Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

VII SEM B.Tech. (BME) DEGREE MAKE-UP EXAMINATIONS DEC/JAN 2018-19

SUBJECT: PATTERN RECOGNITION (BME 4008)

(REVISED CREDIT SYSTEM)

Wednesday, 2nd January 2019: 2PM to 5 PM

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to Candidates:

1. **Answer ALL questions.**
2. **Draw labeled diagram wherever necessary**

1A. State Bayes' theorem for a k-class problem involving d features. Explain the rule for classification with the posterior- probability. (3)

1B. Nine values of feature *x* associated with class-**A** are 2,3,3,3,4,4,6,7,8. The samples from class **B** had *x*-values of 8,9,9,9,9,10,10,11,12 and class C had *x*- values 12,13,13,13,14,14,16,17,18. Draw the histogram with interval width of 2 for each class. Find a decision boundary and design a suitable decision rule for classification. Find the class to which a given random sample having the feature value *x* =11 belongs. (4)

1C. With a neat block diagram explain the elements of a pattern recognition system. (3)

2A. Consider the two classes **A** and **B** with features *x* and *y*. The prior probabilities are P(A)=0.8 and P(B)=0.2 respectively. The parameters of the conditional density(normal) associated with the two classes are:

class A: $\mu_x=30, \sigma_x=2, \mu_y=88, \sigma_y=5, \rho_{xy}=0.6$

class B: $\mu_x=20, \sigma_x=3, \mu_y=75, \sigma_y=8, \rho_{xy}=0.5$. (4)

Find **p(*x*=28, *y*=84 |B)** .

2B. For class A, feature x is normally distributed with μ=2 and σ=2. For class B, x is uniformly distributed in the range 3 to 7. The prior probabilities are P(A) =1/4 and P(B)=3/4. What is the probability that a sample with x=5 belongs to class B? (3)

2C. Define Bayesian theorem when the features are assumed to be independent within each class. What is P(A/x=0,y=0,z=1),if P(A)=1/5,P(B)=4/5),P(x=0/A)=1/3, P(x=0/B) =1/4, P(y=0/A)=1/5, P(y=0/B)=1/5, P(z=1/A)=1/6, P(z=1/B)=1/7, (features are assumed to be independent within each class). (3)

3A. Calculate the cluster distance between the following:
C1= {(15,20), (17, 18), (17,21)}
C2= {(25,25), (27,29)}
Find the following:
i. Average linkage distance
ii. Complete linkage distance
iii. Find the distance between centroids. (3)

3B. Identify the two important steps of the K-Means algorithm for making "K" number of clusters and explain. (3)

3C. Explain how bottom-up approach for clustering is different from top-down approach. Draw the diagram of a typical dendrogram. (4)

4A. Realize the NOR function using Mc-Culloch Pitts neuron model. Define a decision rule and test the network with the test input [1 0]. (3)

4B. Explain perceptron training algorithm with an example. (3)

4C. Draw a neat diagram of BPN (Back Propagation Network), explain the delta rule used for training the net. List four major stages of BPN training algorithm and explain them. (4)

5A. What are the major challenges that are to be considered during the design of a white blood cell? List four important features of white blood cell and discuss its classification. (4)

5B. Describe the advantages of an authentication system in hospitals. Explain how biometric pattern dominates over the other approaches of authentication like PIN or Password or Card. (3)

5C. Explain evaluation of a classifier performance with the following methods:
i. simple counting method
ii. confusion matrix (3)