DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SUBJECT CODE: 23CSX502 **SEM :VI**

SUBJECT NAME: DEEP LEARNING AND NEURAL NETWORKS **YEAR: III**

UNIT II- CONVOLUTION NEURAL NETWORKS
QUESTION BANK

PART-A (2 MARKS)

Sl. No	Question	Mark	Level
1	What is CNN and why is it suitable for image data?	2	K1
2	State the basic architecture of a CNN.	2	K2
3	What is the purpose of the convolution layer in CNN?	2	K1
4	Define local receptive field and weight sharing in CNN.	2	K1
5	What is a feature map?	2	K1
6	What is pooling and why is it used in CNN?	2	K1
7	Differentiate between max pooling and average pooling with suitable examples.	2	K2
8	What is the role of ReLU in CNN?	2	K1
9	What is flattening in CNN?	2	K1
10	Why is parameter sharing used in CNN?	2	K2
11	List the limitations of traditional Artificial Neural Networks (ANN) in image processing.	2	K1
12	Define sparse connectivity (sparse interactions).	2	K1
13	Differentiate between translation invariance and translation equivariance.	2	K2
14	Why is padding important in CNN?	2	K2
15	Define padding and stride in CNN.	2	K1
16	What is AlexNet and its significance?	2	K1
17	State the input size and main layers of the AlexNet architecture.	2	K2
18	List the key innovations introduced by AlexNet.	2	K1
19	How does dropout improve AlexNet performance?	2	K2
20	What is GoogLeNet and its main idea?	2	K1
21	How does the Inception module work in GoogLeNet?	2	K2
22	Why is 1×1 convolution used in CNNs?	2	K2
23	What is global average pooling and what are its benefits in CNNs?	2	K1
24	What is ResNet and why was it introduced?	2	K2
25	Define skip connection in deep neural networks.	2	K1
26	What is the degradation problem in deep neural networks and how does ResNet address it?	2	K2
27	How does ResNet solve the vanishing gradient problem?	2	K1
28	What is R-CNN and what is its full form?	2	K1
29	How does selective search work in R-CNN?	2	K1
30	What is Non-Maximum Suppression (NMS)?	2	K1

PART-B (16 MARKS)

1.	Analyze why Convolutional Neural Networks (CNNs) outperform traditional Artificial Neural Networks (ANNs) for image data, with reference to parameter count, spatial information loss, overfitting, and how CNN architectures overcome these limitations	16	K4
2.	Examine the fundamental architecture of a Convolutional Neural Network CNN and explain how its five core layers Convolution Activation Pooling Fully Connected and Output work sequentially to transform an input image into final class probabilities	16	K4

3. a)	Analyze the variations and extensions of the basic CNN architecture by comparing their strengths and limitations and examining their suitability for specific real-world applications.	8	K4
3. b)	Analyze the role of feature extraction and pooling in Convolutional Neural Networks by examining their advantages and disadvantages in modern AI applications.	8	K4

R=

7	3	5	6	8
2	5	6	7	9
10	11	18	19	10
3	6	7	4	2
3	8	7	4	5

G=

6	4	5	7	6
3	6	7	8	7
9	10	16	17	9
2	5	6	3	1
4	7	6	3	4

B=

5	2	4	5	7
1	4	5	6	8
8	9	14	15	8
1	4	5	2	1
2	6	5	2	3

Kernel=

0	-1	0
-1	5	-1
0	-1	0

4.	Given a 5×5 input image and a 3×3 kernel, evaluate the process of convolution, pooling, fully connected layer output calculation, and activation in a CNN by performing the following: a) Calculate the size of the output feature map and the convolution output after applying a 3×3 kernel on the 5×5 input with valid padding and stride 1. Explain the significance of these parameters. b) Analyse the max pooling operation and determine the size of the pooled feature map when a 2×2 max pooling with stride 2 is applied on the output feature map. Discuss how pooling impacts the feature map. c) Construct the formula for the output of a fully connected (dense) layer given weights $w = [1,1,1,1]$and bias $b = 1$. Express the output $y$in terms of inputs x_1, x_2, x_3, x_4. d) Evaluate the sigmoid activation function by writing its formula and explain its role and importance in neural networks.	16	K5
5. a)	Differentiate between AlexNet, GoogLeNet, ResNet, and Region-Based CNNs.	8	K4
5. b)	Analyze the sequence of operations in one CNN stage and how these operations contribute to processing input images for classification in a Deep CNN like VGG-16.	8	K4
6.	Analyze the architecture and layer-wise functioning of AlexNet. Illustrate your answer with a neat diagram.	16	K4
7.	Analyze the design innovations in GoogLeNet's architecture, such as the Inception module and auxiliary classifiers, by examining how they contribute to improved accuracy and computational efficiency. Illustrate your answer with a neat diagram	16	K4
8.	Analyze the architecture and working of Residual Networks (ResNet) with emphasis on residual learning, the residual block, and skip connections. Using ResNet-34 as an example, describe how these components enable effective training of deep networks. Support your answer with suitable diagrams	16	K4
9.	Analyze the design and working of R-CNN for object detection by examining the roles of selective search, feature extraction, SVM classification, and bounding box regression, and by analyzing the limitations that affect its performance	16	K4