B.E. Eighth Semester (Computer Science & Engineering) (C.B.S.)

Elective - III : Pattern Recognition

P. Pages : 3 **NKT/KS/17/7610**

Time : Three Hours * 0 7 3 9 * Max. Marks : 80

Notes :
1. Solve Question 1 OR Questions No. 2.
2. Solve Question 3 OR Questions No. 4.
3. Solve Question 5 OR Questions No. 6.
4. Solve Question 7 OR Questions No. 8.
5. Solve Question 9 OR Questions No. 10.
6. Solve Question 11 OR Questions No. 12.
7. Assume suitable data whenever necessary.
8. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) What is pattern recognition? Explain design principles of pattern recognition with an example. **7**

b) Explain the various application of pattern recognition. **6**

OR

2. a) Explain the design cycle of pattern recognition with the help of suitable diagram. **7**

b) Explain the following types of learning with example. **6**

i) Supervised Learning

ii) Unsupervised Learning

iii) Reinforcement Learning

3. a) If $P(x)$ is the Poisson distribution, show that **4**

$$\sum_{x=0}^{\infty} P(x) = 1$$

b) Prove that **6**

$$E(z) = E(ax + by) = a\,E(x) + b\,E(y)$$

for both discrete & continuous case.

c) Explain the case : **3**

$$P\left[(A \text{ and } B) \mid C\right] = P(A/C) \cdot P(B/C)$$

OR

4. a) Explain following methods for estimation of parameters from samples. **9**
i) The method of moments.
ii) Maximum likelihood estimates.
iii) Unbiased estimators.

b) A classifier has 30 percent error rate. What is the probability that exactly three errors will be made in classifying 10 samples. **4**

5. a) Explain the following : **8**

i) Bayes' Theorem.

ii) Prior Probability

iii) Posterior Probability

iv) Likelihood Ratio

b) Discuss three methods of estimation of error rates in detail with examples. **6**

OR

6. a) Find $P(A \mid x=0, y=0, z=1)$ given $P(A) = 1/5$, $P(B) = 4/5$ & **7**

$P(x=0 \mid A) = 1/3 \quad P(x=0 \mid B) = 1/4$

$P(y=0 \mid A) = 1/5 \quad P(y=0 \mid B) = 1/5$

$P(z=1 \mid A) = 1/6 \quad P(z=1 \mid B) = 1/7$

State your assumptions.

b) For class A feature x is normally distributed with $\mu = 1$ & $\sigma = 2$. For class B x is uniformly distributed in the range 0 to 4. The prior probabilities are $P(A) = 1/3$ and $P(B) = 2/3$. What is the probability that a sample $x = 3$ belongs to class A & class B. **7**

7. a) Explain support Vector Machine. How it is trained. How XoR operation is implemented using SVM. **7**

b) Explain the ANN back propagation algorithm in detail **7**

OR

8. Explain Hidden Markov model in detail. **14**

9. a) How can Kernel and Window Estimator be used in non parametric decision making? **6**

b) Estimate the error rates for nearest neighbour and Bayesian classification for two classes with equal prior probabilities. Assume class A & class B are uniformly distributed. **7**

OR

10. a) State the steps in adaptive decision binary algorithm. **8**

b) Find the decision regions resulting from three discriminant function. **5**

$D_A = 1 + x + y$

$D_B = 2 - x - 2y$

$D_C = -3 - 2x + 4y$

11. a) Refer the following table & perform partitional clustering using **13**

i) Forgy's Algorithm

ii) K - means Algorithm

Samples	x	y
1	4	4
2	8	4
3	15	8
4	24	4
5	24	12

OR

b) Explain Hierarchical clustering. Perform a hierarchical clustering of the data given in the following table using ward's algorithm. Show the values of squared errors that are computed. **13**

Samples	x	y
1	0.0	0.0
2	0.5	0.0
3	0.0	2.0
4	2.0	2.0
5	2.5	8.0
6	6.0	3.0
7	7.0	3.0

****