

COMPETENCY BASED LEARNING DESIGN/COMPETENCY BASED POST-TEACHING REFLECTION

YEAR – 2025 - 2026

SEMESTER - II

DEPARTMENT - Department of Computer

HANDS ON MACHINE LEARNING

CVAC paper offered by the University to be Studied in Semester-2 of Four-year U.G. courses of studies

(Honours & Honours with Research) courses of studies under CCF, 2022 under this University.

Topic / Unit	Competency-Based Expected Learning Outcome (Knowledge, Skill, Value, Attitude)	Assessment	Brief Description of Strategies, Aids (if any), Evaluation Process	Hours Allotted	Evaluated Outcome / Post-Teaching Reflections
Unit 1: Supervised & Unsupervised Learning, Linear Regression, Cost & Loss Functions, Gradient Descent, Feature Engineering, Train-Test Split, Performance Metrics (MSE, RMSE, R ²)	Knowledge: Understand machine learning workflow and regression concepts. Skill: Build and evaluate linear regression models using Python. Value: Appreciate data-driven decision making. Attitude: Develop analytical thinking and curiosity towards predictive modelling.	Quiz, Lab Assignment, Regression Mini Project	Interactive lecture with PPT, Jupyter Notebook demonstrations, real-world datasets, hands-on coding exercises. Continuous assessment through coding tasks and model evaluation.	8	Most students successfully implemented regression models and interpreted performance metrics. Additional practice was required for understanding gradient descent and feature engineering.

<p>Unit 2: Logistic Regression, Decision Boundary, Overfitting & Underfitting, Regularization, Classification Metrics (Precision, Recall, F1, ROC-AUC, KS)</p>	<p>Knowledge: Understand classification problems and model evaluation techniques. Skill: Develop binary classification models and evaluate performance. Value: Recognise the importance of fair and accurate classification. Attitude: Foster critical analysis of model outcomes.</p>	<p>Practical Assignment, MCQ Test, Case Study</p>	<p>Demonstration of classification datasets, visualisation of decision boundaries, guided Python implementation, peer discussion on model performance.</p>	<p>8</p>	<p>Students were able to apply logistic regression and compute classification metrics. Some students needed reinforcement regarding ROC-AUC interpretation and regularization concepts.</p>
<p>Unit 3: Neural Networks, Forward & Backpropagation, Cross Validation, Multiclass Classification, Bias & Variance, Digit Recognition</p>	<p>Knowledge: Understand fundamentals of neural networks and deep learning concepts. Skill: Implement basic neural network models for classification tasks. Value: Appreciate the role of AI in pattern recognition. Attitude: Develop perseverance in debugging and model tuning.</p>	<p>Coding Assignment, Practical Demonstration, Viva Voce</p>	<p>Use of TensorFlow/Keras, visual demonstrations of neural network architecture, digit recognition examples, collaborative coding sessions.</p>	<p>8</p>	<p>Students demonstrated interest in neural networks and successfully implemented simple models. Backpropagation concepts required additional explanation through visual aids.</p>
<p>Unit 4: Decision Trees, Entropy, Gini Index, Ensemble Methods, Bagging, Boosting, Random Forest, XGBoost</p>	<p>Knowledge: Understand tree-based learning and ensemble techniques. Skill: Compare and implement multiple machine learning algorithms. Value: Recognise the importance of model selection and robustness. Attitude: Encourage evidence-based comparison of algorithms.</p>	<p>Practical Lab Test, Comparative Analysis Report</p>	<p>Visualisation of decision trees, implementation using Scikit-learn, performance comparison activities, guided interpretation of feature importance.</p>	<p>8</p>	<p>Students effectively compared algorithms and understood ensemble advantages. Some learners required support in interpreting entropy and Gini measures.</p>

<p>Unit 5: Machine Learning Project Implementation (Data Collection, Problem Definition, Data Cleaning, Model Building, Evaluation)</p>	<p>Knowledge: Integrate machine learning concepts into a complete project lifecycle. Skill: Develop and present an end-to-end machine learning solution. Value: Promote responsible and ethical use of data. Attitude: Build confidence, teamwork, and problem-solving abilities.</p>	<p>Project Report, Presentation, Viva Voce</p>	<p>Project-based learning using open-source datasets, mentoring sessions, peer review, rubric-based evaluation of project implementation and presentation.</p>	<p>8</p>	<p>Students successfully completed end-to-end projects and demonstrated practical understanding of machine learning workflows. Project work enhanced confidence and application-oriented learning.</p>
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