Reg. No.



A Constituent Institution of Manipal University

# VII SEMESTER B.TECH. (BME) DEGREE MAKE-UP EXAMINATIONS, DECEMBER 2017

# SUBJECT: PATTERN RECOGNITION (BME 4008)

## (REVISED CREDIT SYSTEM)

## Thursday, 28<sup>th</sup> December 2017: 2 PM to 5 PM

#### TIME: 3 HOURS

## MAX. MARKS: 100

#### **Instructions to Candidates:**

Answer FIVE full questions.
Draw labeled diagram wherever necessary

- 1. (a) Given the feature vector "X" as an input, and three possible classes: class-A, class-B and class-C, explain the classification based on Bayes' theorem. Discuss the rule  $_{06}$  for classifier rule using likelihood ratio.
  - (b) The feature x is normally distributed for *class-C1*, with a mean of 3 and a standard deviation of 2. The *class-C2* is also seen normally distributed with a mean of 7 and standard deviation of 2. The third *class-C3* it is uniformly distributed over the 10 interval ( $9 \le x \le 12$ ). The prior probabilities of all the classes are same. Draw the nature of all the given classes. Find the decision boundary between the classes.
  - (c) What is supervised learning? Explain.

04

- 2. (a) Explain the elements of a pattern recognition system and describe how this recognition technique is useful in healthcare application. 08
  - (b) Explain top-down clustering approach with an example.
  - (c) Find the subgroups G1, G2 and G3 from the given cluster,  $G=\{(2,4),(3,4),(5,6),(6,7), (9,8),(9,8.5)\}$ , using bottom-up approach. Define the rule used for grouping.
- 3. (a) Draw architecture of BPN (Back Propagation Network) and discuss major stages of BPN training algorithm.
  - (b) The normal class (N) has prior probability denoted as P(N)=0.8, and the features considered are denoted as x & y. Both the features are normally distributed. Another class considered is AN and the mean vectors and covariance matrices of classes are:

$$\boldsymbol{\mu}_{\mathrm{N}} = \begin{pmatrix} 23\\ 83 \end{pmatrix}, \quad \boldsymbol{\mu}_{\mathrm{AN}} = \begin{pmatrix} 17\\ 61 \end{pmatrix}, \quad \boldsymbol{\Sigma}_{\mathrm{N}} = \begin{pmatrix} 9 & 12\\ 12 & 64 \end{pmatrix}, \quad \boldsymbol{\Sigma}_{\mathrm{AN}} = \begin{pmatrix} 4 & 6\\ 6 & 25 \end{pmatrix}$$
10

Find the posterior probability that a random test signal with x value 25 and y value of 75, belongs to class AN. [Note: use *Matrix* approach only.]

**BME 4008** 

Page 1 of 2

06

Design McCulloch-Pitts neuron for realization of a three input AND function. Test 4. (a) 08 the network with following input data: (1,0,1) and (0,0,1). What is a discriminant function? How is it used for labelling different regions of (b) interest? 04 Draw the diagram of a single layer perceptron and the flowchart for training the (c) network. Define the weight-updating rule used. 08 Explain a biomedical classification system considering cardiac signal. Discuss this 5. (a) 10 with an appropriate features. A series of eight samples gave the following results: (b)

Class	<i>Feature x</i>	<i>Feature</i> y
А	0	1
А	1	0
А	0	1
В	0	1
В	1	0
В	1	0
С	0	1
С	1	1

05

Estimate the P(A | (x = 1, y = 0)).

(c) How performance of the classifier is estimated? Explain.