CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR
(Deemed to be University)
KOKRAJHAR :: BTR :: ASSAM :: 783370

END – SEMESTER EXAMINATION
UG

Session: **Janu-June, 2023** Semester: **IV** Time: **3Hrs.** Full Marks: **100**
Course Code: **UCSE402** Course Title: **Probability and Random Process**

Answer any *five* questions

1. (a) State the Bayes theorem. Explain how it can be used as a classifier.
(b) In an examination you have to a choose the question randomly either from Group A or Group B. In group A, there are 7 known question and 2 unknown question. Similarly, in group B, there are 3 known question and 4 unknown question. You have chosen a group randomly and then randomly choose a question and found that the question is known. What is the probability that the chosen question from the group A?

10 + 10

2. (a) What are the criteria for a Markov chain to reach the state of equilibrium? Determine whether the following Markov chain (matrix A) is regular.

$$A = \begin{pmatrix} 0 & 1 \\ 0.4 & 0.6 \end{pmatrix}$$

(b) In Kokrajhar there are two telephone companies, Airtel and Jio. Due to their aggressive sales tactics, each year 40% of Airtel customers switch to Jio. On the other hand, 30% of Jio customers switch to Airtel. If the initial market share for Airtel is 20% and for Jio is 80%, what will be the market share in the long run (equilibrium state)?

10 + 10

3. (a) Find the Eigenvalue and Eigenvector of the matrix

$$\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$$

(b) Convert the matrix A into diagonal form and hence find the value of A^3.

10 + 10

4. Let X and Y are two jointly continuous random variables with joint probability density function

$$f_{XY}(x,y) = \begin{cases} x + cy^2, & \text{if } 0 \le x \le 1, 0 \le y \le 1 \\ 0, & \text{otherwise} \end{cases}$$

(a) Find the value of c.
(b) Find $P(0 \le X \le \frac{1}{2}, 0 \le Y \le \frac{1}{2})$.
(c) Find $f_X(x)$ and $f_Y(y)$.

$5 + 5 + 10$

5. (a) Define Moment Generating Function. Find the mean and variance of Binomial distribution using Moment Generating Function.
(b) Define the Central Limit Theorem.

$15 + 5$

6. (a) Describe Simple random sampling and stratified sampling.
(b) Define the correlation coefficient and prove that its value lies in [-1, 1].
(c) If we consider the data points from your entire class like
$\{(x_i, y_i)$: where x_i is the age and y_i is the height of i^{th} student$\}$.
Explain the possible nature of the distribution of these data points.

$6 + 8 + 6$

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