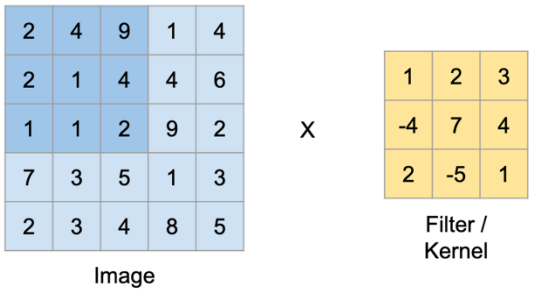
VII Semester BTech Examination DEC 2023	Set No.: 02
Course name: Deep Learning (CSE)	**Course code: CSE 4064**

Q. No.	Description	Marks	Course Outcome (1-5)	Competency Levels (1-6)
1A	Show the steps to solve the system of linear equations. Additionally, provide the solutions for the following equations: i) $2x+3y=12$ ii) $4x-5y=-7$	**4**	**1**	**4**
1B	Expound any four probability distributions and its role in deep learning model training.	**4**	**1**	**4**
1C	Illuminate the significance and characteristics of fundamental mathematical preliminaries, such as scalars, vectors, matrices, and tensors, in the context of deep learning.	**2**	**1**	**4**
2A	Illustrate the effective application of a single perceptron in solving the AND and OR problems, elucidate the reasons for its inability to handle the XOR problem, and substantiate your explanations using pertinent operations of both single perceptrons and multilayer perceptrons, accompanied by illustrative examples.	**4**	**2**	**5**
2B	Consider a neural network architecture that has two input units *x1* and *x2,* one hidden layer three units *h1, h2, and h3*, and one output unit. Use sigmoid activation function for both hidden and output units. Initialize the weight parameters randomly and show one forward and backward propagation to calculate the gradient and updating parameters. *(x1, x2)* = (0.8, 0.2), target output *y* = 1, Learning rate = 0.01, Loss function = squared loss.	**4**	**2**	**5**
2C	Enumerate and illustrate the characteristics of the following activation functions, accompanied by relevant graphs: i) Sigmoid ii) Tanh iii) ReLu iv) Leaky ReLu	**2**	**2**	**4**
3A	Elaborate on the concept of semi-supervised learning within the domain of deep learning. Offer a comprehensive overview that distinguishes semi-supervised learning from both supervised and unsupervised learning methods. Provide a detailed exploration of the motivations behind and advantages associated with employing semi-supervised approaches in machine learning.	**4**	**3**	**3**
3B	Detail how early stopping contributes to the regularization of deep learning models, presenting a suitable algorithm and accompanying illustrations to elucidate the process and its impact on model training.	**4**	**3**	**4**
3C	Compare and contrast the regularization techniques of parameter tying and parameter sharing in the context of deep learning.	**2**	**3**	**5**

4A	Examine the stochastic gradient descent (SGD) algorithm in the optimization of deep learning models. Discuss the drawbacks associated with SGD and explore the ways in which incorporating momentum, as well as Nesterov momentum, can effectively mitigate these challenges, enhancing the efficiency and convergence of the optimization process.	**4**	**4**	**4**
4B	Conduct a convolution operation on the provided input image matrix using the given kernel, applying a stride of 1 without padding. Display the resulting matrix. Subsequently, execute a max-pooling operation with a 2x2 window and present the resulting matrix. Calculate the total number of parameters required for the entire convolutional and pooling operation and compare this figure with the number of parameters needed for a conventional fully connected neural network.  	**4**	**4**	**5**
4C	Provide insights on the following model convergence challenges we may encounter during the deep learning optimization. i) Local minima ii) Saddle points iii) Plateaus iv) Cliffs	**2**	**3**	**2**
5A	Identify and expound upon the key motivation behind the development and utilization of convolutional neural networks in deep learning.	**4**	**2**	**4**
5B	Elucidate the following recurrent neural network architectures and its applications. i) Bidirectional RNNs ii) Encoder-Decoder Sequence-to-Sequence Architectures iii) Deep Recurrent Networks iv) Recursive Neural Networks	**4**	**3**	**5**
5C	Enumerate the challenges associated with long-term dependencies in sequential data and elucidate how Recurrent Neural Networks (RNNs) can effectively address these challenges.	**2**	**5**	**4**

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(Signature) **(Signature)**

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