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SEMESTER S5
MACHINE LEARNING LAB

Course Code	PCITL507	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	LAB

Course Objectives:

1. By the end of this course, students will be able to implement and evaluate multiple machine learning models, including Multiple Linear Regression, Logistic Regression, Decision Trees (ID3 & CART), Naïve Bayes' Classifier, and Support Vector Machines, using practical datasets such as house prices, Titanic survival data, and spam emails.
2. Gain hands-on experience in applying advanced machine learning techniques to various tasks, including character recognition using Multilayer Perceptron, clustering with K-Means and DBScan, sentiment analysis with Random Forest, Adaboost, and XGBoost, Q-Learning for game strategies, and image classification using Convolutional Neural Networks (CNNs).

Experiment No.	Experiment
1	Study of Python Libraries for ML applications such as Pandas and Matplotlib.
2	Implement Multiple Linear Regression for House Price Prediction.
3	Implement Logistic Regression for Titanic Survival Prediction without using Libraries.
4	Implement Decision trees – ID3 & CART.
5	Implement Naïve Bayes' Classifier for Diagnosis of Heart Patients.
6	Implement Support Vector Machines to Filter Spam Mails.
7	Implement Multilayer Perceptron for Character Recognition using MNIST Dataset
8	Implement k-Nearest Neighbor without using libraries for IRIS Dataset
9	Implement K-Means Clustering & DBScan.
10	Implement Sentiment Analysis using Random Forest, Adaboost, XGboost
11	Implement Q-Learning for a Simple Game.

12	Implement CNN for Image Classification.

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	*Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)*	*Internal Exam*	***Total***
5	**20**	**20**	**50**

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	**Total**
10	**15**	**10**	**10**	**5**	**50**

- **Submission of Record**: Students shall be allowed for the end semester examination only upon submitting the duly certified record.
- **Endorsement by External Examiner**: The external examiner shall endorse the record.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		**Bloom's Knowledge Level (KL)**
CO1	Demonstrate proficiency in Python Libraries for Machine Learning, Python libraries such as Pandas and Matplotlib to preprocess data, visualize datasets, and gain insights essential for machine learning applications.	**K3**
CO2	Implement various machine learning algorithms, including Multiple Linear Regression, Logistic Regression, Decision Trees (ID3 & CART), and Naïve Bayes' Classifier, and will be able to assess their performance on different datasets.	**K3**

CO3	Build and apply advanced models such as Multilayer Perceptron for character recognition, Support Vector Machines for spam filtering, and Convolutional Neural Networks for image classification, as well as implement clustering techniques like K-Means and DBScan.	**K3**
CO4	Implement Q-Learning for simple game scenarios and perform sentiment analysis using ensemble methods such as Random Forest, Adaboost, and XGboost, demonstrating a comprehensive understanding of both supervised and reinforcement learning techniques.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	2	-	-	2	-	-	2
CO2	3	3	2	2	2	2	-	-	2	-	-	2
CO3	3	3	2	2	2	2	-	-	2	-	-	2
CO4	3	3	2	2	2	2	-	-	2	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Python Machine Learning	Sebastian Raschka (Author), Vahid Mirjalili (Author)	Packt	2nd Edition, 2019
2	Machine Learning	Tom M Mitchell	McGraw Hill Education	First Edition, 2013
3	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media, Inc.	2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,	Aurélien Géron	O'Reilly Media, Inc.	2nd Edition, 2019

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://cse.iitkgp.ac.in/~pabitra/course/ml/ml.html

Continuous Assessment (20 Marks)

1. **Preparation and Pre-Lab Work (5 Marks)**
   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (5 Marks)**
   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (5 Marks)**
   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.
4. **Viva Voce (5 Marks)**
   - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**
   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
   - Creativity and logic in algorithm or experimental design.
2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**
   - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.
3. **Result with Valid Inference/Quality of Output (10 Marks)**
   - Accuracy of Results: Precision and correctness of the obtained results.

- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**
    - Ability to explain the experiment, procedure results and answer related questions
    - Proficiency in answering questions related to theoretical and practical aspects of the subject.
5. **Record (5 Marks)**
    - Completeness, clarity, and accuracy of the lab record submitted.

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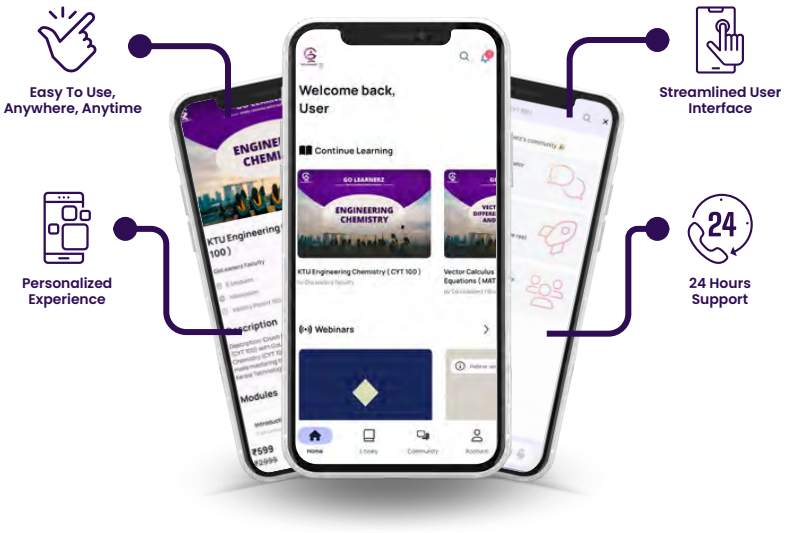

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