Course Code & Name	26CAPL8002 Data Science lab		
Teaching Hours /week (L: T:P: R)	0:0:4:0	Credits	2
CIE Marks	50	ESE Marks	50
Course Type	Lab(PCL)	Exam Hours	3
Prerequisites (if any)	-		

Course Objectives:

1. Design and implement feed-forward and deep neural networks using modern deep learning frameworks to solve classification and regression problems.
2. Tune and optimize key hyperparameters to improve the accuracy, robustness, and efficiency of deep learning models.
3. Evaluate and analyze model performance using appropriate metrics and validation techniques for effective model interpretation and improvement

Course Outcomes (COs)

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

CO#	Course Outcome	Bloom's Knowledge Level (KL)
CO 1	To provide practical exposure to feed-forward and deep neural networks for solving classification and regression problems.	K3
CO 2	To introduce the design of single-layer and multi-layer neural network architectures along with hyperparameter tuning techniques for performance improvement.	K3
CO 3	To familiarize learners with deep learning frameworks such as TensorFlow, Keras, and PyTorch for implementing convolutional and recurrent neural networks.	K3
CO 4	To present methods for evaluating model performance using metrics such as accuracy, precision, recall, F1-score, confusion matrix, and loss curves.	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)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	1	2	1	-	-	2
CO 2	3	3	2	3	2	-	-	2
CO 3	3	3	3	3	2	-	-	2
CO 4	3	3	3	3	3	-	-	2

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

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE)

Attendance	(Continuous Assessment) Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record	Internal Lab Examination-1	Internal Lab Examination- 2	Total
8	22	10	10	50 Marks

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

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 Marks

Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.

Continuous Assessment (22 Marks)

1. Conduct of Lab Experiments/Project (12 Marks)
2. Timely Completion of Lab Reports/ Project Reports (5 Marks)
3. Viva Voce (5 Marks)

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

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Algorithm/Flowchart (10 Marks)
2. Conduct of Experiment/Execution of Work (15 Marks)
3. Quality of Output (10 Marks)
4. Viva Voce (10 Marks)
5. Record (5 Marks)

Exp. No.	List of Experiments
1	Implement a simple single-layer perceptron for binary classification.
2	Train a multi-layer feed-forward neural network on the MNIST dataset.
3	Implement a simple single-layer perceptron for binary classification.
4	Train a multi-layer feed-forward neural network on the MNIST dataset.
5	Compare performance of networks with different activation functions (ReLU, Sigmoid, Tanh).
6	Experiment with varying the number of hidden layers and neurons on MNIST/Fashion-MNIST datasets.
7	Implement Models with Tune learning rate, batch size, number of epochs, and optimizers (SGD, Adam) to observe performance changes.
8	Apply dropout and L2 regularization to prevent overfitting.
9	Build a Convolutional Neural Network (CNN) for image classification (CIFAR-10 dataset).

10	Implement a Recurrent Neural Network (RNN) for sequence prediction (e.g., text generation or time series forecasting).
11	Plot training and validation loss/accuracy curves for a trained network.Compare Keras vs PyTorch implementations of the same network for training
12	Generate a confusion matrix and compute precision, recall, and F1-score for classification tasks.
13	Implement Transfer Learning for Object Detection Use pre-trained YOLOv5 or Faster R-CNN models. Fine-tune the model to detect objects in a custom dataset

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Deep Learning with Python A practical guide to deep learning using Python and Keras, ideal for lab work and coding exercises.	François Chollet	Manning Publications.	Second Edition 2021
2	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media, Inc.	Third Edition 2022

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Deep Learning	Bunduma, N.	O'Reilly	2017

2	Deep Learning and Neural Networks	Heaton, J	Heaton Research Inc	2015

Web References/ Video Links (NPTEL, SWAYAM…)	
Sl.No	**Link ID**
1	https://www.coursera.org/learn/machine-learning
2	https://www.coursera.org/learn/data-scientists-tools

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