[Time: Three Hours]   **[Marks:80]**

Please check whether you have got the right question paper.
N.B: 1. Question.No.1 is compulsory.
2. Attempt any three questions out of the remaining five questions.
3. Figures to the right indicate full marks.

Q.1 a) Find the Laplace Transform of $\frac{\cos\sqrt{t}}{\sqrt{t}}$ **05**

b) Verify Caryley-Hamilton Theorem for A=$\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ and deduce that $A^8 = 625\ I$ **05**

c) with usual notation find p of 9P (X = 4) = P (X=2)   **05**

d) Evaluate $\int_c \bar{z}\ dz$, where c is the upper half of the circle r = 1.   **05**

Q.2 a) Find the inverse Laplace-Transform by using convolution theorem $\frac{1}{S^2\ (s+a)^2}$.   **06**

b) If f(z) = u + iv is analytic and $u + v = \frac{2\ sin\ 2x}{e^{2y} + e^{-2y} - 2cos2x}$. find f(z)   **06**

c) Find a matrix P that diagonalises the matrix A =
$\begin{bmatrix} -1 & 4 & -2 \\ -3 & 4 & 0 \\ -3 & 1 & 3 \end{bmatrix}$ and hence. Find the diagonal matrix and transforming matrix.   **08**

Q.3 a) Find the inverse Laplace Transform of $\frac{S^2+2S+3}{(S^2+2S+5)(S^2+2S+2)}$.   **06**

b) find the Bilinear Transformation which maps the points z = -1, 1, ∞ onto the points w = -i, -i, i.   **06**

c) Using the Kuhn-Tucker conditions solve the following N.L.P.P.   **08**
Maximise $z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$
Subject to $x_1 + x_2 \le 2$
$2x_1 + 3x_2 \le 12$
$x_1, x_2, x_3 \ge 0$

Q.4 a) Evaluate $\int_{1-i}^{2+i}(2x + iy + 1)dz$, along the curve $x = t + 1$, $y = 2t^2 - 1$. **06**

b) Find the coefficient of correlation between x and y for the following data: **06**

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

c) Reduce the following quadratic form **08**
$2x_1^2 + x_2^2 - 3x_3^2 - 8x_2x_3 - 4x_3x_1 + 12x_1x_2$ to normal form throught congruent transformation. Also find its rank, signature and value-class.

Q.5 a) Evaluate $\int_0^{2\pi} \frac{cos2\theta}{5+4\,cos\theta}\,d\theta$ **06**

b) The marks obtained by students in a college are normally distributed with mean 65 and variance 25. if 3 students are selected at random from this college what is the probability that at least one of them would have scored more then 75 marks? **06**

c) Find the orthogonal matrix which diagonalises the real symmetrix matrix. $\begin{bmatrix} 7 & 4 & -4 \\ 4 & -8 & -1 \\ -4 & -1 & -8 \end{bmatrix}$ **08**

Q.6 a) Using Lagrange's multiplier method solve the following N.L.P.P. **06**
Optimise $Z = 4x_1 + 8x_2 - x_1^2 - x_2^2$
Subject to $x_1 + x_2 = 4$
$x_1, x_2 \geq 0$

b) Find the eigen values and eigen vectors for **06**
$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$

c) find inverse Laplace Transform of **08**
i) $\frac{e^{4-3s}}{(s+4)^{5/2}}$ ii) $\tan^{-1}\left(\frac{s+a}{b}\right)$

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