Course Outcomes: At the end of the course, the students will be able to

"1. demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning

2. discuss the Neural Network training, various random models

3. explain the Techniques of Keras, TensorFlow, Theano and CNTK

4. classify the Concepts of CNN and RNN

5. implement Interactive Applications of Deep Learning."

Unit-1

1. (K1) Define Artificial Intelligence and list its main branches.
2. (K2) Explain the evolution of Machine Learning with examples from Probabilistic Modeling to Deep Learning.
3. (K1) What is Probabilistic Modeling? Explain with an example how it is used in Machine Learning.
4. (K2) Describe the structure and learning process of Early Neural Networks like Perceptrons.
5. (K2) Explain Kernel Methods in Machine Learning. How do they support non-linear classification?
6. (K2) Compare and contrast Decision Trees, Random Forests, and Gradient Boosting Machines with examples.
7. (K1) What are the four main branches of Machine Learning? Give one application of each.
8. (K2) Explain the concept of Supervised Learning with a suitable diagram and example.
9. (K2) Discuss how Machine Learning models are evaluated using Accuracy, Precision, Recall, and F1-score.
10. (K2) What is Overfitting and Underfitting? How can they be detected and resolved?

Unit-2

1. Define Deep Learning. How is it inspired by the biological neural networks of the human brain? *(K1)*
2. Differentiate between biological vision and machine vision with examples. *(K2)*
3. Explain the similarities and differences between human and machine language understanding. *(K2)*

4. What is an Artificial Neural Network (ANN)? Describe its structure with a neat diagram. *(K1)*
5. Explain how a single-layer and multi-layer neural network differ in terms of learning capability. *(K2)*
6. Describe the process of training a deep neural network. Include key concepts like loss function, gradient descent, and backpropagation. *(K2)*
7. List and explain the common challenges in training deep networks. *(K1/K2)*
8. What are the techniques used to improve deep learning models? Explain any two. *(K2)*
9. Discuss the importance of activation functions in deep networks. Compare ReLU, Sigmoid, and Tanh functions. *(K2)*
10. What is the role of optimization algorithms in deep learning? Briefly explain Adam and SGD. *(K2)*

Unit-3

1. Define a Neural Network. Explain its basic anatomy with a neat diagram. *(K1)*
2. Describe the different layers used in a neural network. Give examples of each. *(K2)*
3. Write short notes on the role of activation functions in neural networks. *(K2)*
4. Compare Keras, TensorFlow, Theano, and CNTK in terms of usability and performance. *(K2)*
5. List the steps involved in setting up a deep learning workstation. Describe the importance of each step. *(K1/K2)*
6. What is binary classification? Explain with the example of movie review sentiment analysis. *(K2)*
7. Explain the preprocessing steps required before training a model on IMDB movie reviews. *(K2)*
8. Define multiclass classification. How does it differ from binary classification? *(K1/K2)*
9. Explain how to classify newswires using deep learning. Mention the dataset and model architecture used. *(K2)*
10. Describe the process of compiling, training, and evaluating a deep learning model using Keras. *(K2)*

UNIT-4

1. **(K1)**
Define Convolutional Neural Networks. **List** the main components and their functions in a CNN architecture.

2. **(K2)**
Explain how representation learning works in CNNs. **Why** is it important in deep learning tasks?

3. **(K2)**
Illustrate the role and working of **Convolutional Layers** with a neat diagram and example.

4. **(K1)**
What is multichannel convolution? **Describe** with an example how convolution operation works on RGB images.

5. **(K1)**
Define Recurrent Neural Networks. **How do** they differ from Feedforward Neural Networks?

6. **(K2)**
Explain the step-by-step working of an RNN for sequence data (e.g., text or time series).

7. **(K2)**
Write and Explain a simple RNN implementation using Python or PyTorch code.

8. **(K1)**
What are PyTorch Tensors? **List** their basic operations with examples.

9. **(K2)**
Explain how CNN models are built and trained in **PyTorch**, including model definition, loss function, and optimizer setup.

10. **(K2)**
Differentiate between NumPy arrays and PyTorch tensors. **Discuss** why PyTorch is more suitable for deep learning applications.

Unit-5

1. **(K1)** Define *Machine Vision* and explain its role in interactive deep learning applications with examples.
2. **(K2)** Describe the workflow of a *Natural Language Processing (NLP)* system using deep learning. What are the key components involved?
3. **(K2)** What are *Generative Adversarial Networks (GANs)*? Explain their architecture with a neat diagram and real-world applications.

4. **(K1)** List and briefly describe the major types of *deep reinforcement learning* algorithms. How does it differ from traditional reinforcement learning?
5. **(K2)** Explain the concept of an *agent–environment interaction* in Deep Reinforcement Learning with a suitable example.
6. **(K1)** What is an *Autoencoder*? Explain its architecture and how it is used for dimensionality reduction.
7. **(K2)** Describe the working of a *Boltzmann Machine*. How is energy minimized during training?
8. **(K1)** Define *Restricted Boltzmann Machines (RBMs)*. What are their advantages over standard Boltzmann Machines?
9. **(K2)** Illustrate the structure of a *Deep Belief Network (DBN)*. How are multiple RBMs stacked in a DBN?
10. **(K2)** Compare and contrast *Autoencoders*, *RBMs*, and *DBNs* in terms of structure, learning strategy, and use cases.

Mapping of Unit-wise Questions with Course Outcomes (COs)

Unit 1 – Fundamentals of Deep Learning

Course Outcome: CO1 – Fundamental concepts of AI, ML, and DL

Q. No	Question	CO
1	Define AI and its branches	CO1
2	Evolution of ML (Probabilistic to Deep)	CO1
3	Probabilistic Modeling with example	CO1
4	Structure and learning in Early Neural Networks	CO1
5	Kernel Methods in ML	CO1
6	Compare: Decision Trees, RF, GBM	CO1
7	Four branches of ML	CO1
8	Supervised learning with diagram	CO1
9	Evaluation metrics: Accuracy, Precision, etc.	CO1
10	Overfitting vs Underfitting	CO1

Unit 2 – Deep Learning Concepts

Course Outcomes: CO1, CO2 – Deep Learning foundations and training

Q. No	Question	CO
1	Define Deep Learning + Biological brain	CO1
2	Biological vs Machine vision	CO1
3	Human vs Machine language	CO1
4	Artificial Neural Network + Diagram	CO2
5	Single-layer vs Multi-layer ANN	CO2
6	Training deep networks (Loss, GD, Backprop)	CO2
7	Challenges in training DL models	CO2

Q. No	Question	CO
8	Techniques to improve DL models	CO2
9	Activation functions: ReLU, Sigmoid, Tanh	CO2
10	Optimizers: Adam, SGD	CO2

Unit 3 – Neural Networks & Frameworks

Course Outcome: CO3 – Frameworks and classification tasks

Q. No	Question	CO
1	Neural Network Anatomy + Diagram	CO2
2	Different layers in Neural Network	CO2
3	Role of Activation functions	CO2
4	Compare: Keras, TensorFlow, Theano, CNTK	CO3
5	Setting up Deep Learning workstation	CO3
6	Binary classification: Movie Reviews	CO3
7	Preprocessing for IMDB dataset	CO3
8	Define Multiclass classification	CO3
9	Newswires classification example	CO3
10	Compiling, training, evaluating model in Keras	CO3

Unit 4 – CNN and RNN

Course Outcome: CO4 – Concepts of CNN, RNN, PyTorch

Q. No	Question	CO
1	Define CNN + components	CO4
2	Representation learning in CNNs	CO4
3	Convolution layers + example	CO4
4	Multichannel convolution on RGB images	CO4

Q. No	Question	CO
5	Define RNN + compare with FFN	CO4
6	Step-by-step working of RNN	CO4
7	Simple RNN in Python or PyTorch	CO4
8	Define PyTorch Tensors + operations	CO4
9	CNN model building in PyTorch	CO4
10	NumPy vs PyTorch + DL use cases	CO4

Unit 5 – Interactive DL Applications

Course Outcome: CO5 – Applications: Vision, NLP, GANs, DRL, Generative Models

Q. No	Question	CO
1	Define Machine Vision + examples	CO5
2	NLP workflow in DL	CO5
3	GAN architecture + applications	CO5
4	Types of DRL + comparison with RL	CO5
5	Agent–Environment interaction in DRL	CO5
6	Autoencoder architecture + use case	CO5
7	How Boltzmann Machines work	CO5
8	Define RBM + advantages	CO5
9	Structure of DBN with stacked RBMs	CO5
10	Compare: Autoencoders, RBMs, DBNs	CO5