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Printed Page:-4 **Subject Code:- BCSML0611/BCSMLH0611**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VI - 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) Hyperparameters are: (CO1,K2) 1

(a) Learned automatically during training

(b) Set before training begins

(c) Part of the output layer

(d) Same as model weights

(1.2) In simple linear regression Y = mx + c + e, 'e' represents: (CO1,K2) 1

(a) Slope

(b) Intercept

(c) Residual/Error

(d) Dependent variable

(1.3) In CNN, a 6×6×3 image has dimensions h=6, w=6, and d=3 where d=3 refers to:(CO2,K2) 1

(a) Depth of the network

(b) RGB color channels

(c) Number of filters

(d) Stride value

(1.4) The Convolution of a 5×5 image matrix with a 3×3 filter produces a feature map of size:(CO2,K2) 1

(a) 5×5

(b) 4×4

(c) 3×3

(d) 2×2

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(1.5) In CNN, having max pooling always decrease the parameters:(CO3,K1) 1

(a) True
(b) FALSE
(c) Can be true and false
(d) Can not say

(1.6) In a simple MLP model with 8 neurons in the input layer, 5 neurons in the hidden layer and 1 neuron in the output layer, The size of the weight matrices between hidden-output layer and input-hidden layer:(CO3,K2) 1

(a) [1 X 5] , [5 X 8]
(b) [5 x 1] , [8 X 5]
(c) [8 X 5] , [5 X 1]
(d) [8 X 5] , [1 X 5]

(1.7) Music Generation and Image Captioning are the examples of (CO4, K1) 1

(a) One-to -one RNN
(b) One-to-Many RNN
(c) Many-to-One RNN
(d) Many-to-many RNN

(1.8) Vanilla Neural Network is the example of:(CO4,K1) 1

(a) One-to -one RNN
(b) One-to-Many RNN
(c) Many-to-One RNN
(d) Many-to-many RNN

(1.9) De-noising and Contractive are examples of _____ (CO5, K1) 1

(a) Autoencoder
(b) Convolution Neural Networks
(c) ANN
(d) Recurrent Neural Networks

(1.10) _____ is a recommended Model for Pattern Recognition in Unlabeled Data. (CO5, K2) 1

(a) CNN
(b) Auto encoder
(c) Shallow Neural Networks
(d) RNN

2. Attempt all parts:-

(2.1) Write the formula for Total Error in Bias-Variance Tradeoff and explain each component.(CO1,K3) 2

(2.2) State the purpose of the Pooling layer in CNN.(CO2,K2) 2

(2.3) Explain IoU.(CO3,K1) 2

(2.4) Define many-to-many RNN . Give one example .(CO4,K2) 2

(2.5) Discuss Overcomplete autoencoder.(CO5,K2) 2

SECTION-B 30

Answer any one of the following:-

(3.1) Explain the ROC Curve. Describe TPR and FPR with formula. Explain the significance of AUC.(CO1,K3) 6

(3.2) Distinguish between Grid Search and Random Search for Hyperparameter Tuning. State when each should be preferred.(CO1,K2) 6

Answer any one of the following:-

(3.3) Explain the types of Pooling in CNN — Max Pooling, Average Pooling, and Sum Pooling — with examples.(CO2,K3) 6

(3.4) Explain the role of ReLU activation function in CNN. Compare ReLU with Sigmoid and Tanh activation functions.(CO2,K2) 6

Answer any one of the following:-

(3.5) Explain various types of padding in deep learning.(CO3,K2) 6

(3.6) Differentiate among the detection, recognition and identification of objects. (CO3,K2) 6

Answer any one of the following:-

(3.7) Illustrate Bidirectional RNNs with a suitable diagram.(CO4,K4) 6

(3.8) Elaborate various types of Recurrent Neural Networks (RNNs). (CO4, K2) 6

Answer any one of the following:-

(3.9) Explain Variational Autoencoder in detail with neat diagram.(CO5,K2) 6

(3.10) Explain how Autoencoders can be used for Anomaly Detection? (CO5, K3) 6

SECTION-C 50

4. Answer any one of the following:-

(4.1) Explain all regression evaluation metrics — MAE, MSE, RMSE, R-squared, and Adjusted R-squared with mathematical derivations. Discuss advantages, limitations, and appropriate use cases for each.(CO1,K4) 10

(4.2) Using the fraud detection example (TP=100, TN=9000, FP=700, FN=200), compute Accuracy, Precision, Recall, F1-Score, TPR, and FPR. Explain what each metric reveals about model performance in this imbalanced dataset.(CO1,K3) 10

5. Answer any one of the following:-

(5.1) Explain the CNN pipeline for image classification step-by-step: Input → Convolution → ReLU → Pooling → Fully Connected Layer → Softmax → Output. For each step, include the mathematical operation, purpose, and the effect on input dimensions using a 32×32 image example.(CO2,K3) 10

(5.2) Investigate the application of CNN in Natural Language Processing (NLP) and Text Classification. Explain how text is converted into a 2D word embedding matrix, how 1D convolution filters operate on text.(CO2,K3) 10

6. Answer any one of the following:-

(6.1) Explain the purpose of an inception module and draw the inception network used in Google-Net.(CO3,K2) 10

(6.2) How does You Look Only Once (YOLO) object detection algorithm works? Explain in detail. (CO3, K3) 10

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7. Answer any <u>one</u> of the following:-

(7.1)	Explain the following in details along with diagram and its equations: i) LSTM, ii) GRU (CO4,K3)	10
(7.2)	Illustrate the architecture of a typical Recurrent Neural Networks (RNNs) with the help of a diagram. (CO4, K2)	10

8. Answer any <u>one</u> of the following:-

(8.1)	Differentiate between overcomplete and undercomplete autoencoders and explain with the help of its diagram.(CO5,K2)	10
(8.2)	Discuss the general architecture of Autoencoders along with different ways to constrain the network. (CO5, K2)	10