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Semester–V

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1.	PCC	CL10	Database Management System	2	1	-	3
2.	PCC	CL11	Foundations of Machine Learning	2	1	-	3
3.	PCC	CL12	Neural Network	3	-	-	3
4.	PEC	CL01	Elective-I	3	-	-	3
5.	HSMC	HS06	Humanities and Social Sciences Open Courses - II	2	-	-	2
6.	IFC	EC01	Interdisciplinary Foundation Course-II	2	-	-	2
7.	LC	CL10 (P)	SQL & MongoDB Lab	-	-	4	2
8.	LC	CL11 (P)	Machine Learning Lab	-	-	2	1
9.	PROJ	CL02	Mini Project	-	-	4	2
10.	SBC	CL02 (P)	Programming with Java Script	-	-	2	1
11.	LLC	LLC03	Liberal Learning Course -III	Credit to be added in Sixth Semester.			
12.	MLC	MLC03	Environmental Studies	1	-	-	Audit
13.	PROJ	–	Internship-I	Credit to be added in Sixth Semester.			
Total Academic Credits							22

Electives-I	**Humanities and Social Sciences Open Courses – II**
(A) Fuzzy Sets & Theory	(A) Industrial Safety Psychology
(B) Advanced Computer Architecture	(B) Project Management
(C) Cyber Security	(C) Business Communication
(D) Information Storage Management	

- **Interdisciplinary Foundation Course-II, EC01**
  [Offered by Electronics & Communication Department]
  - Sensors and Automation
- **Liberal Learning Course-III, LLC02 (Any One Course from NCC/NSO/NCA)**
  - **Note:** The pool of choices will be the same as in LLC01& LLC02.

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PCC-CL10	Database Management System	2L:1T:0P(4hrs.)	Credits:03

Prerequisite: Discrete Structure, Data Structure

Course Objective:

The main objective of this course is to understand fundamental of data base management system.

Course Contents: (40 hrs.)

Module1: (07hrs.)

Introduction to DBMS, File system vs DBMS, Advantages of database systems, Database System architecture, Data models, Schemas and instances, Data independence, Functions of DBA and designer, Design issues, Entity-Relationship model: Basic concepts, Design process, E-R diagrams, weak entity sets, extended E-R features–generalization, specialization and aggregation.

Module 2: (11hrs.)

Structure of relational databases, Relation algebra fundamental operators and syntax, relational algebra queries, Tuple calculus, Keys, Types of Keys. SQL: Data retrieval queries, Data extraction from single, multiple tables equi-join, non-equijoin, self-join, outer join. Usage of like, any, all, exists, in Special operators. DDL, DML, integrity constraints, Complex queries, Referential integrity.

Module 3: (08hrs.)

Data Base Design: Introduction to normalization, Normal forms, Functional Dependency (FD), Types of FD, closure of attributes, irreducible set of FD, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalve dependencies.

Module 4: (08hrs.)

Transaction Processing Concepts: - Transaction system, ACID Property, Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Concurrency Control Techniques: Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, Recovery with concurrent transaction.

Module 5: (06hrs.)

Data Storage and Indexes-file organizations, primary, secondary index structures, various index structures-hash-based, dynamic hashing techniques, multi-level indexes, B and B+ trees. Cursor management: nested and parameterized cursors, Triggers, Types of triggers.

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Course Outcomes:

After completion of the course the student will be able to:

1. Describe basic concepts of DBMS and Design ER model.
2. Solve queries using Relational Algebra and SQL.
3. Understanding of functional dependencies and Explain normalization by applying Normalizations techniques to database.
4. Explain basic the fundamental concepts of transaction processing and concurrency control.
5. Understanding various storage systems and indexing.

List of Text / Reference Books:

1. Date CJ, "An Introduction to Database System", Pearson Educations, 8thEdition,2003.
2. Korth, Silbertz, Sudarshan, "Fundamental of Database System", McGraw Hill, 5thEdition,2006.
3. Peter Rob, "Database System: Design Implementation & Management", Cengage Learninig 4thEdition,2000.
4. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Educations,7thEdition2017.
5. Atul Kahate, "Introduction to Database Management System", Pearson Educations, 2004.
6. Oracle 9i Database Administration Fundamental-I, Volume I, Oracle Press, TMH.
7. Paneerselvam," Database Management System", PHI Learning, 3rdEdition,2018.
8. J.D. Ullman, "Principles of Database and Knowledge– Base Systems", Computer Science Press, 2ndEdition1988.
9. Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", AddisonWesley,1995.

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PCC-CL11	Foundation of Machine Learning	2L:1T:0P(4hrs.)	Credits:03

Prerequisite: Linear Algebra, Probability &Python

Course Objective:

1. Students understand issues and challenges of Machine Learning.
2. Should be able to select data, model selection, model complexity etc.
3. Understanding of the strengths and weaknesses of many popular machine learning approaches.

Course Contents: (38 hrs.)

Module1: **(06hrs.)**

Brief Introduction to Machine Learning, Types of ML: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Real-world applications of ML, Key concepts: Features, Labels, Training, Testing, Validation, Steps in a typical ML pipeline.

Module 2: **(08hrs.)**

Data Link Probability Basics, Linear Algebra, Statistical Decision Theory – Regression & Classification, Linear Regression, Logistic Regression, Overfitting and Underfitting, Bias-Variance trade-off, Bias – Variance Linear Regression Multivariate Regression.

Module 3: **(10hrs.)**

Dimensionality Reduction, Subset Selection, Shrinkage Methods, Principal Components, Regression Linear Classification, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification.

Module 4: **(08hrs.)**

Perceptron Learning, ANN Early models, Back Propagation: Initialization, Training & Validation, Parameter Estimation: Maximum Likelihood Estimation, Bayesian Parameter Estimation, Decision Trees, Evaluation Measures, Hypothesis Testing, Ensemble Methods, Graphical Models.

Module 5: **(06hrs.)**

Clustering, Gaussian Mixture Models, Spectral Clustering Ensemble Methods Learning Theory, Reinforcement Learning, Introduction to Hypothesis Testing.

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Course Outcomes:

After completion of the course the student will be able to:

1. Identify the characteristics of data sets and compare the trivial data and big data for various applications.
2. Understand machine learning techniques and computing environment that are suitable for the applications under consideration.
3. Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
4. Develop scaling up machine learning techniques and associated computing techniques and technologies for various applications.
5. Implement various ways of selecting suitable model parameters for different machine learning techniques.

List of Text / Reference Books:

1. Machine Learning – Tom M. Mitchell, - MGH.
2. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.
3. Machine Learning, Saikat Dull, S. Chandramouli, Das, Pearson.
4. Machine Learning with Python for Everyone, Mark Fenner, Pearson.
5. Machine Learning, Anuradha Srinivasa Raghavan, Vincy Joseph, Wiley.
6. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley.
7. Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing.

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Semester–V

PCC-CL12	Neural Network	3L:0T:0P(3hrs.)	Credits:03

Prerequisite:

Course Objective:

Understand artificial neural networks, from single-layer perceptrons and supervised learning with backpropagation to unsupervised learning for pattern discovery and apply them to real-world problems.

Course Contents: (38 hrs.)

Module1: **(06hrs.)**

Artificial Neural Networks (ANN) and their biological roots and motivations. ANNs as numerical data/signal/image processing devices. a summing dendrite, synapses and their weights, pre- and post- synaptic signals, activation potential and activation function. Excitatory and inhibitory synapses. The biasing input. Types of activating functions. Encoding (training phase) and decoding (active phase). Taxonomy of neural networks: - feed forward and recurrent networks with supervised and unsupervised learning laws laws, static & dynamic processing systems, basic data structures: mapping of vector spaces, clusters, principal components.

Module 2: **(08hrs.)**

Linear Networks: - Adaline - the adaptive linear element, Linear regression. The Wiener-Hopf equation. The Least-Mean-Square (Widrow-Hoff) learning algorithm. Method of steepest descent. Adaline as a linear adaptive filter. A sequential regression algorithm. Multi-Layer Feedforward Neural Networks: - Multi-Layer Perceptrons. Supervised Learning. Approximation and interpolation of functions. Back-Propagation Learning law. Fast training algorithms. Applications of multilayer Perceptrons: Image coding, Paint-quality inspection, Nettalk.

Module 3: **(10hrs.)**

Self-Organising Systems: -Unsupervised Learning, Pattern clustering, Topological mapping, Kohonen's self-organizing map, Local learning laws-Generalised Hebbian Algorithm. The Oja's and Sanger's rules. Principal component analysis - Karhunen-Loeve transform.

Module 4: **(08hrs.)**

Feedback neural networks: - Pattern storage and retrieval, Hopfield model, Boltzmann machine, Recurrent neural networks.

Module 5: **(06hrs.)**

Radial basis function networks: - Regularization theory, RBF networks for function approximation, RBF networks for pattern classification. Kernel methods for pattern analysis: - Statistical learning theory, Support vector machines for pattern classification, Support vector regression for function approximation, Relevance vector machines for classification and regression.

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Course Outcomes:

After completion of the course the student will be able to:

1. Ability to understand the concepts of Neural Networks.
2. Ability to select the Learning Networks in modeling real world systems.
3. Understand training of recurrent Hopfield networks and associative memory concepts.
4. Ability to use an efficient algorithm for Deep Models.
5. Ability to apply optimization strategies for large scale applications.

List of Text / Reference Books:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India.
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill.
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall.

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Semester–V

PEC-CL01 (A)	Fuzzy Sets & Theory	3L:0T:0P (3hrs.)	Credits:03

Prerequisite: Set Theory

Course Objective:

This course introduces students to the basic concepts of modeling in systems using fuzzy sets. The concepts of fuzzy sets are introduced and their role in applications of semantic interpreters, control systems and reasoning systems.

Course Contents: (45 hrs.)

Module1: FUZZY SETS (08hrs.)

Basic concepts of fuzzy set – t-norm – t-conorms – Membership function – α-cut – Algebra of fuzzy sets – Distance between fuzzy sets – Fuzzy relation.

Module 2: FUZZY ARITHMETIC (09hrs.)

Fuzzy numbers – Arithmetic operations of fuzzy numbers – Extension principle – Interval arithmetic – Defuzzification.

Module 3: FUZZY FUNCTION (10hrs.)

Fuzzy valued functions – Fuzzy equations, fuzzy inequalities, system of fuzzy linear equations – Maximum and minimum of fuzzy functions.

Module 4: FUZZY LOGIC (10hrs.)

Classical Logic – Multi-valued Logics – Fuzzy Propositions – Fuzzy Quantifiers – Linguistic hedges – Inference from conditional Fuzzy proposition.

Module 5: APPLICATIONS OF FUZZY SET THEORY (08hrs.)

Fuzzy sets in Decision making – Optimization in Fuzzy environment – Fuzzy set application in image processing – Fuzzy set application in pattern reorganization.

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Course Outcomes:

After completion of the course the student will be able to:

1. Understand basic knowledge of the fuzzy sets, operations and their properties.
2. Understand the fundamental concepts of Fuzzy functions and Fuzzy logic.
3. Apply the concepts of Fuzzy sets in image processing, pattern reorganization and decision making.
4. Apply the concepts of Fuzzy logic in image processing.
5. Identify the applications of fuzzy sets.

List of Text / Reference Books:

1. Didier Bubois and Henri Prade, “Fuzzy sets and systems”, Academic Press.
2. James J Buckley, Esfandiar Eslami, “An Introduction to Fuzzy logic and Fuzzy sets” (Springer).
3. H.J. Zimmernman, “Fuzzy set theory and application” (Allied Publication in Association with KLUWER).

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Semester–V

PEC-CL01 (B)	Advanced Computer Architecture	3L:0T:0P(3hrs.)	Credits:03

Prerequisite: CSO

Course Objective:

Gain knowledge of parallel processing, implement and analyze arithmetic hardware across scalar systems, and design instruction pipelining to evaluate processor performance.

Course Contents: (43 hrs.)

Module1: **(09hrs.)**

Flynn's Classification, System Attributes to Performance, Parallel computer models - Multiprocessors and multicomputer, Multi vector and SIMD Computers. Data and resource dependencies, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Control flow, data flow and Demand driven mechanisms. Static interconnection networks, Dynamic interconnection Networks: Bus Systems, Crossbar Switch, Multiport Memory, Multistage and Combining Networks.

(10hrs.)

Module 2:

Instruction set architecture, CISC Scalar Processors, RISC Scalar Processors, VLIW architecture, Memory Hierarchy, Inclusion, Coherence and Locality, Memory capacity planning. Interleaved memory organization-memory interleaving, pipelined memory access, Bandwidth and Fault Tolerance. Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt.

(10hrs.)

Module 3:

Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling - score boarding and Tomasulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscalar pipeline design, Super pipeline processor design.

Module 4: **(08hrs.)**

Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer networks, deadlock, and virtual channels. Vector Processing Principles, Vector instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD organization: distributed memory model and shared memory model. Principles of Multithreading: Multithreading Issues and Solutions, Multiple-Context Processors.

Module 5: **(06hrs.)**

Parallel Programming Models, Shared-Variable Model, Message-Passing Model, Data-Parallel Model, Object-Oriented Model, Functional and Logic Models, Parallel Languages and Compilers, Language Features for Parallelism, Parallel Programming Environment, Software Tools, and Environments.

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Course Outcomes:

After completion of the course the student will be able to:

1. Understand the Concept of Parallel Processing and its applications.
2. Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. Develop the Pipelining Concept for a given set of Instructions.
5. Distinguish the performance of pipelining and non-pipelining environment in a processor.

List of Text / Reference Books:

1. Advanced Computer Architecture, Kai Hwang, McGraw-Hill, India
2. Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
3. Computer Organization and Architecture, William Stallings ,8th edition, PHI
4. Computer Organization, Carl Hamachar, Vranesic, Zaky, 5th edition, McGraw Hill.

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Semester–V

PEC-CL01 (C)	Cyber Security	3L:0T:0P(3hrs.)	Credits:03

Prerequisite: Computer Network

Course Objective:

Analyze and resolve security issues in an organization to secure an IT infrastructure.

Course Contents: (42 hrs.)

Module1: **(08hrs.)**

Introduction of Cyber Crime, Challenges of cyber-crime, Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Internet Time Theft, Salami attack/Salami Technique.

Module 2: **(10hrs.)**

Web jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime, Perception of cyber criminals: hackers, insurgents and extremist group etc. Web servers were hacking, session hijacking.

Module 3: **(10hrs.)**

Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment, and E- mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackle Cyber Crime and Trends.

(08hrs.)

Module 4:

The Indian Evidence Act of 1872 v. Information Technology Act, 2000: Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages.

Module 5: **(06hrs.)**

Tools and Methods in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks, Buffer and Overflow, Attack on Wireless Networks, Phishing: Method of Phishing, Phishing Techniques. Introduction to KALI Linux.

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Course Outcomes:

After completion of the course the student will be able to:

1. Define and explain the concepts of cybercrime and its classification.
2. Delineate the components online frauds, intrusions, virtual crimes, and hacking.
3. Knowledge of different acts in cybersecurity.
4. List the various parts of IT act related to electronic records.
5. Knowledge of different Cyber Security tools.

List of Text / Reference Books:

1. Jonathan Clough, “Principles of Cyber-crime”, Cambridge University Press, 2ndEdition, 2015.
2. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Charles River Media, 2ndEdition,2005.
3. Vivek Sood “Cyber Law Simplified”, TMH,2001.
4. Nina Godbole, Sunit Belapure, “Cyber Security”, Wiley-India.
5. William Hutchinson, Mathew Warren, “Information Warfare: Corporate attack and defense in digital world”, Elsevier, Reed International and Professional Publishing Ltd,2001.
6. Harish Chander, “Cyber Laws and IT Protection”, Prentice Hall India Learning PrivateLimited,2012.

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Semester–V

PEC-CL01 (D)	Information Storage & Management	3L:0T:0P(3hrs.)	Credits:03

Prerequisite:

Course Objective:

To introduce solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities.

Course Contents: (40 hrs.)

Module1: **(06hrs.)**

Introduction to Storage Technology: Data proliferation, evolution of various storage technologies, Overview of storage infrastructure components, Information Lifecycle Management, Data categorization.

Module 2: **(10hrs.)**

Storage Systems Architecture: Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, RAID levels & parity algorithms, hot sparing, Front end to host storage provisioning, mapping, and operation.

Module 3: **(10hrs.)**

Introduction to Networked Storage: JBOD, DAS, NAS, SAN & CAS evolution, and comparison. Applications, Elements, connectivity, standards, management, security and limitations of DAS, NAS, CAS & SAN.

Module 4: **(08hrs.)**

Hybrid Storage solutions; Virtualization: Memory, network, server, storage & appliances. Data center concepts & requirements, Backup & Disaster Recovery: Principles Managing & Monitoring: Industry management standards (SNMP, SMI-S, CIM), standard framework applications, Key management metrics (Thresholds, availability, capacity, security, performance).

Module 5: **(06hrs.)**

Information storage on cloud: Concept of Cloud, Cloud Computing, storage on Cloud, Cloud Vocabulary, Architectural Framework, Cloud benefits, Cloud computing Evolution, Applications & services on cloud, Cloud service providers and Models, Essential characteristics of cloud computing, Cloud Security and integration.

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Semester–V

Course Outcomes:

After completion of the course the student will be able to:

1. To Understand the Concept of Information Storage and Data Centre Environment.
2. To understand about Data Protection.
3. To Understand Fiber Channel SAN.
4. To describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.
5. To Understand Cloud Computing.

List of Text / Reference Books:

1. G. Somasundaram & Alok Shrivastava (EMC Education Services) editors, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley India,2009.
2. Ulf Troppens, Wolfgang Mueller-Friedt, Rainer Erkens, Rainer Wolafka, NilsHaustein, "Storage Network explained: Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE", Wiley India.
3. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, Taylor Frances Pub.1stEdition,2017
4. Nick Antonopoulos, Lee Gillam, "Cloud Computing: Principles, System &Application", Springer.
5. Anthony T. Velete, Toby J.Velk, and Robert Eltenpeter, "Cloud Computing: A practical Approach", McGraw-Hill Education (India) Pvt. Limited,2009.
6. Dr. Kumar Saurabh, "Cloud Computing: Insight into New Era I", Wiley India Pvt. Limited, 2011.

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PCC-LC-CL10 (P)	SQL & Mongo DB Lab	0L:0T:04P (4hrs.)	Credits:02

Prerequisite:

Course Objective:

To introduce solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities.

Course Contents:

Module1:
Installation: SQL Server or Oracle or MySQL, Overview of using SQL tool, SQL Syntax, Data types in SQL: Numeric data types, Date and Time data types, Character and String data types, Unicode character string data types, Binary data types, and Miscellaneous data types, Creating Tables, Oracle and SQL Data Definition language (DDL), Data manipulation language (DML) Data Control language (DCL).

Module 2:

DDL Commands, Create, Alter, Drop, Truncate, and Rename. Data Definition Language Operations, Create a Database, Use Database, Rename a Database, Drop Database, Add a Column to exiting Table, Add multiple columns to existing Table, Modify an existing column, Rename a Column, Drop a Column, Truncate a Table, and Drop a Table. Integrity Constraints.

Module 3:

DML Commands, select, insert, update, and delete. Data Manipulation Language Operations, retrieving data from a table, inserting data into a table, updating existing data into a table, and deleting all records from a table. logical operation (and, or, not), like, wildcards, in, between, aliases, any, all, union, intersect, SQL aggregate functions, count, sum, avg, max, min, clauses: order by, group by, having.

Module 4:

Joins: inner join, left join, right join, full join, self-join, sub query: nested query. Correlated sub query exists, not exists, DCL commands such as grant and revoke, views: views creation and dropping. Introduction to PL/SQL, practicing on triggers - creation of trigger.

Module 5:

Introduction to Basics of NoSQL and MongoDB, Overview of MongoDB Architecture, CRUD Operations in MongoDB.

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Course Outcomes:

After completion of the course the student will be able to:

1. Describe basic concepts of SQL and its data type.
2. Apply data definition language command and analyze its output.
3. Apply data manipulation language command and analyze its output.
4. Apply data control language command, PLSQL and analyze its output.
5. Understand the fundamentals of MongoDB, including its architecture and core concepts, and perform basic CRUD operations to manage databases and collections within a NoSQL environment.

List of Practical's:

1. Introduction to Oracle and SQL.
2. Write the queries for Data Definition language (DDL).
3. Write the queries for Data manipulation language (DML).
4. Use of various types of Integrity Constraints.
5. Write the queries for Data Control language (DCL).
6. Use of SELECT command with different clauses.
7. Write SQL queries using logical operation (AND, OR, NOT).
8. Write SQL queries for aggregate functions (Max, Min, Sum, Avg, and Count).
9. Write SQL queries for group by and having.
10. Write SQL queries for sub queries and nested queries.
11. Write an SQL query to implement JOINS.
12. Write SQL queries to create views.
13. Write program using PL/SQL
14. Installing and setting up MongoDB.
15. Creating and dropping databases & collections.

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Semester–V

PCC-LC-CL11 (P)	Machine Learning Lab	0L:0T:02P (2hrs.)	Credits:01

Prerequisite:

Course Objective:

1. Provide a comprehensive understanding of machine learning concepts, including supervised and unsupervised learning, and their applications.
2. Develop proficiency in applying various machine learning algorithms and techniques, such as regression, clustering, and classification, to solve real-world problems.
3. Enhance practical skills in using Python and relevant libraries to implement and evaluate machine learning models.

Course Contents:

Module1:
Implement Linear Regression, Apply Gradient Descent, Evaluate Regression Models using MSE, RMSE, MAE, R^2 Score.

Module 2:

Implement K-means Clustering, Visualize Clusters using Matplotlib/Seaborn, Determine Optimal Clusters (Elbow Method, Silhouette Score).

Module 3:

Perform Matrix Operations (Addition, Multiplication, Inversion), Apply Linear Algebra for Feature Transformation and Dimensionality Reduction (e.g., PCA using NumPy/SciPy).

Module 4:

Implement Logistic Regression, Perform Binary and Multi-class Classification, Evaluate Classifier Performance using Confusion Matrix, Accuracy, Precision, Recall, F1 Score, ROC Curve.

Module 5:

Build and Train a Simple ANN using TensorFlow/Keras, Use ANN for Classification Tasks, Implement Gaussian Mixture Models (GMM), Compare Clustering Outputs of K-means and GMM.

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Course Outcomes:

After completion of the course the student will be able to:

1. Students will be able to understand the basics of machine learning and implement linear regression models, evaluating their performance using appropriate metrics.
2. Students will be able to apply unsupervised learning techniques, particularly K-means clustering, and visualize clusters to interpret data patterns.
3. Students will gain proficiency in performing linear algebra operations and applying these concepts to machine learning problems.
4. Students will be able to implement and evaluate logistic regression models for both binary and multi-class classification tasks.
5. Students will be able to build and train artificial neural networks and compare clustering techniques, including Gaussian Mixture Models and K-means, to analyze their effectiveness.

List of Practical's:

1. Implement a linear regression model using python.
2. Perform K-means clustering on the Iris dataset and visualize the clusters using a scatter plot.
3. Perform basic linear algebra operations using NumPy, such as matrix multiplication and inversion.
4. Implement logistic regression for binary classification on the Iris dataset (using only two classes for simplicity).
5. Implement logistic regression for multi-class classification on the Iris dataset and evaluate its performance using a confusion matrix.
6. Demonstrate how to build a simple Artificial Neural Network (ANN) using Keras to classify images from the MNIST dataset, which contains handwritten digits from 0–9.
7. Implement K-means clustering using Python.
8. Implement naive baye's theorem to classify the English text.
9. Implement an algorithm to demonstrate the significance of genetic algorithm.
10. Implement the finite words classification system using Back-propagation algorithm.

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Bachelor of Technology (B.Tech.)

Department of Computer Science & Engineering (AIML)

Semester–V

PROJ-CL02 (P)	Mini Project	0L:0T:04P (4hrs.)	Credits: 2

Prerequisite: Knowledge of programming languages, databases, software engineering, problem-solving, teamwork, communication, project planning, and relevant tools and technologies.

Course Objective:

To provide computer science and engineering students with hands-on experience in project development, enhancing their technical, problem solving, teamwork, and project management skills while applying theoretical knowledge to real-world challenges.

Course Contents:

The course covers mini project development, starting with real-world applications and problem-solving, where students brainstorm ideas, conduct feasibility studies, and write detailed proposals. It then focuses on project planning, including task definition, milestones, resource management, system design, and database modeling. Students set up development environments, adhere to coding standards, and integrate front-end and back-end components, with an emphasis on UI design and testing. The course also teaches technical documentation, quality assurance, progress reporting, peer reviews, and bug tracking. Finally, students prepare project presentations, conduct demos, collect feedback, submit reports, and reflect on the learning experience, discussing potential improvements.

Course Outcomes:

After completion of the course the student will be able to:

1. Devise project ideas, conduct feasibility studies, write, and present proposals, incorporating feedback.
2. Develop project plans, set milestones, estimate budgets, form teams, and create detailed system designs.
3. Develop modules, follow coding standards, and perform comprehensive testing.
4. Prepare documentation, submit progress reports, ensure quality, and manage bug tracking effectively.
5. Ability to demonstration of project, gather feedback from evaluators, submit project reports with software engineering standards.

List of Text / Reference Books:

1. “Project Management: A Systems Approach to Planning, Scheduling, and Controlling”, 13th Edition, Harold Kerzner, ISBN: 978-1-119-80537-3.
2. "Software Engineering: A Practitioner's Approach" by Roger S. Pressman.
3. "Software Engineering" by Ian Sommerville.
4. “Software Quality Assurance: Principles and Practice" by Nina S. Godbole.

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Semester–V

SBC-CL02 (P)	Programming with Java Script	0L:0T:02P (2hrs.)	Credits: 1

Prerequisite: Basics of programming

Course Objective:

1. Understand JavaScript Fundamentals and Syntax.
2. Master JavaScript Data Types, Operators, and Control Structures.

Course Contents:

Module1:
General overview of JavaScript, JavaScript history, Relation between JavaScript and ECMA Script, Versions of JavaScript. Syntax review, Keywords and reserved words, Variable declaration, Variable scope, Block scope.

Module 2:

Data Types: Primitive values, Reference values, Types, Type conversion. Expressions (arithmetic, relational, logical, assignment and others), and Operators overview.

Module 3:

Control structures: Flow control and conditionals, Loops, and iteration, Jumps. Error handling: Throwing errors, Error handling.

Module 4:

Numbers: Number literals, Number object, Number methods, Math object, Date object, Working with Numbers. Strings: String literals, String object, String methods, Working with Strings. Arrays: Creating and populating Arrays, Array methods, Working with Arrays.

Module 5:

Functions: Defining functions, Calling functions, Functions as values, Arguments and parameters, Function scope, Closures, Arrow functions. Regular Expressions: Creating regular expressions, RegExp object and its methods, String methods for matching patterns.

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Semester–V

Course Outcomes:

After completion of the course the student will be able to:

1. Understand JavaScript's historical context, its relationship with ECMA Script standards, and differentiate between JavaScript versions.
2. Proficiently use JavaScript data types (primitive and reference), apply type conversion techniques, and use various operators and expressions effectively.
3. Confidently utilize control structures (conditional statements, loops) and error handling mechanisms to write robust JavaScript code.
4. Learn to work adeptly with JavaScript number literals, methods of Number and Math objects, manipulate strings, and manage arrays effectively.
5. Demonstrate proficiency in defining and invoking functions, understanding function scope and closures, using arrow functions, and applying regular expressions for pattern matching.

Suggested idea for Practical's:

1. Research and present a timeline of major JavaScript versions and their features.
2. Compare ECMA Script versions (e.g., ES5, ES6) and discuss their impact on JavaScript development.
3. Create examples demonstrating the use of JavaScript syntax including variables, operators, and statements.
4. Identify and explain the use of keywords and reserved words in JavaScript.
5. Write code snippets to demonstrate global scope, function scope, and block scope in JavaScript.
6. Contrast variable hoisting and its implications with block-scoped variables (let and const).
7. Develop exercises illustrating implicit and explicit type conversion in JavaScript.
8. Compare coercion between primitive values and reference values.
9. Construct practical scenarios using if, else if, and switch statements.
10. Develop exercises using for, while, and do-while loops to iterate over arrays and objects.
11. Develop exercises to manipulate string literals and utilize String object methods like slice, indexOf, and replace.
12. Create exercises to demonstrate array creation, population, and manipulation using methods like push, pop, map, and filter.
13. Develop practical exercises to define functions with parameters and return values.
14. Create exercises to build regular expressions for pattern matching.