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## MANIPAL INSTITUTE OF TECHNOLOGY

(A Constituent Institute of Manipal University) Manipal - 576 104



## **II SEMESTER M.Tech. (BME) DEGREE MAKEUP EXAMINATIONS, JUNE/JULY 2016 SUBJECT: PATTERN RECOGNITION (BME 528)** (REVISED CREDIT SYSTEM)

Saturday, 2<sup>nd</sup> July 2016: 9 am to 12 noon

## **TIME: 3 HOURS**

MAX. MARKS: 100

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		Instructions to Candidates:		
1. 2.	<ul> <li>Answer any FIVE full questions.</li> <li>Draw labeled diagram wherever necessary</li> </ul>			
1.	(a)	Describe the basic architecture of McCulloch Pitts neuron model and realize a NOT function using McCulloch Pitts neuron model.	08	
	(b)	Explain various elements of pattern recognition system. Describe the role of classifier in the above system and the challenges involved in its design.	08	
	(c)	With respect to neural network explain following:	04	

- With respect to neural network explain following: (C)
  - i) Supervised Training
  - ii) Activation function
- 2. (a) What is "posterior probability"? Define the relation between the posterior 08 probability and class conditional probability. Use above relationship and describe the classification procedure for a K-class problem consisting a feature vector of size d.
  - What is *class discovery*? Explain top down approach for class discover. (b)
  - What is supervised training? Explain how the basic unit of neural network is (c) 06 trained.
- Explain the benefits of digitization of blood slide. Discuss how it can be carried out 08 3. (a) with an example.

(b) Given two classes named G1 and G2. Let the extracted features be x and y. Each of the features can take either of the values as shown in the table-1. What is the probability that a new sample with x=2, y=1 belongs to class G1?

Class	Samples	<i>x</i> =1	<i>x</i> =2	y=1	y=2
А	6	3	3	4	2
В	6	4	2	4	2

Table-1

- (c) Explain the mechanism of getting clusters in a divisional approach.
- 4. (a) The values of feature x for 7 samples from class-A are 3,3,3,4,4,5,5. The samples from class-B had x values of 5,6,8,8,9,9,9,11. Draw the histogram for each class and find a decision boundary between classes. Suggest a suitable decision rule for classification. Find the class of a given random sample, when the sample feature value(x) is 5.
  - (b) Draw the architecture of the perceptron network and describe the training rules. 06
  - (c) What is bio-metric system? With a neat block diagram explain a simple biometric 08 application and discuss its benefit.
- 5. (a) Explain the training algorithm defined in case of Hebb network. Design a Hebb net 10 for implementing, AND function. Show that the trained network may be used for classification of input vectors.
  - (b) In a clustering problem following are the defined clusters: Cluster1= {(2, 1), (3, 2)} Cluster 2= {(6, 6), (6,5)}
    10 Cluster 3={(9,8), (9,9)} Find the average linkage distance between the clusters using city block distance. Identify the most similar two clusters and indicate them with a neat scatter plot. Discuss this hierarchical classification with a neat sketch of dendrogram.

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6. (a) Explain clustering based on "minimum squared error" method. Use the sample details given in the table 2, clearly indicating the details of estimation of error.

Table 2			
Samples Feature		Feature	
	X	У	
1	1	2	
2	2	3	
3 6		7	
4 8		8	
5 11		9	

- (b) Explain the advantages of *Artificial neuron*.
- (c) A series of seven samples and their feature values are given in table 3. Find the prior probabilities associated with *class-A* and *class-B*, and also estimate the probability that the test sample  $X = \begin{bmatrix} 0 & 1 \end{bmatrix}^T$  came from class A.

		Table 3	
Samples	CLASS	Feature x	Feature y
	Name		
1	А	0	1
2	А	1	0
3	А	0	1
4	В	0	1
5	В	1	0
6	A	0	1
7	В	1	1

(d) The feature "x" is normally distributed for class A, with a mean value of 2 and a standard deviation of 1. But for the class B it is uniformly distributed between 4 & 8. The prior probabilities are P(A) = 0.4 & P(B) = 0.6. Find P(A|x = 2) and plot the class conditional probabilities associated with the *class-A* and *class-B*.

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