Duration: 3 hours **Max. 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.

Q 1

a. Evaluate the complex line Integral $\int_0^{1+i} (x - y + ix^2)dz$ along the straight line from z=0 to z=1+i **5**

b. Find a vector orthogonal to u=(-6, 4, 2) v=(3, 1, 5) **5**

c. The equations of lines of regressions are 2x+3y+8=0 and x+2y-5=0, find means of x and y and coefficient of line of regression between x and y **5**

d. Let W be the set of 2 X 2 matrices of the form $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ where a and b are real numbers, Show that W is a subspace of space V of all 2X 2 matrices. **5**

Q 2

a. Find the Spearman's rank coefficient correlation of the following data **6**

X	32	55	49	60	43	37	43	49	10	20
Y	40	30	70	20	30	50	72	60	45	25

b. Find the extremal of $\int_{x_1}^{x_2} \frac{1+y^2}{y'^2} dx$ **6**

c. Obtain Taylor and Laurent series expansion about z=0 of function f(z)= $\frac{z-1}{z^2-2z-3}$ indicating regions of convergence **8**

Q. 3

a. A continuous random variable has probability density function as $f(x) = kx^2 \ \ 0 \le x \le 2$, find k , mean and P(0.2 <x<0.5) **6**

b. $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-2)(z-3)} dz$ where C is the circle i. |z|=1 ii. lzl=4 **6**

c. Reduce the quadratic form to canonical form, find it's rank and signature $21x_1^2+11x_2^2+2x_3^2-30\ x_1\ x_2+12\ x_1\ x_3-8\ x_3\ x_2$ **8**

Q 4 a. Using Gram-Schmidt process, construct, an orthonormal basis of (1, 1, 1), (-1, 1, 0) and (1, 2, 1) in R^3 have Euclidian inner product **6**

b. Find the probability that at most 4 defective bulbs will be found in a box of 200 bulbs, if it is known that 2% of the bulbs are defective **6**

c. By Rayleigh -Ritz method, Solve the boundary value problem **8**
y''+y+x=0 0< x<1 y(0)=y(1)=0

Q 5 Ten students got the following percentage of marks in mathematics and statistics **6**

a.

Maths	78	36	98	25	75	82	90	62	65	39
Stats	84	51	91	60	68	62	86	58	53	47

Calculate the coefficient of correlation.

b. In a normal distribution 7% of the items are below 35 and 89% of the items are below 63. Find the mean and standard deviation **6**

c. Find the extremal of $\int_{x_1}^{x_2}(y''^2 - y^2 + x^2)dx$ **8**

Q 6 a. Verify Cauchy -Schwartz inequality for u=(1, 2, 4) and v= (-3, 2, 5) **6**

b. Evaluate $\oint_C \frac{\sin^6 z}{\left(z-\frac{\pi}{6}\right)^3}dz$ where C is a circle |z|=2 **6**

c. Find Singular value decomposition of $\begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$ **8**

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