MID-SEMESTER EXAMINATION, November -2025
Deep Learning Using Python (CSE4685)

Programme: B.Tech (CSE) **Semester:7th**
Full Marks: 30 **Time: 2 Hours**

Sibu Prasad Sahu

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Able to apply the key fields of linear algebra and probability to build complex neural models.	L2	1(a 1(b), 1(c)	2+2+2
Able to analyse, design and implement Artificial Neural Networks (ANNs) and optimization techniques for solving complex learning problems.	L3	2(a, b, c), 3(a, b, c), 4(a, b, c), 5(a, b, c)	2+2+2+ 2+2+2+ 2+2+2+ 2+2+2
Able to analyse, build and implement Convolutional Neural Networks (CNNs) using PyTorch for solving classification problems.			
Able to analyse, design and implement autoencoder using PyTorch for nonlinear data handling.			
Able to design and interpret Recurrent Neural Networks (RNNs) and long short-term memory (LSTM) for sequential data analysis.			
Able to develop Generative Adversarial Networks (GANs) to synthesize new data.			

*Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) What is Deep Learning? Write the key features of Deep Learning. 2

(b) What are Null space and Column space. Find out the null space of the given matrix **A**. 2

A= [3 6, -1 -2]

(c) 2

Table1. Movie genre data distribution

Movie Genre	Actual Label	Predicted Label
Action	0.5	0.4
Drama	0.15	0.25
Comedy	0.30	0.30
Horror	0.05	0.05

The true label and predicted label of movie genre are given in **Table.1**. Find out the Cross-Entropy loss of the given data?

2. (a) What is a Feed Forward Neural Network (FFNN)? Highlight the role of hidden layer in FFNN. 2

(b) Differentiate single layer perceptron and multi-layer perceptron. 2

(c) Compute the output of a neuron with inputs [0.50,0.30] and the network parameters are weights [0.20, 0.40], bias is 0.1 and activation function is tanh. 2

3. (a) What are linearly and nonlinearly separable problems? How these issues are handled using Neural Networks? 2

(b) Find the optimal weights of the perceptron which act as an OR gate for the given data keeping bias (b=0) as fixed. w_1=0.6, w_2=0.6 and Learning rate(η)=0.5. Draw the resultant perceptron which act as an OR gate with the optimal weights calculated. 2

(c) 2

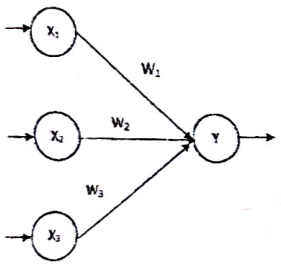

Table2. Network details

Network Input	Weights
X_1=3.5	W_1=0.89
X_2=2.9	W_2=-2.07
X_3=1.2	W_3=3.5

Compare output of the given network if activation function is i) Sigmoid function ii) tanh function iii) ReLU function

4. (a) Given a sigmoid neuron with output $y=\frac{1}{(1+e^{(-z)})}$, where z = $z = w^T \times x$, derive the update rule for the weights w using Delta rule and gradient descent. 2

(b) Explain Backpropagation training in Neural Network. Highlights its issues. 2

(c) Consider a single neuron based Neural Network. Apply Delta rule and gradient to update weight and bias through Backpropagation learning. The network parameters are as follows. 2

Input	Target output	Weight	Bias	Learning rate	Activation Function
0.65	1	0.72	0.2	0.1	Sigmoid

5. (a) What is overfitting? How can it be prevented in neural network? 2

(b) Explain the working principle of momentum based gradient descent. How it differs from basic gradient descent? 2

(c) Discuss mathematically RMSProp optimizer in Deep Learning. How it overcomes the issues of AdaGrad optimizer? 2

End of Questions