

Paper ID [EC501]

(Please fill this Paper ID in OMR Sheet)

M.Tech.

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) Derive Fourier integral representation of the function $f(x) = \begin{cases} |x|, & -1 < x < 2 \\ 0, & x \leq -1, x \geq 2 \end{cases}$

At what point does the Fourier integral fail to converge to $f(x)$?

(b) Evaluate the Fourier transform of $f(x) = H(x)e^{-ax}$, $a > 0$.

Q2) (a) Evaluate the inverse Fourier transform of $e^{-|w|} \cos w$.

(b) State and prove Fourier convolution theorem.

Q3) Find the Z transform of

(a) Unit step sequence

(b) $\cosh\left(\frac{n\pi}{2} + \theta\right)$

Q4) (a) If $U(z) = \frac{2z^2 + 3z + 4}{(z-3)^3}$, $|z| > 3$, find the values of u_1 , u_2 and u_3 .

(b) Find the inverse z-transform of $\frac{(1-e^{at})z}{(z-1)(z-e^{-at})}$

Q5) (a) Solve the following equations by Gauss Seidal method

$$2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16$$

(b) Solve the following equations by Crout's method

$$2x + 3y + z = 9, x + 2y + 3z = 6, 3x + y + 2z = 8$$

Q6) (a) Determine smallest eigen value of the matrix by using power method

$$\begin{bmatrix} 10 & 2 & 1 \\ 2 & 20 & -2 \\ -2 & 3 & 10 \end{bmatrix}$$

(b) Find the bilinear transformation which maps the points $z_1 = 2, z_2 = i$ and $z_3 = -2$ into the points $w_1 = 1, w_2 = i$ and $w_3 = -1$.

Q7) (a) Show that the transformation $w = \frac{2z+3}{z-4}$ maps the circle $x^2 + y^2 - 4x = 0$

onto the straight line $4u + 3 = 0$. Explain why the curve obtained is not a circle.

(b) By the transformation $w = z^2$, show that the circle $|z-a| = c$ (a and c are real) in the z -plane correspond to the limacons in the w -plane.

Q8) (a) Prove that the shortest distance between any two points in a plane is a straight line.

(b) Use Galerkin's method to solve the BVP $y'' - y + x = 0, y(0) = y(1) = 0$. Compare the approximate and the exact solution.