Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 31-05-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program:** B. Tech	
Course Code: ECE3026	**Course Name:** Neural Networks and Deep Learning	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	36	46	56		

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Name one of the most popular optimization algorithms used in training deep learning models.	**2 Marks**	**L2**	**CO2**
2.	A single-layer neuron is limited to solving only linearly separable problems. Explain how a multi-layer neuron (MLP) overcomes this limitation and enables the classification of non-linearly separable data. Support your explanation with a suitable diagram.	**2 Marks**	**L2**	**CO1**
3.	What is name of a process that increase the size and diversity of a dataset by creating modified versions of existing data. List few of them?	**2 Marks**	**L2**	**CO2**
4.	List four machine learning algorithm most popularly used for image classification.	**2 Marks**	**L2**	**CO2**
5.	A single-layer neuron is limited to solving only linearly separable problems. Explain how a multi-layer neuron (MLP) overcomes this limitation and enables the classification of non-linearly separable data. Support your explanation with a suitable diagram.	**2 Marks**	**L2**	**CO1**

6.	List four popular Convolutional Neural Network (CNN) architectures commonly used for image classification.	**2 Marks**	**L2**	**CO2**
7.	Several platforms provide tools and frameworks for designing AI-based applications using Convolutional Neural Networks (CNNs) and Deep Neural Networks (DNNs). List and describe popular platforms used for developing AI applications with CNNs and DNNs	**2 Marks**	**L2**	**CO2**
8.	Any CNN model needs to evaluate for its correctness, List the parameters used for CNN evaluation.	**2 Marks**	**L2**	**CO2**
9.	As most of the CNN model designed needs to run on a hardware. List the parameter designer needs to check that affects Affects memory usage, deployment size, and inference speed.	**2 Marks**	**L2**	**CO2**
10.	Name technique used in machine learning to prevent overfitting by adding a penalty term to the loss function. This helps the model generalize better to unseen data	**2 Marks**	**L2**	**CO2**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Activation functions play a crucial role in neural networks by introducing non-linearity and enabling complex pattern recognition. Explain the role of activation functions in a neural network and list different types of activation functions commonly used. Describe the significance of each activation function in model performance.	**6 Marks**	**L2**	**CO 2**
	b.	A single-layer perceptron (SLP) can classify only linearly separable data. **Mathematically prove why a single-layer perceptron fails to solve non-linearly separable problems, such as the XOR problem.** Support your explanation with a suitable example or visualization.	4 Marks	**L2**	**CO 2**
		Or			
12.	**a.**	A Single-Layer Perceptron (SLP) fails to classify the XOR problem due to its non-linearity. Explain how a Multi-Layer Neuron (MLN) model can solve the XOR problem. Describe its architecture, key components, and the role of hidden layers in learning a non-linear decision boundary. Support your	**5 Marks**	**L2**	**CO 1**
	b.	A single-layer perceptron can only solve linearly separable problems. **Explain how non-linearity is addressed using a Multi-Layer Perceptron (MLP).** Discuss the role of hidden layers and activation functions in learning complex decision boundaries.	**5 Marks**	**L2**	**CO 1**

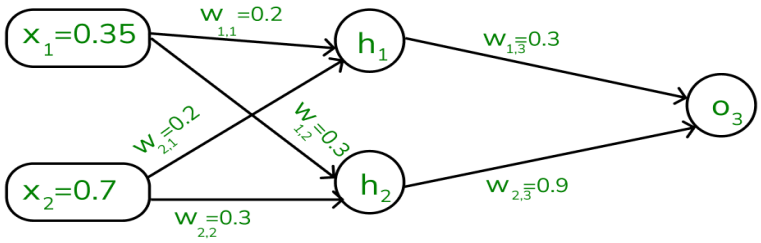
13.	**a.**	Explain the concept of Support vector Machines and the role of hyperplane that works as a decision boundary in the classification.	6 Marks	**L2**	**CO 3**
	b.	List any two real-world applications where the Support Vector Machine (SVM) algorithm is effectively.	2Marks	**L2**	**CO 3**
	c.	Explain whether Support Vector Machine (SVM) is a supervised or unsupervised machine learning method. Justify your answer with an example**.**	2 Marks	**L2**	**CO 3**
Or					
14.	**a.**	Explain the concept of machine learning algorithms and discuss their practical applications in real-world scenarios.	**4 Marks**	**L2**	**CO 3**
	b.	Describe how the Decision Tree algorithm works in machine learning. List two practical applications of this algorithm.	**4 Marks**	**L2**	**CO 3**
	c.	Define K means algorithm of Machine learning .	**2 Marks**	**L2**	**CO 3**

15.	**a.**	Activation functions play a crucial role in neural networks by introducing non-linearity and enabling complex pattern recognition. Explain the role of activation functions in a neural network and explain relu and tanh activation functions commonly used.	**5 Marks**	**L2**	**CO 1**
	b.	Explain Multi-layer Nural Network?	2Marks	**L2**	**CO 1**
	c.	Explain Xor Problem and how MLP can solve it	3Marks	**L2**	**CO 1**
Or					
16.	**a.**	Compare Recurrent Neural Networks (RNNs) and Convolutional Neural Networks (CNNs) in terms of data processing, architecture, and applications.	**5 Marks**	**L2**	**CO 1**
	b.	Explain the function of micro cells in RNNs, and identify one real-world application where RNNs are effectively used.	**3Marks**	**L2**	**CO 1**
	c.	Identify one real-world application where RNNs are effectively used.		**L2**	**CO 1**

17.	**a.**	Explain Convolutional Neural Networks (CNNs) and Deep Neural Networks (DNNs). Describe their working principles and key differences.	**6 Marks**	**L2**	**CO 2**
	b.	Explain the difference between Max Pooling layers in CNNs. How do they affect the extracted features and overall network performance?	2 Marks	**L2**	**CO 2**
	c.	Explain the difference between Average Pooling layers in CNNs. How do they affect the extracted features and overall network performance?	2 Marks	**L2**	**CO 2**
Or					

18.	**a.**	Convolutional Neural Networks (CNNs) are designed using multiple layers, each serving a specific purpose in feature extraction and classification. List and explain the common layers used in designing a CNN. Describe the function of each layer and how they contribute to the overall performance of the model.	**6 Marks**	**L2**	**CO 2**
	b.	Explain the convolution operation in detail with a example on a input data of 5*5 matrix and kernal of 3*3.	**3Marks**	**L2**	**CO 2**
	c.	Explain what is stride and its impact in CNN	**1Mark**	**L2**	**CO 2**

19.	**a.**	The massive amounts of data generated from Electronic medical records, billing, clinical systems, data from wearables, and a variety of research projects continue to generate massive amounts of data. This creates a significant opportunity for healthcare practitioners to improve patient care by leveraging actionable insights from past patient data. Of course, data science is the driving force behind it. Data scientists all over the world are steadily transforming the healthcare industry with superior machine learning and analytics. They're trying to optimize every area of healthcare operations by tapping the potential of data, from increasing care delivery to achieving operational experience. List broad classification of health care where ML is found very useful and is emerging day by day.	**8 Marks**	**L2**	**CO 3**
	b.	With the help of AI tool and IoT we can make sure the doctors are available online 24&7 . Discuss one example for the same	4 Marks	**L2**	**CO 2**
	c.	Explain how ML can be used for the Drug Discovery and delivery timeline	6Marks	**L2**	**CO 2**
		Or			
20.	**a.**	A hospital is implementing an AI-based diagnostic tool that can classify MRI brain scans to detect whether a patient has a tumor or not. They plan to use a Convolutional Neural Network (CNN) for automatic image classification. The dataset contains thousands of labeled MRI images categorized as: *Normal, Benign, and Malignant*. Explain why a CNN is suitable for this medical image classification problem. Identify key components of a CNN that contribute to learning spatial features from MRI images.	**10 Marks**	**L2**	**CO 2**
	b.	Discuss two challenges that may arise when training CNNs on medical datasets and how they can be addressed.	**4 Marks**	**L2**	**CO 2**
	c.	Propose evaluation metrics that should be used to measure the model's performance in a medical context and justify your choices.	**6 Marks**	**L2**	**CO 2**

21.	**a.**	Given a neural network, calculate the Cost Function using the forward pass if the target output is 5 and the learning rate is 1. Show step-by-step calculations, including the weighted sum, activation function, and final loss computation.  	**10 Marks**	**L3**	**CO 1**
	b.	Calculate the updated weights of hidden layer by propagating error in backward layer	10 Marks	**L3**	**CO 1**
		Or			
22.	a.	You are working on an AI project to build intelligent systems for three different domains: handwritten digit recognition, weather prediction, and facial recognition. You are required to use appropriate deep learning models for each task. Explain the architecture and working principle of a basic Feedforward Neural Network (NN). State one real-world application. *(5 Marks)*	5 Marks	L2	CO 2
	b.	Describe the structure of a Convolutional Neural Network (CNN). Why is CNN more effective than a traditional NN for image-based tasks? *(5 Marks)* Explain how a Recurrent Neural Network (RNN) handles sequential data. What role do hidden states and memory play in RNNs? *(5 Marks)*	10 Marks	L2	CO 3
	c.	Given the three tasks below, match each with the most appropriate deep learning model (CNN, RNN, or NN), and justify your choice. 1. Handwritten digit recognition 2. Weather prediction based on past temperature data 3. Face identification from security camera images	5Marks	L2	CO 3