

Roll No.

Total No. of Questions : 08]

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Paper ID [EC501]

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M.Tech. (Sem. - 1st)

ADVANCED MATHEMATICS FOR ENGINEERS (EC - 501)

Time : 03 Hours

Maximum Marks : 100

Instruction to Candidates:

- 1) Attempt any **Five** questions.
- 2) All questions carry equal marks.

Q1) (a) Find the Fourier integral representation of $f(x) = \begin{cases} x & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$

(b) Find $f(x)$ if Fourier cosine transform is $\frac{1}{2\pi}(a - \frac{s}{2})$ if $s < 2a$ & zero if $s \geq 2a$.

Q2) (a) Using Parseval's identity, evaluate $\int_0^{\infty} \frac{\sin^2 ax}{x^2} dx$.

(b) Find the z transform of $2n + 5 \sin \frac{n\pi}{4} - 3a^4$.

Q3) (a) Find $Z(u_{n+2})$, if $Z(u_n) = \frac{z}{z-1} + \frac{z}{z^2+1}$.

(b) Find the inverse z transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$.

Q4) (a) Solve by using Gauss elimination method

$$x_1 + x_2 + x_3 = 11, 2x_1 - 6x_2 - x_3 = 0 \text{ and } 3x_1 + 4x_2 + 2x_3 = 0.$$

(b) Using Power method find the smallest eigen value of

$$\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

Q5) (a) Solve by Jacobi's iterative method

$$2x_1 + x_2 + 4x_3 = 12, 8x_1 - 3x_2 + 2x_3 = 20 \text{ and } 4x_1 + 11x_2 - x_3 = 33.$$

(b) Using Crout's triangularization method, solve the system of algebraic equations

$$2x_1 - 2x_2 - 2x_3 = -4, -2x_2 + 2x_3 = -2 \text{ and } -x_1 + 5x_2 + 2x_3 = 6.$$

Q6) (a) Determine and sketch the image of $|z - 3| = 5$ under $w = \frac{1}{z}$.

(b) Represent $w = \frac{z+i}{iz+4}$ as a composite of mappings.

Q7) (a) Write a note on Schwarz's Christoffel's transformation.

(b) Prove that the shortest distance between two points in a plane is a straight line.

Q8) (a) Find the extremals of the functional $\int_{x_0}^{x_1} (16y'^2 - y''^2 + x^2) dx$.

(b) Using Galerkin's method, solve the boundary value problem $y'' = 3x + 4y$; $y(0) = 0$, $y(1) = 1$.