Printed Page:- **Subject Code**:- **ACSAI0613/ACSAIH0613**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VI - THEORY EXAMINATION (20.....- 20.....)

Subject: Deep Learning

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

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SECTION-A 20

1. Attempt all parts:-

1-a. In the context of Artificial Neural Networks, what does "overfitting" refer to? (CO1,K2) 1

(a) When the model learns the training data too well, including its noise and outliers, and performs poorly on unseen data.

(b) When the training process is too slow to converge to an optimal solution.

(c) When the network weights become excessively large during training.

(d) When the model is too simple to capture the underlying patterns in the data, leading to high training and test error.

1-b. The primary role of a loss function in training an Artificial Neural Network: (CO1,K2) 1

(a) To define the architecture of the neural network.

(b) To quantify the difference between the network's predicted output and the actual target output.

(c) To speed up the training process by pruning unnecessary connections.

(d) To prevent the network from overfitting to the training data.

1-c. Which of the following is NOT a primary advantage of using Convolutional Neural Networks (CNNs) for image classification compared to traditional fully connected neural networks? (CO2,K2) 1

(a) Automatic feature extraction

(b) Parameter sharing

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(c) Invariance to translation

(d) Reduced training time for very deep architectures

1-d. Which activation function is most commonly used in the hidden layers of a CNN and why? (CO2,K2) 1

(a) ReLU (Rectified Linear Unit), because it helps mitigate the vanishing gradient problem and is computationally efficient.

(b) Softmax, because it normalizes outputs to a probability distribution.

(c) Tanh, because it has a zero-centered output.

(d) Sigmoid, because it outputs probabilities.

1-e. Which of the following describes 'padding' in a convolutional layer? (CO3, K2) 1

(a) Adding extra layers to the CNN architecture.

(b) Reducing the number of channels in the feature map.

(c) Adding zeros or other constant values around the input image borders to control the output size and retain information at the edges.

(d) Applying a non-linear activation function to the output.

1-f. How does YOLO predict bounding boxes and class probabilities for objects in an image? (CO3,K2) 1

(a) It divides the image into a grid and each grid cell predicts bounding boxes and class probabilities.

(b) It uses a sliding window approach with a fixed-size classifier.

(c) It generates region proposals first, then classifies and refines them.

(d) It classifies each pixel independently as belonging to an object or background.

1-g. What is the main challenge faced by vanilla RNNs when dealing with long sequences? (CO4,K1) 1

(a) Overfitting due to too many parameters.

(b) Inability to handle variable-length input sequences.

(c) Difficulty in parallelizing computations.

(d) Vanishing and exploding gradients.

1-h. In an LSTM cell, what is the primary function of the 'forget gate'? (CO4,K1) 1

(a) To regulate what information should be thrown away from the cell state.

(b) To determine what information to output from the cell state.

(c) To calculate the hidden state based on the previous hidden state.

(d) To decide which information from the current input to add to the cell state.

1-i. What is the primary purpose of an autoencoder? (CO5,K1) 1

(a) Dimensionality Reduction

(b) Image classification

(c) Reinforcement Learning

(d) Object localization

1-j. Autoencoders are trained using: (CO5,K1) 1

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(a) Feed Forward
(b) Back Propagation
(c) Feed back
(d) They do not require Training

2. Attempt all parts:-

2.a.	Elaborate on the 'Curse of Dimensionality' in the context of machine learning. (CO1, K2)	2
2.b.	List some of the application of computer vision. (CO2, K1)	2
2.c.	Describe the function of padding in a convolutional neural network. (CO3, K2)	2
2.d.	Why are sequence models particularly well-suited for processing data where the order of elements is crucial? (CO4, K2)	2
2.e.	Enumerate the primary applications of Autoencoders for unsupervised learning. (CO5,K1)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Illustrate the need of activation functions in modern neural networks. Explain different types of activation functions used in modern neural networks. (CO1, K2)	6
3-b.	Suppose you are predicting price of house from three input features size of house, age of house and number of floors using linear regression model. The actual output and predicted outputs for five houses are as follows: Actual Price (Y): 65, 52, 54, 78, 81 Predicted Price ($\hat{Y}$): 68, 57, 51, 79, 86 Calculate R-squared and Adjusted R-squared and give the interpretation of calculated values. (CO1, K3)	6
3-c.	You've trained an image classification model that shows excellent performance on your training data but struggles on new, unseen images. Discuss how hyperparameter tuning could address this issue, providing specific examples of hyperparameters you would adjust. (CO2, K3)	6
3-d.	Illustrate the primary motivations for incorporating pooling layers within Convolutional Neural Networks, specifically considering their impact on model robustness and computational efficiency. (CO2, K4)	6
3.e.	Describe 1x1 convolution operation along with its advantages. (CO3, K2)	6
3.f.	Compare and contrast the fundamental architectural characteristics and primary operational mechanisms of Recurrent Neural Networks (RNNs) and Feedforward Neural Networks (FFNNs). (CO4, K2)	6
3.g.	Analyze how dropout regularization and batch normalization contribute to the improved training and generalization performance of deep neural networks. (CO5, K4)	6

SECTION-C 50

4. Answer any one of the following:-

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4-a.	Describe various measures to evaluate performance of a machine learning model for classification task. In a binary classification model, you have the following results: True Positives (TP) = 15, False Positives (FP) = 5, and False Negatives (FN) = 9. Calculate the Precision, Recall, and F1-score for this model. (CO1, K3)	10
4-b.	Differentiate between single layer and multilayer feed forward artificial neural networks. In the context of training an Artificial Neural Network, explain the backpropagation algorithm. Specifically, detail how it uses gradient descent to adjust the weights and biases of the network layers, and discuss the role of the chain rule in calculating the gradients of the loss function with respect to these parameters. (CO1.K3)	10
5. Answer any <u>one</u> of the following:-		
5-a.	Describe the fundamental layers and their arrangement within a typical Convolutional Neural Network (CNN) architecture, and illustrate this structure with a basic block diagram. (CO2,K2)	10
5-b.	Describe the stepwise process to train a Convolutional Neural Networks (CNNs). (CO2,K3)	10
6. Answer any <u>one</u> of the following:-		
6-a.	Differentiate between object detection and object localization. Describe the steps followed by You Look Only Once(YOLO) algorithm for the task of object detection. (CO3,K3)	10
6-b.	Discuss the motivation behind the design of Inception Networks. Explain the basic architecture of Inception Networks. (CO3, K2)	10
7. Answer any <u>one</u> of the following:-		
7-a.	Describe various components of Recurrent Neural Networks (RNNs) with the help of a diagram. Illustrate Backpropagation Through Time (BPTT) in context of Recurrent Neural Networks (RNNs)(CO4, K2)	10
7-b.	Explain the working of bi directional Recurrent Neural Networks (RNNs) along with its advantages over traditional Recurrent Neural Networks (RNNs). (CO4, K2)	10
8. Answer any <u>one</u> of the following:-		
8-a.	Discuss different types of Autoencoders along with their advantages and disadvantages. (CO5, K2)	10
8-b.	Describe the fundamental architectural components of a standard Autoencoder, and identify at least two common methods used to constrain the network during training to prevent it from simply learning an identity function. (CO5, K3)	10

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