Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: PROGRAM ELECTIVE III - PATTERN RECOGNITION

[ICT 4020]

REVISED CREDIT SYSTEM

(26/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Explain the method to obtain a separating vector that achieves a good performance on both separable and non-separable problems. Determine whether the solution vector gives a separating hyperplane for the matrix $Y = \begin{pmatrix} 1 & 6 & 9 \\ 1 & 5 & 7 \\ -1 & 5 & 9 \\ -1 & 0 & 10 \end{pmatrix}$ 5

1B. How do bagging and boosting improve the accuracy of any classifier? 3

1C. Discuss any four problems of statistical pattern recognition. 2

2A. Explain the Bayes decision theory for independent binary features. Prove that the discriminant function of Bayes classifier estimates the probability distribution of the patterns belonging to each class. 5

2B. List the properties of distance function between patterns. Also, explain any two metrics for calculating distance between data points. 3

2C. Discuss m-fold cross validation technique. 2

3A. Derive the criterion function J(.) in terms of within class scatter and between class scatter in Fisher linear discriminant. 5

3B. Explain how density estimation can be used in the field of pattern recognition. Consider the data given in Table 3B (a) and Table 3B (b): 3

Table 3B (a): Class conditional probabilities

P(X|wj)	Good	Fair	Bad
Interesting lecture	0.8	0.5	0.1
Boring Lecture	0.2	0.5	0.9

Table 3B (b): Prior probabilities

Quality of the course (w_j)	Good	Fair	Bad
Prior probability	0.2	0.4	0.4

Given that lecture is interesting, find the probability of

i. Course being good

ii. Course being bad

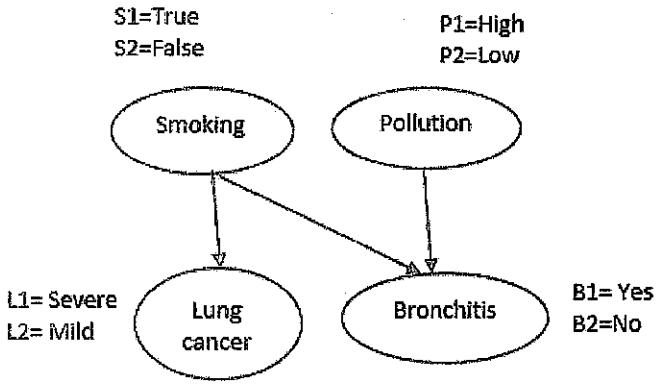
3C. Prove that, as probability of an object belonging to a class increases the conditional risk decreases. 2

4A. Apply Principal Component Analysis to transform the dataset given in Table 4A. 5

Table 4A : 2-dimensional dataset

H	9	15	25	14	10	18	0	16	5	19	16	20
M	39	56	93	61	50	75	32	85	42	70	66	80

4B. Consider the Bayesian belief network given in Figure 4B. Determine the classification for Bronchitis for a person who smoke and travels in a less polluted area.



P(p1)	P(p2)
0.6	0.4

P(s1)	P(s2)
0.7	0.3

	P(b1|si,pi)	P(b2|si,pi)
S1,p1	0.72	0.28
S1,p2	0.92	0.08
S2,p1	0.09	0.91
S2,p2	0.07	0.93

3

Figure 4B: A belief network for disease example

4C. In a two category linearly separable case, the solution region in a feature space is not a decision region. Justify. 2

5A. Differentiate between linear discriminant function and linear discriminant analysis. With a neat diagram explain how linear discriminant function divides the feature space by a hyperplane decision surface. 5

5B. Show that the class conditional density p(x|D) follows a normal density where D is a set of samples and $x \in D$. 3

5C. Explain the evaluation issue in Hidden Markov Model. 2