K. J. Somaiya Institute of Technology, Sion, Mumbai
(An Autonomous Institute Affiliated to the University of Mumbai)

End Semester Examination: November - December 2025

Program: B.Tech. (Information Technology) Scheme: IIB

Regular Examination: LY Semester: VII

Course Code: Machine Learning and Deep Learning Course Name: ITDLC7041

Date of Exam: 02/12/2025 Duration: 2.5 Hours Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

Ques. No.	Question	Max. Marks	CO	BT Level
Q1	**Solve <u>any two</u> questions out of three: (05 marks each)**	10		
a)	Explain Overfitting and Underfitting with example.		1	U
b)	Compare Random Forest with Incremental Learning for large-scale streaming data in terms of memory usage, training time, and adaptability.		2	U
c)	Explain the basic architecture of a neural network.		3	U
Q2	**Solve <u>any two</u> questions out of three: (05 marks each)**	10		
a)	Apply 2×2 Max Pooling with a stride of 2 on the given feature map and Compute the final pooled output. $\begin{pmatrix} 1 & 3 & 2 & 0 \\ 4 & 2 & 1 & 5 \\ 0 & 6 & 3 & 1 \\ 2 & 1 & 4 & 7 \end{pmatrix}$		4	A
b)	Apply the architecture of a simple RNN to explain how sequential information is processed over time steps.		5	A
c)	Apply the generator and discriminator architecture of a GAN to show how they learn to produce realistic images.		6	A
Q3	**Solve <u>any two</u> questions out of three. (10 marks each)**	20		
a)	Explain different modeling approaches used in ML and how model selection depends on the nature of the problem.		1	U
b)	A Bagging-Based Ensemble classifier predicts whether customers will churn (Positive = churn) on a test set of 400 customers. Based on confusion matrix from the 400 predictions Compute Accuracy, Precision, Recall (Sensitivity), Specificity. Show all steps and give		2	A

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<table>
<tr><td></td><td>values to 4 decimal places and percentages to 2 decimal places.
<table>
<tr><td></td><td colspan="3">Predicted</td></tr>
<tr><td rowspan="3">Actual</td><td></td><td>Positive</td><td>Negative</td></tr>
<tr><td>Positive</td><td>85</td><td>30</td></tr>
<tr><td>Negative</td><td>25</td><td>260</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>c)</td><td>Apply the back propagation algorithm to a sample two-layer network to illustrate how weights and biases are updated through gradient descent.</td><td></td><td>3</td><td>U</td></tr>
<tr><td>Q4</td><td>Solve <u>any two</u> questions out of three. (10 marks each)</td><td rowspan="4">20</td><td></td><td></td></tr>
<tr><td>a)</td><td>Apply 2D input feature map of size 6 × 6 is passed through a convolution layer with: Filter size = 3 × 3,Stride = 2,Padding = 1,ReLU activation after convolution to :
(a) Compute the output feature map size using CNN formula.
(b) Compute the first two convolution outputs (top-left two positions).
(c) Apply ReLU on those values.
Input Feature Map
<table>
<tr><td>1</td><td>2</td><td>0</td><td>1</td><td>2</td><td>1</td></tr>
<tr><td>3</td><td>1</td><td>1</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>2</td><td>2</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>2</td><td>1</td><td>1</td><td>3</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>2</td><td>0</td></tr>
</table>
Convolutional Filter
<table>
<tr><td>1</td><td>0</td><td>-1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>-1</td></tr>
</table></td><td>4</td><td>A</td></tr>
<tr><td>b)</td><td>Apply a simple Recurrent Neural Network (RNN) to compute hidden states and final output for a short sequence.
• Input sequence: x=[2, 1]
• Initial hidden state: h_0=0
• Parameters:W=0.4, U=0.6, V=1.2</td><td>5</td><td>A</td></tr>
<tr><td>c)</td><td>Apply the autoencoder concept to compress and reconstruct MNIST digit images. Explain how encoding reduces dimensionality.</td><td>6</td><td>A</td></tr>
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