

(OLD COURSE)

QP Code : 3996

Max . Marks : 100

Duration : 3 hours

- Note: 1. Question No. 1 (ONE) is Compulsory.
 2. Attempt any 4 (FOUR) questions from Que. 2 to Que. 7
 3. Figures to the right indicate full marks .

- Que. 1 a) If $\vec{F} = (3x + 4y)i - 4\cos xj + 5\sin 4yk$, Find $\nabla \cdot \vec{F}$ and $\nabla \times \vec{F}$ 5
- b) Show that every square matrix can be uniquely expressed as the sum of a Hermitian matrix and Skew- Hermitian matrix . 5
- c) A random has probability density function
- | | | | | | | | |
|--------|---|----|----|----|----|-----|-----|
| x : | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| P(x) : | k | 3k | 5k | 7k | 9k | 11k | 13k |
- Find k and mean 5
- d) Find Spearman's Rank Correlation Coefficient (R) for the following data 5
- | | | | | | | |
|-----|---|---|---|---|---|---|
| X : | 1 | 2 | 4 | 3 | 6 | 5 |
| Y : | 3 | 5 | 6 | 4 | 2 | 1 |
- Que. 2 a) Find the mean and variance of Binomial Distribution. 6
- b) Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} 8 & -3 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ 6
- c) Verify Greens theorem for $\int_C (xy + y^2)dx + x^2dy$ where C is the closed curve of the region bounded by $x = y$ and $y = x^2$ 8
- Que 3 a) Find the rank of the following matrix 6
- $$A = \begin{bmatrix} 3 & 2 & 5 & 7 \\ 1 & 1 & 2 & 3 \\ 3 & 3 & 6 & 9 \end{bmatrix}$$
- b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as poisson variate with mean 1.5. Calculate the proportion of days on which some demand is refused. 6
- c) Using Stokes theorem, Evaluate $\int_C F \cdot dr$, where $F = yzi + xzj + xyk$ where C is boundary of Sphere $x^2 + y^2 + z^2 = 1, z = 0$ 8
- Que.4 a) Show that the matrix $A = \begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$ is derogatory. 6
- b) In an intelligence test administered to 1000 students the average was 42 and standard deviation was 24 .find the number of students i) Exceeding 50 , ii) between 30 and 44. 6
- c) Find rank , signature , index, and class value of quadratic form. 8
- $$5x^2 + 26y^2 + 10z^2 + 6xy + 4yz + 14xz$$

Pg 42

Que.5 a) For what values of α the equations $3x-2y + \alpha z=1, 2x+y+z =2,$
 $x+2y- \alpha z =-1$ will have no solution, unique solution. 6

b) Show that the matrix $A = \begin{bmatrix} 2 & -3 & -2 \\ 1 & -1 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ satisfies Cayley –Hamilton Theorem 5

c) Find the Coefficient of Correlation between x and y for the following data 8

X:	62	64	65	69	70	71	72	74
Y:	126	125	139	145	165	152	180	208

Que. 6 a) Show that the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ is diagonalizable. Find the 6

transforming matrix and the diagonal matrix.

b) Let X be a continuous random variable with probability density function
 $f(x) =kx(1-x) 0 < x < 1$. Find k, mean. 6

c) Fit a straight line to the following data

X:	1	2	3	4	5	6
Y:	49	54	60	73	80	86

Que. 7 a) Determine l, m, n if $A = \frac{1}{3} \begin{bmatrix} l & 2 & 2 \\ 2 & m & -2 \\ 2 & -2 & n \end{bmatrix}$ is orthogonal. 6

b) If $A = \begin{bmatrix} 1 & 2 & 2 \\ -1 & 0 & 1 \\ 2 & 3 & 4 \end{bmatrix}$ Find adjoint of A (adjA). 6

c) If the vector field $\vec{F} = (y^2 \cos x + z^3)\vec{i} + (2yz \sin x - 4)\vec{j} + (3xz^2 + 2)\vec{k}$ is a
conservative field. Find scalar potential for \vec{F} 8