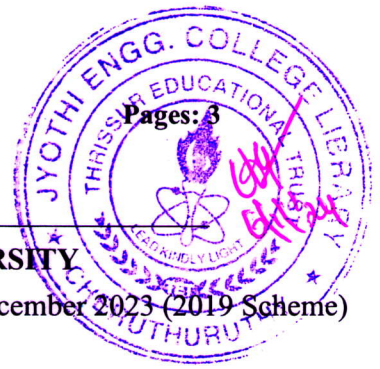


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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh Semester B.Tech Degree Regular and Supplementary Examination December 2023 (2019 Scheme)

**Course Code: AIT401**

**Course Name: FOUNDATIONS OF DEEP LEARNING**

**Max. Marks: 100**

**Duration: 3 Hours**

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- 1 Write down the equations of the following activation functions and its derivatives: (3)  
Sigmoid, Tanh, ReLu.
- 2 Design a neural network with two hidden layers having single neuron (using (3)  
ReLU activation) and an output neuron to approximate a function  $f(x)=x^2-4x+4$   
as accurately as possible in the range  $x \in [0,5]$ .
- 3 Explain the concept of early stopping in neural network training. (3)
- 4 Why is weight initialization crucial in neural network training? (3)
- 5 Explain the concept of a residual block in the context of deep neural networks (3)
- 6 What happens if the stride of the convolutional layer increases? What can be the (3)  
maximum stride? Justify your answer
- 7 Explain the function of input gate in LSTM (3)
- 8 Explain Recursive neural network. (3)
- 9 Draw the general structure of an autoencoder and explain. (3)
- 10 Describe any two applications of GAN. (3)

**PART B**

*Answer any one full question from each module, each carries 14 marks.*

**Module I**

- 11 a) What advantages does a deep feedforward network offer over shallow networks? (4)  
b) Explain the terms overfitting and underfitting in the context of neural networks. (10)

**OR**

- 12 a) Describe the structure and functionality of a perceptron. (7)  
b) Explain the role of the loss function in a neural network. Discuss the significance (7)  
of choosing different loss functions.

**Module II**

- 13 a) Explain the Kaiming and Xavier weight initialization methods and their significance in deep learning. (6)
- b) What is Regularization technique? Discuss various regularization techniques (8)

**OR**

- 14 a) Consider a two-input neuron that multiplies its two inputs  $x_1$  and  $x_2$  to obtain the output  $o$ . Let  $L$  be the loss function that is computed at  $o$ . Suppose that you know that  $\partial L / \partial o = 5$ ,  $x_1 = 2$ , and  $x_2 = 3$ . Compute the values of  $\partial L / \partial x_1$  and  $\partial L / \partial x_2$ . (7)
- b) Differentiate between Gradient Descent (GD), Stochastic Gradient Descent (SGD), and Mini-batch Gradient Descent in terms of their working principles. (7)

**Module III**

- 15 a) Design a Convolutional Neural Network (CNN) for gender classification using face images of size  $256 \times 256$ . Determine suitable filter sizes, activation functions, and the width of each layer within the network. (7)
- b) Discuss the motivation behind using convolutional layers in neural networks, emphasizing their advantages over fully connected layers. (7)

**OR**

- 16 a) Consider an input image with dimensions of  $28 \times 28$  pixels. You apply a convolutional operation with a kernel (filter) size of  $3 \times 3$ , a padding of 0, and a stride of 2. Calculate the dimensions of the output feature map. Also, calculate the padding value if we need the output to have the same size as the input with a stride of 1. (4)
- b) What are the key differences between AlexNet, ZFNet, VGGnet-19, and ResNet-50 in terms of their architectures, performance? (10)

**Module IV**

- 17 a) Design a multi-layered Recurrent Neural Network (RNN) that takes a sequence of length 'T' as input and generates a single output Context. (7)
- b) Explain how LSTM addresses the long term dependency issues in language models. (7)

**OR**



- 18 a) Provide an example of how Recurrent Neural Networks are used in language modeling. Explain how RNNs generate sequences. (7)
- b) Discuss the important design patterns of Recurrent Neural Networks (RNNs). (7)

**Module V**

- 19 a) Explain the concept of Variational Autoencoders. (7)
- b) Discuss the applications of GAN. (7)

**OR**

- 20 a) Describe Boltzmann Machines. How do they learn and generate samples in a probabilistic manner? (7)
- b) Explain Denoising Autoencoders. (7)

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