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**BTECH**  
**(SEM VII) THEORY EXAMINATION 2024-25**  
**DEEP LEARNING**

**TIME: 3 HRS****M.MARKS: 100****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q no.	Question	C O	Level
a.	Discuss the differences between a perceptron and a support vector machine in terms of learning.	1	K <sub>2</sub>
b.	Define and explain the role of a loss function in neural networks.	1	K <sub>2</sub>
c.	Discuss the role of convolutional layers in Convolutional Neural Networks.	2	K <sub>2</sub>
d.	Compare deep and shallow networks in terms of representational capacity and computational complexity.	2	K <sub>2</sub>
e.	Discuss how batch normalization impacts the training of convolutional neural networks.	3	K <sub>2</sub>
f.	How autoencoders can be used to learn low-dimensional representations of data?	3	K <sub>2</sub>
g.	Discuss the role of non-convex optimization in deep learning.	4	K <sub>3</sub>
h.	Analyze the challenges of stochastic optimization in deep learning.	4	K <sub>3</sub>
i.	How deep learning models have revolutionized computer vision tasks?	5	K <sub>3</sub>
j.	What are the key challenges in modeling audio signals?	5	K <sub>3</sub>

**SECTION B****2. Attempt any three of the following:****10 x 3 = 20**

Q no.	Question	C O	Level
a.	Explain the mathematical foundation of the Support Vector Machine (SVM) algorithm and describe its kernel trick for non-linear classification problems. How does it differ from logistic regression?	1	K <sub>2</sub>
b.	Derive and explain the role of batch normalization in accelerating deep neural network training. How does it help in reducing internal covariate shifts?	2	K <sub>2</sub>
c.	Describe the process of hyperparameter optimization in training a ConvNet. What are the key hyperparameters, and how do they influence network performance?	3	K <sub>2</sub>
d.	Compare and contrast LSTMs and traditional recurrent neural networks (RNNs). How do LSTMs mitigate the vanishing gradient problem in sequence modeling?	4	K <sub>3</sub>
e.	Analyze the applications of deep learning in bioinformatics. Provide examples of how neural networks are used for tasks like protein structure prediction.	5	K <sub>6</sub>

**SECTION C****3. Attempt any one part of the following:****10 x 1 = 10**

Q no.	Question	C O	Level
a.	Explain the concept of stochastic gradient descent (SGD). How does it differ from batch and mini-batch gradient descent in terms of computational	1	K <sub>2</sub>



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M.MARKS: 100

	efficiency and convergence?		
b.	Compare and contrast the theoretical underpinnings of perceptrons and logistic regression in the context of binary classification problems.	1	K <sub>2</sub>

4. Attempt any *one* part of the following:

10 x 1 = 10

Q no.	Question	CO	Level
a.	Explain the architecture and training process of a Generative Adversarial Network. What challenges arise during training, and how can they be mitigated?	2	K <sub>2</sub>
b.	Discuss the probabilistic theory behind deep learning models. How do Bayesian principles apply to the optimization and uncertainty estimation in deep networks?	2	K <sub>2</sub>

5. Attempt any *one* part of the following:

10 x 1 = 10

Q no.	Question	CO	Level
a.	Compare Principal Component Analysis and Linear Discriminant Analysis terms of their objectives and mathematical formulations. Provide examples of their use in classification tasks.	3	K <sub>2</sub>
b.	Derive the reconstruction loss of an autoencoder. How does this loss relate to the dimensionality reduction capabilities of the network?	3	K <sub>2</sub>

6. Attempt any *one* part of the following:

10 x 1 = 10

Q no.	Question	CO	Level
a.	Explain how deep reinforcement learning combines reinforcement learning principles with deep network architectures.	4	K <sub>3</sub>
b.	Derive the architecture of a recurrent neural network language model. Discuss its strengths and limitations compared to word-level RNNs.	4	K <sub>3</sub>

7. Attempt any *one* part of the following:

10 x 1 = 10

Q no.	Question	CO	Level
a.	Discuss the limitations of deep learning models in real-world applications. How can interpretability and ethical considerations be integrated into these systems?	5	K <sub>3</sub>
b.	Explain the architecture of a deep learning model used for face recognition. How does it ensure robustness against variations in pose and illumination?	5	K <sub>3</sub>