Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

VII SEM B.TECH. (BME) DEGREE END SEMESTER EXAMINATIONS DEC/JAN, 2020-21

SUBJECT: PATTERN RECOGNITION (BME 4008)

(REVISED CREDIT SYSTEM)

Friday, 1st January 2021: 9 AM to 12 NOON

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

Instructions to Candidates:

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

1A. State the Bayesian Theorem for a *K*-class problem with *d-features* in the following cases:

i) When the features are discrete type.

ii) When the features are continuous type. (3)

Discuss the rule for classification based on the posterior probability.

1B. The training vectors for the two classes namely Normal (N) and Hypotension (H) are given in the table 1B. Mark the optimal region associated with each of the class on the histogram plot with a step width of 5, and define an appropriate rule for classification.

Table 1B

Members of Normal(N)	systolic pressure (mm Hg)		Members of Hypertension(H)	systolic pressure (mm Hg)
1	97		1	75
2	101		2	77
3	105		3	81
4	108		4	85
5	111		5	87
6	115		6	89
7	119		7	92

(4)

1C. Given the series of 5 samples and their feature values as described in Table1C. Calculate the posterior value *P(A|x=0, y=1)* using Bayesian theorem and interpret the result. (3)

Table 1C

CLASS Name	***Feature*** x	***Feature*** y
A	0	1
B	1	0
A	0	1
B	1	1
A	1	1

2A. A feature "*x*" is normally distributed for *class-A* and *class-B*. Their prior probabilities of class-A and class-B are respectively 0.7 and 0.3. The following are the mean and standard deviation details of the classes: (5)

class-A : $\mu_A = 11$ and $\sigma_A = 3$

class-A: $\mu_B = 5$ and $\sigma_B = 2$

Draw the nature of the classes and design a decision rule based on the optimal discriminating function.

2B. Explain the algorithm for bottom up clustering considering the average cluster distance. Also compare cluster distance between following clusters using Average linkage distance and single linkage distance: (5)

C1= {(30,35), (32, 38), (41, 45)}

C2= {(20,25), (27,29)}

Note: For the estimation of the sample distance use city clock distance.

3A. Identify the algorithm which discover the clusters by passing through data only two times and apply that to find the clusters in the following problem having the patterns are represented with two features as shown: (2,5), (4,6),(7,8),(8,8),(10,11), for a given K=2. (4)

3B. Discuss how artificial neuron can have realized as processing node. Explain this by a suitable example. (3)

3C. Discuss the show the supervised learning is different than unsupervised learning? (3)

4A. Breakdown the design of a pattern classifier into various stages and discuss the challenges associated with each. (5)

4B. Discuss the challenges of digitization typical glass slide and explain the workflow of digitization and classification of a slide with blood smear. (5)

5A. Explain how a multilayer Back Propagation Neural Network (BPNN) training algorithm helps in generating a desired output response in the output layer of the designed network. Explain this with the details of the weight updating rules. (4)

5B. Describe elements of a biometric identification system and discuss the challenges of designing that with the help of static and dynamic signatures. (3)

5C. Construct a confusion matric for the two class problem having 500 samples with the following details:

- True positive =235
- True negative=220
- False positive=18
- False negative= 27

(3)

Calculate the sensitivity and specificity values.