
2. Raj Kamal, Preethi Saxena, Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning, McGraw hill Education.
3. Cindi Howson, Successful Business Intelligence, McGraw-Hill Publications, E-ISSN:0-07-149851-6.
4. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, “Harness the Power of Big data – The big data platform”, McGraw Hill, 2012.

Course Outcomes:

CO1: Differentiation of digital data and to define big data and analytics.

CO2: Apply different techniques for big data analytics.

CO3: Comprehend HDFS architecture and programming environment.

CO4: Device NoSQL statement to process unstructured data.

CO5: Understanding programming in Hive and Pig technologies.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	1							
CO2		2						
CO3	1		3					
CO4	1							
CO5	1			4				

Course Code: PCAB306E	**Deep Learning Fundamentals**	**Credits: 03**
L:T:P - 3:0:0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course Learning objectives:

1. Explain the fundamental concepts of artificial neurons, neural network architectures, and learning paradigms.
2. Apply perceptron learning and backpropagation algorithms to solve classification and pattern recognition problems.
3. Illustrate the strength and weaknesses of many popular deep learning approaches.
4. Analyze different regularization and optimization techniques used in training deep learning models.
5. Develop sequence modeling solutions using recurrent neural networks (RNNs), LSTMs, and encoder-decoder architectures for time-series or sequential data.

UNIT -I

10 Hrs.

Introduction: What is a Neural Network? The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures Rosenblatt’s Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

UNIT –II

10 Hrs.

Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Computer Experiment: Pattern Classification, Back Propagation and Differentiation. Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problem.

UNIT –III

10 Hrs.

Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: How Learning Differs from pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rate. Convolution Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms.

UNIT –IV

10 Hrs.

Random or Unsupervised Features, The Neuroscientific Basic for Convolutional Network, Convolutional Networks and the History of Deep Learning. Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.

Text Books

Suggested Learning Resources:

Textbooks

1. Simon Haykin, Neural networks and Learning Machines, Third Edition, Pearson, 2016

2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Books

Reference book

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009

2. N.D. Lewis, “Deep Learning Made Easy with R: A Gentle Introduction for Data Science”, January 2016
3. Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly publications

Course Outcomes

CO1: Understanding Deep Learning Fundamentals
CO2: Design and Implementation of Neural Networks
CO3: Optimization and Performance Tuning
CO4: Application of Advanced Deep Learning Architectures

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	1							
CO2		2		2				
CO3								
CO4			1,2					3
CO5								

Course Code: PCAC301E	**Computer Networks**	**Credits : 03**
Hours/Week (L:T:P) : 3:0:0		**CIE Marks : 50**
Total Hours: 40		**SEE Marks : 50**

Course Objectives:

1. Understand computer networks fundamentals and issues.
2. Appreciate computer network models and role of layers in each model.
3. Understand different protocols and techniques supported at each level of network software
4. Comprehend application and challenges of computer networks.

UNIT-I	**10 Hrs.**

Introduction: Uses of Computer Networks, Network Hardware. Network Software: Protocol Hierarchies, Design Issues for the Layers. Types of Networks, Topologies, **Reference Models:** The OSI Reference Model, The TCP/IP
Reference Model, A Comparison of the OSI and TCP/IP Reference Models. Physical Layer- Guided Transmission Media, Digital Modulation and Multiplexing.

UNIT-II	**10 Hrs.**

Data Link Layer-Data link Layer Design issues, Framing, Flow Control and Error Correcting and Detection codes, Sliding Window Protocols (Stop and Wait, Go-Back-N (GBN) and Selective Repetitive (SR)), Medium Access Control-The Channel Allocation Problem, Multiple Access Protocols.

Data Link Layer Switching: Uses of bridges, repeaters, hubs, switches, routers and gateways.

UNIT-III	**10 Hrs.**

The Network Layer: Network Layer Design issues, Routing algorithms- The Optimality Principal, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Congestion Control Algorithms, Quality of Service, Internetworking. The Network Layer in the Internet: The Network Layer in the internet- IP version 4 Protocol(IPv4), The Main IPv6 Header, Extension Headers,

Internet Control Protocols: ICMP, ARP, DHCP.

UNIT-IV	**10 Hrs.**

The Transport Layer -The Transport Service: Services Provided to the Upper Layers, Berkeley Sockets, Elements of Transport Protocols, Internet transport protocols.TCP: Introduction to TCP, The Service Model, Protocol, Segment Header, UDP.

The Application Layer- The Domain Name System, Electronic Mail, The World-Wide-Web.

Suggested Learning resources

Text Books

1. Andrew S. Tanenbaum, David J Wetherall, “Computer Networks”, Pearson Education, Pearson Publication, 5th Edition, 2012.
2. Behrouz A Forouzan, Firouz Mosharraf, “Computer Networks A Top-Down Approach”, Tata McGraw-Hill Education Pvt. Ltd, 2011.
3. William Stallings, &quot;Data and Computer Communication&quot; ,8th edition, Pearson Publications,2007.

Course Outcomes:

After completion of the course student will be able to

CO1: To comprehend basics of data communication system.

CO2: Enumerate the layers of the OSI, TCP/IP model and demonstrate functions of each layer and comprehend the concept of data link protocols.

CO3: To exhibit the ability to apply different error detection and correction technique to solve communication problem.

CO4: To exhibit the ability to understand issues related to transport layer and protocols.

CO5: Demonstrate the concept of internetworking, routing techniques of network layer.

CO-PO Mapping

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	1	2						
CO2	2	2	1					
CO3	2	1	1					
CO4		1	2					
CO5		1	2					

Course Code: PCAC304E	Cloud Essentials	Credits: 03
L:T:P - 3:0:0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course Learning objectives:

1. Explain the fundamentals of cloud.
2. Analyze Business Benefits and Risks of Cloud Computing.
3. Evaluate Emerging Trends in Cloud Computing.

UNIT-I — 10 Hrs.

Introduction to Cloud: Defining a cloud, Characteristics of Cloud Computing, Cloud computing reference model, Architectures for parallel and distributed computing, Elements of parallel computing and Elements of distributed computing. Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Function as a Service (FaaS), Blockchain-as-a-Service (BaaS) and use cases, Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid and Multi-Cloud, Community Cloud..

UNIT–II — 10 Hrs.

Core Components of Cloud Architecture: Compute Services, Storage Services, Networking Services, Virtualization, Types of Virtualization, Containers vs. Virtual Machines (VMs), Load Balancing in Cloud, Auto-Scaling & Fault Tolerance, Content Delivery Networks(CDN), Bare Metal Cloud ,Cloud Orchestration and Automation..

UNIT–III — 10 Hrs.

Cloud Automation, DevOps, and Future Innovations: Cloud Automation and Infrastructure as Code (IaC), DevOps and Continuous Integration/Continuous Deployment (CI/CD), Multi-Cloud and Hybrid Cloud Strategies, Sustainability and Green Cloud Computing, Cloud Innovations- AI-powered cloud automation-5G and its impact on cloud computing..

UNIT–IV — 10 Hrs.

Cloud Security & Risk Management: Cloud Adoption, Advantages and Challenges of Cloud Adoption, Security Risks in Cloud- Data Breaches, Identity Theft, Network Security in Cloud. Security Solutions in Cloud: Identity and Access Management (IAM), Data Encryption Techniques, Firewalls & Intrusion Detection Systems: Compliance & Regulatory Frameworks, Disaster Recovery and Business Continuity Planning in Cloud. **Emerging Trends and case study**: AI, Edge Computing, Quantum Cloud, Event-driven architecture in cloud, Cloud-based AI services -AWS SageMaker, Google Vertex AI, Azure ML. Case Study: Netflix’s Cloud Migration, Zoom’s Cloud Scalability

Text Books

1. CompTIA Cloud Essentials+ Study Guide: Exam CLO-002 [2 ed.] .
2. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.
3. Handbook of Cloud Computing, Borko Furht- Armando Escalante.
4. Cloud Essentials: CompTIA Authorized Courseware for Exam CLO-001.
5. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013.

Reference Books

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media

Course Outcomes

CO1: Demonstrate the fundamental concepts of cloud computing.
CO2: Understand Cloud Security Challenges
CO3: Understand and Explain Cloud Compute Services and Analyze Cloud Networking Services
CO4: Compare different deployment and service models of cloud to develop different variety of applications with securities

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	2							
CO2	2	2			2			
CO3	2	2			3			
CO4	2	3		3				3
CO5								

Course Code:PCAC305E	Cyber Security	Credits: 03
L:T:P - 3:0:0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course objectives:

1. To learn cybercrime and cyber law
2. To understand the cyber-attacks and tools for mitigating them.
3. To understand information gathering.
4. To learn how to detect a cyber-attack.
5. To learn how to prevent a cyber-attack.

UNIT -I	10 Hrs.

INTRODUCTION Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cyber criminals – Classification of Cyber crimes– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act –Cyber crime and Punishment.

UNIT –II	10 Hrs.

ATTACKS AND COUNTER MEASURE SOS WAP : Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Counter measures.

UNIT –III	10 Hrs.

RECONNAISSANCE Harvester – Who is Netcraft–Host–Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.

UNIT –IV	10 Hrs.

INTRUSION DETECTION :Host -Based Intrusion Detection – Network -Based Intrusion Detection– Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

INTRUSION PREVENTION: Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations –Intrusion Prevention Systems – Example Unified Threat Management Products.

Text Books

1. Patrick Engebret son,—The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy‖, Elsevier, 2011. (Unit-3)
2. William Stallings, LawrieBrown,—Computer Security Principles and Practice‖,ThirdEdition, Pearson Education, 2015. (Unit-4 & 5)
3. Anand Shinde, —Introduction to Cyber Security Guide to the World of Cyber Security‖, Notion Press, 2021. (Unit-1 &2)

Reference Books

1.David Kim, Michael G. Solomon, —Fundamentals of Information Systems Security‖, Jones & Bartlett Learning Publishers, 2013.

2. Nina Godbole, Sunit Belapure,— Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives‖, Wiley Publishers, 2011.

Course Outcomes

CO1: Explain the basics of cyber security, cybercrime and cyber law
CO2: Classify various types of attacks and learn the tools to launch the attacks
CO3: Apply various tools to perform information gathering
CO4: Apply intrusion techniques to detect intrusion
CO5: Apply intrusion prevention techniques to prevent intrusion

Course Outcomes	Programme Outcomes							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1		1						
CO2		2		3				
CO3	2	2			3			
CO4	2	2			3	3		
CO5		1		2			3	