Duration: 3 hours **Marks: 80**

N.B. (1) Question No. 1 is **COMPULSORY**.

(2) Answer **ANY THREE** questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to right indicate full marks.

Que. 1 a. Show that the following quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$ is positive definite **5**

b. Find the extremal of $\int_{x1}^{x2} \sqrt{1 + (\frac{dy}{dx})^2}dx$ **5**

c. Find a unit vector orthogonal to the vectors (1,1,1) and (0,1,1,). **5**

d. Evaluate $\int_0^{1+i} \bar{Z}\,dz$ along the real axis from $z = 0$ to $z = 1$ then vertically to $1 + i$. **5**

Que. 2 a. Find the extremal of $\int_0^{\frac{\pi}{2}} (y'^2 - y^2 + 2xy)dy$ with $y(0) = 0$ $y(\frac{\pi}{2}) = 0$. **6**

b. In a normal distribution 30% of the items are below 35 and 10% of the items are above 60. Find the mean and standard deviation. **6**

c. The lines of regression are 20x-9y-107=0 and 15x=8y+130, V(x)=16 Find the means, r, and V(y). **8**

Que. 3 a. In sampling a large number of parts manufactured by a machine the mean number of defectives in a sample of 20 is 2. Out of 1000 such a sample how many would you except to contain i) 3 defectives ii)less than 3 defectives. **6**

b. Find the line of regression of Y on X for the following data **6**

X	5	6	7	8	9	10	11
Y	11	14	14	15	12	17	16

c. Show that V={(x,0)/x is real} with the operations of addition and scalar multiplication defined as $(x_1,0) + (x_2,0) = (x_1+x_2,0)$ and $k(x,0) = (kx,0)$ is a vector space. **8**

Que. 4 a. Reduce the following quadratic form $3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2zx$ to canonical form also find rank signature and index. **6**

b. Verify Cauchy-Schwartz inequality for U= (2,4, -3,5) and V= (3,2,3, -1) **6**

c. Find all possible expansions of $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ about z = -1 **8**

Que. 5 a. If the probability mass function of a random variable is **6**

$f(x)=kx(1-x),\ 0 \le x \le 1$ .find its mean and variance.

b. Find the orthonormal basis by Gram-Schmidt process to (-1,1 0), (0,1,1), (1 0 1). **6**

c. Fit a second-degree parabolic curve to the following data **8**

X	1	2	3	4	5	6	7	8	9
Y	2	6	7	8	10	11	11	10	9

Que. 6 a. Show that {(a 0 0) such that a is real} is subspace of R^3 **6**

b. Evaluate $\oint_C \frac{(z-3)}{z^2+2z+5}dz$ where C is the circle (a) lzl=1 **6**

(b) lz+1-il=2 (c)lz+1+il=2

c. Use Rayleigh-Ritz Method to find the extremal of **8**

$\int_0^1 (xy + \frac{1}{2}y'^2)dx$ given y(0)=1 & y(1)=0

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