Time : 3 Hrs

Marks : 80

N.B.

1. Q. No.1 is **compulsory.**

2. Answer any **four** out of remaining <u>six</u> questions.

3. <u>Figures</u> to the right indicate full marks.

4. Use of statistical tables is permitted.

5. Write the sub –questions of main question collectively together.

1. a) Find vector orthogonal to both $(-6, 4, 2), (3, 1, 5)$. 5

   b) If $A = \begin{bmatrix} 2 & 3 \\ -3 & -4 \end{bmatrix}$ then find A^{50}. 5

   c) A discrete r. v. has the probability density function given below. 5

X	:	-2	-1	0	1	2	3
$P(X = x)$	:	0.2	k	0.1	2k	0.1	2k

   Find k, mean & variance.

   d) Integrate the function $f(z) = x^2 + ixy$ from A(1, 1) to B(2, 4) along straight line AB. 5

2. a) Find the eigen values and eigen vectors of $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ 6

   b) If X denotes the outcome when a fair die is tossed, find M. G. F. of X & hence, find the mean & variance of X. 6

   c) Evaluate $\int_{-\infty}^{\infty} \frac{x^2}{(x^2 + 4)(x^2 + 9)} dx$ using contour integration. 8

3. a) Using Cauchy Schwartz inequality show that $\frac{b+c}{a} + \frac{c+a}{b} + \frac{a+b}{c} \geq 6$ 6

   b) Caclulate the Correlation coefficient from the following data. 6

X:	23	27	28	29	30	31	33	35	36	39
Y:	18	22	23	34	25	26	28	29	30	32.

   c) If the mean of the following distribution is 16 find m, n & variance. 8

X	:	8	12	16	20	24
$P(X = x)$	:	1/8	m	n	1/4	1/12

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4. a) Using Gram – Schmidt process find the orthonormal basis $[3, 0, 4], [-1, 0, 7], [2, 9, 11]$,   6

   b) Given $6y = 5x + 90, 15x = 8y + 130, \sigma_x^2 = 16$. Find i) $\bar{x}$ & $\bar{y}$, ii) σ_y^2, iii) r.   6

   c) Is the given matrix diagonalizable $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$. Find diagonalising matrix and the   8

   diagonal matrix.

5. a) Evaluate $\int_C \frac{(z+4)^2}{z^4+5z^3+6z^2} dz$ where C is a circle $|z| = 1$,.   6

   b) If X is Binomial Distributed with mean 2 & variance 4/3, find probability distribution of X.   6

   c) Fit a Poisson distribution to the following data.   8

X:	0	1	2	3	4
F:	122	60	15	2	1

6. a) A c. r. v. X has the following probability law   6

   $$f(x) = kx^2(1 - x^3) \qquad 0 \le x \le 1$$
   $$= 0 \qquad\qquad elsewhere$$

   Find i) k, ii) $P(0 < x < 1/2)$, iii) $\bar{x}$, iv) σ^2.

   b) Using C-H theorem find the matrix represented by $A^8 - 5 A^7 + 7 A^6 - 3 A^5 + A^4 - 5 A^3 + 8 A^2 - 2 A + I$ 6

   Where $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$.

   c) Find all possible Taylor's & Laurent's series expansions of the function, $f(z) = \frac{z-1}{(z+1)(z-3)}$

   about $z = 0$ indicating the region of convergence in each case.   8

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