

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION-2022

B.Tech- VII Semester (CS/IT/ECE)

COURSE CODE (CREDITS): 20B1WEC732 (3)

MAX. MARKS: 35

COURSE NAME: Machine Learning for Wireless Communication

COURSE INSTRUCTORS: Dr. Alok Kumar

MAX. TIME: 2 Hours

*Note: All questions are compulsory. Marks are indicated against each question in square brackets.*

**Q.1** What is spectrum scarcity problem and why it is arising in wireless communication? How we can overcome this problem? Justify your answer with suitable explanation.

[CO3] [4 Marks]

**Q.2** How K-Means clustering works? How to select the K value in K-Means clustering? Consider the given data sets of wireless sensor network which have two variables X and Y. After two iterations, find the centroid of two clusters and show the datasets belonging to each cluster. Consider the initial centroid of two clusters as (1, 5) and (4, 1) respectively.

[CO1, CO4] [4 Marks]

X	Y
2	4
2	6
5	6
4	7
8	3
6	6
5	2
5	7
6	3
4	4

**Q.3** What is Orthogonal Frequency Division Multiplexing (OFDM)? How OFDM is different from FDM? Explain the working of OFDM transmitter and receiver with suitable diagram.

[CO2, CO3] [4 Marks]

**Q.4** Why Cooperative Spectrum Sensing is better than non-cooperative spectrum sensing? How the performance of Cooperative Spectrum Sensing Cognitive Radio Network can be improved with the help of machine learning?

[CO3, CO4] [4 Marks]

**Q.5** How confusion matrix is useful to evaluate the performance of machine learning model? Explain three key metrics: *Precision*, *Recall* and *F1 score* based on confusion matrix. Find out recall and precision for the given confusion matrix. [CO1] [4 Marks]

		Predicted Class		
		A	B	C
Actual Class	A	20	10	30
	B	40	50	10
	C	40	40	60

**Q.6** What is Multiple-Input Multiple-Output (MIMO) system? In MIMO, spatial multiplexing and spatial diversity are two radio communication techniques commonly employed with 4G LTE and 5G NR networks. How spatial multiplexing is different from spatial diversity? Write one application of each of the two techniques. [CO2, CO3] [4 Marks]

**Q.7** How machine learning (ML) can assist in attainment the demands of 5G requirements? Write two applications where ML can improve the performance of existing and future wireless communication systems? [CO3, CO4] [4 Marks]

**Q.8** What is the role of the Activation functions in Neural Networks (NN)? Why do we use an activation function? Explain the Sigmoid and Rectified Linear Unit (ReLU) activation function employed in NN? [CO1] [4 Marks]

**Q.9** Consider a wireless communication system which employed TDMA/FDD technique. It uses 25 MHz for the forward link which is broken into radio channels of 200 KHz. A single radio channel supported 8 speech channels. Find the number of simultaneous users that can be accommodated in that system. [CO2, CO3] [3 Marks]