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**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA**  
**(An Autonomous Institute Affiliated to AKTU, Lucknow)**

**B.Tech**

**SEM: IV - THEORY EXAMINATION (2025 - 2026)**

**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.

**SECTION-A**

20

1. Attempt all parts:-

- (1.1) What are the two popular aspects of the curse of dimensionality? (CO1, K1) 1
- (a) Bias and Variance
  - (b) Data sparsity and distance concentration
  - (c) Precision and Recall
  - (d) MAE and MSE
- (1.2) Which technique uses L1 regularization to help in feature selection? (CO1, K1) 1
- (a) Ridge
  - (b) Lasso
  - (c) Elastic Net
  - (d) OLS
- (1.3) Which activation is commonly used in hidden layers of Artificial Neural Networks? (CO2, K1) 1
- (a) ReLU
  - (b) Sigmoid only
  - (c) Softmax only
  - (d) Linear only
- (1.4) Fine-tuning refers to: (CO2, K2) 1
- (a) Adjusting weights of model
  - (b) Deleting model
  - (c) Freezing model
  - (d) Ignoring data

- (1.5) Which issue arises in a convolutional layer without padding due to boundary effects? (CO3, K2) 1
- (a) Overfitting
  - (b) Lost pixels at edges
  - (c) Vanishing gradients
  - (d) Increased noise
- (1.6) What is the formula for the amount of 'Same' padding (P) given filter size F and stride S=1? (CO3, K1) 1
- (a)  $P=(F-1)/2$
  - (b)  $P=F/2$
  - (c)  $P=F-1$
  - (d)  $P=F+1$
- (1.7) The primary purpose of a Language Model is: (CO4, K1) 1
- (a) Translate text
  - (b) Probability of a sequence
  - (c) Detect edges
  - (d) Sort words
- (1.8) Which gate in a GRU decides how much of the past state to keep? (CO4, K1) 1
- (a) Forget Gate
  - (b) Update Gate
  - (c) Reset Gate
  - (d) Output Gate
- (1.9) Reconstruction loss measures the difference between: (CO5, K2) 1
- (a) Input and Label
  - (b) Weight and Bias
  - (c) Input and Output
  - (d) Layer 1 and Layer 2
- (1.10) Stacked Autoencoders consist of multiple layers of: (CO5, K1) 1
- (a) CNNs
  - (b) Encoders & Decoders
  - (c) LSTMs
  - (d) SVMs

2. Attempt all parts:-

- (2.1) Why Root Mean Square Error(RMSE) is often preferred over Mean Square Error(MSE) ? (CO1, K2) 2
- (2.2) Differentiate between max pooling and average pooling with the help of an example. (CO2, K2) 2
- (2.3) Give reasons for using Gaussian Blur in Canny Edge Detection? (CO3, K2) 2
- (2.4) Explain vanishing gradient problem in standard RNNs? (CO4, K2) 2
- (2.5) List some applications of autoencoders for unsupervised learning. (CO5, K2) 2

## **SECTION-B**

30

Answer any one of the following:-

- (3.1) Why is Adjusted R-Squared considered a more reliable metric than R-Squared for multiple predictors? (CO1, K4) 6
- (3.2) Compare grid search and random search methods used for hyperparameter tuning. Also mention when each method is preferred. (CO1, K4) 6

Answer any one of the following:-

- (3.3) You've trained an image classification model using convolutional Neural Network (CNN) 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
- (3.4) Analyze the impact of increasing the number of convolutional layers in a Convolutional Neural Network (CNN) on model complexity and potential for overfitting. (CO2, K4) 6

Answer any one of the following:-

- (3.5) Discuss the utility of 1x1 Convolutions in deep neural networks. (CO3, K2) 6
- (3.6) If an input image is of size 224x224, determine the size of output feature map after applying the convolution operation with kernel of size 7x7, stride 2 and no padding? (CO3, K3) 6

Answer any one of the following:-

- (3.7) Explain how different RNN architectures (one-to-one, one-to-many, many-to-one, many-to-many) are used in real-world applications. (CO4, K3) 6
- (3.8) Describe the architecture of Stacked Recurrent Neural Networks and their applications in modeling complex sequential data. (CO4, K3) 6

Answer any one of the following:-

- (3.9) Elaborate on the architecture and training process of Stacked Autoencoders. (CO5, K2) 6
- (3.10) How does Dropout act as a form of ensemble learning? (CO5, K4) 6

## **SECTION-C**

50

4. Answer any one of the following:-

- (4.1) Explain the use of the chain rule in backpropagation for gradient computation and describe the implementation steps for updating weights and biases in a neural network with one hidden layer. (CO1, K3) 10
- (4.2) Describe various measures to evaluate performance of a machine learning model for the task of classification. In a binary classification model, you have the following results: True Positives (TP) = 20, False Positives (FP) = 8, and False Negatives (FN) = 12. Calculate the Precision, Recall, and F1-score for this model. (CO1, K3) 10

5. Answer any one of the following:-

- (5.1) Illustrate the architecture of a typical Convolutional Neural Network (CNN) by describing its main layers and their arrangement with the help of a block diagram. (CO2, K3) 10
- (5.2) Outline the step-by-step procedure for training a Convolutional Neural Network (CNN). (CO2, K3) 10

6. Answer any one of the following:-

- (6.1) Critically evaluate Sobel, LoG, and Canny edge detection methods. Which one is best suited for noisy real-world images? (CO3, K5) 10
- (6.2) Provide a detailed motivation for the Inception Network architecture and explain the "Inception Module" (CO3, K2) 10

7. Answer any one of the following:-

- (7.1) Compare and contrast Recurrent Neural Networks (RNNs) with Feedforward Neural Networks (FFNNs) in terms of architecture and working mechanism. (CO4, K4) 10
- (7.2) Describe various components of Recurrent Neural Networks (RNNs) with the help of a diagram. Why is Backpropagation Through Time (BPTT) considered "computationally heavy"? (CO4, K4) 10

8. Answer any one of the following:-

- (8.1) Provide a comprehensive overview of Autoencoders, including architecture and mathematical formulation. (CO5, K2) 10
- (8.2) Derive and explain all mathematical equations for the Batch Normalization process. (CO5, K4) 10