NAVRACHANA UNIVERSITY
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School:	School of Engineering and Technology
Program/s:	BSC Data Science
Year: 3rd	**Semester:** 5th
Examination:	End Semester Examination
Examination year:	December - 2021

Course Code: DS302	**Course Name:** Artificial Neural Networks		
Date: 03/12/2021		**Total Marks:**	40
Time: 11:30 am to 01:30 pm		**Total Pages:**	2

Instructions:

➔ Write each answer on a new page.
➔ Use of a calculator is permitted.
➔ Draw all relevant waveforms in answer sheet only.
➔ *COs=Course Outcome mapping. # BTL=Bloom's Taxonomy Level mapping

Q. No.	Details	Marks	COs*	BTL#
Q.1	**Attempt ANY 8 from the following:**	**[08]**		
A.	Define an Artificial Neural Network in your own words.	01	CO1	1, 2
B.	Let $\vec{x} = [1, 1, 0, 1, 0]$ be the input and $\theta = 3$ be the threshold value. What will be the output y of MP Neuron?	01	CO5	1, 5
C.	When standardization is required in the Perceptron?	01	CO5	1, 2
D.	Let $\vec{x} = [0, 1, -1, 2]$ be the input and $\vec{w} = [1, 2, 1, -4]$ be the weights. What will be the output of Perceptron neuron?	01	CO5	1, 5
E.	Write the weight calculation formula for Delta rule.	01	CO5	1
F.	According to the Universal approximation theorem how many hidden layers are required to approximate any continuous function using a multilayer network of sigmoid neurons.	01	CO6	1
G.	The Generalized delta rule is implemented using _____ method/algorithm.	01	CO6	1
H.	What is the advantage of Radial Basis Function (RBF) Network over multi-layered perceptron (MLP)?	01	CO6	1, 2
I.	(TRUE/FALSE). Hebb's rule is an unsupervised learning algorithm.	01	CO3	1, 2
Q.2	**Attempt ANY 5 from the following:**	**[10]**		
A.	List any four ANN algorithms that you learned in the class. Briefly Explain how neural networks are useful for real world problems?	02	CO5	1
B.	(TRUE/FALSE). Both signum and sigmoid activation functions are differentiable. Justify your answer.	02	CO4	1, 2
C.	Let $\vec{x} = [0.5, 0.25, 1, 0.4]$ be the input and $\vec{w} = [2, -4, 2, 5]$ be the weights. Assume bias $b = 1$. What will be the output of Sigmoid neuron? Explain why.	02	CO5	1, 3
D.	Write formula and make graph of any one activation function.	02	CO4	1, 4

E.	Let the desired output be $y = [0, 1, 1, 0]$ and the calculated output be $Y = [0.1, 0.9, 1.1, 0]$. Determine a squared error loss.	02	CO1	1, 2	

F. Suppose $X = [1, 0, 1, 0, 0]$ be the input. Then what will the weight matrix W in the Hopfield Neural Network?   02   CO7   1, 5

G. Write the 2 postulates which was given by Hebb.   02   CO7   1

Q. 3 Attempt ANY 3 from the following: **[12]**

A. Explain linearly separable and not linearly separable data with figure. Give one example of binary function which is not linearly separable. Which algorithms only works for the linearly separable data.   04   CO2   1, 2

B. Perform one epoch of the Perceptron Learning Algorithm for classifying OR function. Let $\vec{w} = (1, 1, 1)$. Determine the accuracy, weights and bias after one epoch.   04   CO5   1, 2, 4

C. Explain the architecture of a Radial Basis Function Network with figure. Write various radial basis functions $\phi(r)$ used in it.   04   CO6   1, 2

D. Write steps of implementing a Hopfield Neural Network. Write applications of Hopfield Neural Network.   04   CO7   1, 2, 3

E. Consider an example of a single input x and a single output y with the data given in the table.   04   CO5   1, 2, 3

x	y
0.5	0.2
2.5	0.9

We want to find a sigmoid function such that (0.5, 0.2) and (2.5, 0.9) lie on this sigmoid, using the steps of Delta rule. Let the initial weight be $w = -2$ and the initial bias be $b = -2$. Show calculations of $\hat{y}_1$ and $\hat{y}_2$.

Q. 4. Attempt ANY 2 from the following: **[10]**

A. Classify the AND function using mathematical approach of the McCulloch-Pitts Neuron Model. Draw the final decision boundary along with the given points.   05   CO5   1, 2, 3, 4

B. Explain Supervised learning, Unsupervised learning and Reinforced learning with diagram.   05   CO3   1, 2

C. Design and train a neural network to classify the bipolar AND function using Hebb's rule. Use all four patterns exactly once.   05   CO7   1, 3, 5

D. Briefly explain the network architecture of Discrete Hopfield Neural Network with figure. Which type of learning is used in it?   05   CO7   1, 2

************End of Question Paper************