Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (INFORMATION TECHNOLOGY / COMPUTER AND COMMUNICATION ENGINEERING)

MAKE-UP EXAMINATIONS, JUNE 2018

SUBJECT: PROGRAM ELECTIVE III - PATTERN RECOGNITION

[ICT 4020]

REVISED CREDIT SYSTEM
(22 / 06 /2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions.
- Missing data, if any, may be suitably assumed.

1A. With a neat diagram explain the generalized linear discriminant function. 5

1B. Explain the Jackknife estimate of bias and variance 3

1C. Explain Fisher linear discriminant analysis. 2

2A. With the help of a diagram, explain the design of a pattern recognition system. 5

2B. Consider the data given in Table 2B (a) and Table 2B (b). Given that the person is right handed find the probability of

i. Quality of hand writing being good

ii. Quality of hand writing being bad 3

Table 2B (a): Class conditional probabilities

P(X|wj)	Fast	Average	Slow
Right handed	0.6	0.3	0.2
Left handed	0.4	0.7	0.8

Table 2B (b): Prior probabilities

Quality of handwriting (wj)	Good	Fair	Bad
Prior probability	0.3	0.6	0.1

2C. Explain the decoding issue in Hidden Markov Model. 2

3A. Describe the error correction techniques for finding a separating vector when the samples are linearly separable. 5

3B. Discuss any two classification issues with respect to dimensionality of the dataset. 3

3C. Given a feature vector X, if $P(w_2|x) \geq P(w_1|x)$ we decide on class w_2 and thus the probability of error is given by $P(error|x)=P(w_1|x)$. Justify the statement with a neat diagram. 2

4A. Explain the normal density function for the following cases:

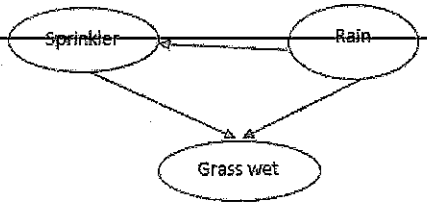
i. Univariate density 5

ii. Bivariate density

4B. Considering a multivariate Gaussian case, determine the components of parameter vector. 3

4C. In linear discriminant functions, prove that weight vector w is normal to any vector lying in the hyperplane. 2

5A. Explain different types of Bayesian belief networks along with its probability distribution over any variable of the network. Consider the belief network given in Figure 5A and determine the probability that it is raining when grass is wet.



Rain	
T	F
0.2	0.8

	Sprinkler	
Rain	T	F
F	0.4	0.6
T	0.01	0.99

		Grass wet	
Sprinkler	Rain	T	F
F	F	0.0	1.0
F	T	0.8	0.2
T	F	0.9	0.1
T	T	0.99	0.01

5

Figure 5A: A belief network

5B. Consider a two class problem having three independent binary features and classes w_1 and w_2. Assume that w_1 and w_2 are equiprobable and the individual components $p_i=0.8$ and $q_i=0.5$ for i=1,2,3. Obtain the decision boundary and represent it diagrammatically. 3

5C. Using Chi-square analysis determine the correlation for the data given in Table 5C. [Chi-square value (10.83) for $p = 0.001$ with 1D.F]

Table 5C: Contingency table

	Basketball	Non-Basketball
Cereal	2000	1750
Non-cereal	1000	250

2