



CCF R

Reg. No. :

Name :

**Fourth Semester B.Tech. Degree Examination, May 2015
(2013 Scheme)**

**13.401 : PROBABILITY, RANDOM PROCESSES AND NUMERICAL
TECHNIQUES (FR)**

Time : 3 Hours

Max. Marks : 100

PART - A

Answer **all** questions. **Each** question carries **4** marks.

1. If (x, y) is uniformly distributed over the triangular region 'R' bounded by $y = 0$, $x = 3$ and $y = (4/3)x$, find the covariance between x and y . Will they be independent. Justify your answer.

2. Find the constant 'K' such that $f(x) = \begin{cases} ke^{-x^2} & , x \geq 0 \\ 0 & , \text{otherwise} \end{cases}$



represent probability density function of the random variable X. Also determine mode and mean of X.

3. Let X be a Poisson's random variable such that $P(x = 2) = 9 P(x = 4) + 90 P(x = 6)$. Find the variance of X.

4. Five dice are thrown 243 times. How many times does one expect to get atleast two dice to show 1 or 2 on top face.

5. Solve by Gauss-Siedal method

$$10x + y + z = 12$$

$$2x + 10y + z = 13$$

$$2x + 2y + 10z = 14.$$



PART - B

Answer **one full** questions from **each** Module. **Each** question carries **20** marks.

Module - I

6. a) Derive the mean and variance of exponential distribution and write the pdf of exponential distribution.
- b) In a normal distribution, 7% of items are under 35 and 39% of items are over 63. Find mean and variance.
- c) Prove that Poisson distribution is a limiting case of Binomial distribution.
7. a) Derive the mean and variance of Binomial.
- b) Write the pdf of normal distribution and hence write the pdf of standard normal distribution.

The mean weight of 500 students at a certain school is 50 kgs and SD is 6 kgs. Assume that weights are normally distributed, find the expected no. of students weighing.

- 1) b/w 40 and 50 kgs
 - 2) more than 60 kgs.
- c) Write the p.m.f of Poisson distribution. Write the expression for mean and variance.

A certain screw making machine has a chance of producing two defectives out of 100. The screws are packed in boxes of 100. Using Poisson distribution, find the approx. number of boxes containing.

- 1) no. of defective screws
- 2) one defective screws
- 3) two defective screws.

Module - II

8. a) Suppose that the joint pdf of two dimensional r.v (x, y) is given by

$$f(x, y) = \begin{cases} x^2 + \frac{xy}{3}; & 0 < x < 1, 0 < y < z \\ 0 & ; \text{ elsewhere} \end{cases}$$



Find:

- a) $P(x > 1/2)$
- b) Marginal pmf of x
- c) $P(y < 1/2/x < 1/2)$

b) Suppose that the two dimensional r.v (x, y) have join pdf

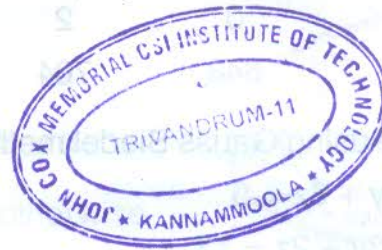
$$f(x, y) = \begin{cases} x + y; & x \geq 0, y \leq 1 \\ 0 ; & \text{elsewhere} . \end{cases}$$

Compute the covariance.

9. a) Suppose that the two dimensional continuous R.V has joint pdf given by

$$f(x, y) = \begin{cases} x^2 + \frac{xy}{3}; & 0 \leq x \leq 1; 0 \leq y \leq 2 \\ 0 ; & \text{elsewhere} \end{cases}$$

- 1) Check whether it is a pdf.
- 2) Find the marginal pdf of x.
- 3) Find the marginal pdf of y.



- b) Show that correlation coefficient assumes values b/w 1 and -1.
- c) If x, y and z are uncorrelated R.V with $\sigma = 5, 12$ and 9 respectively. If $U = X+Y$, if $V = Y + Z$, evaluate the correlation coefficient b/w U and V.

Module – III

10. a) Show that the Poisson process x (t) given by the probability law

$$P\{x(t) = n\} = \frac{e^{-\lambda t} (\lambda t)^n}{n!}, n = 0, 1, 2, \dots \text{ is not stationary.}$$

b) Find the auto correlation function of the process {X(t)} for which the power

spectral density is given by $S(w) = \begin{cases} 1+w^2, & |w| \leq 1 \\ 0, & |w| > 1 \end{cases}$.



11. a) Find the power spectral density of a WSS process with auto correlation function $R(\tau) = e^{-\alpha\tau^2} \cos \omega_0\tau$.
- b) What do you mean by Ergodicity. Explain ergodic processes and state ergodic theorem.
- c) Write the relation between auto correlation and power spectral density.

Module – IV

12. a) Find the root of the equations $xe^x = \cos x$, using Regula Falsi method, upto four decimal places.

- b) Using Gauss elimination solve

$$x + 4y - z = -5$$

$$x + y - 6z = -15$$

$$3x - y - z = 4$$

- c) Use Lagrange's formula to find the form of $f(x)$ given

x	0	2	3	6
$f(x)$	648	704	729	792

13. a) Solve using Gauss Siedel method.

$$2x + y + 6z = 9$$

$$8x + 3y + 2z = 13$$

$$x + 5y + z = 7.$$

- b) State Newton's interpolation formula and use it to calculate the value of $f(1.85)$, given the following table.

x	1.7	1.8	1.9	2.0	2.1	2.2	2.3
$f(x)$	5.474	6.05	6.686	7.389	8.166	9.025	9.974

- c) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using

a) Trapezoidal rule

b) Simpson's $\frac{1}{3}$ rule.