Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 08

M.Tech.(ECE)   (Sem.–1)
# ADVANCED MATHEMATICS FOR ENGINEERS
Subject Code : EC-501
Paper ID : [E0561]

Time : 3 Hrs.   **Max. Marks : 100**

INSTRUCTION TO CANDIDATES :
 1.   **Attempt any FIVE questions out of EIGHT questions.**
 2.   **Each question carry TWENTY marks.**

1.   a)   Find the Fourier transform of $f(x) = \begin{cases} 1 & \text{for} |x| < 1 \\ 0 & \text{for} |x| > 1 \end{cases}$

        Hence evaluate $\int\limits_{0}^{\infty} \dfrac{\sin x}{x} dx.$

     b)   Find the Fourier cosine transform of $f(x) = \dfrac{1}{1+x^2}$. Hence derive Fourier sine

        transform of $\phi(x) = \dfrac{x}{1+x^2}$.

2.   a)   State and prove Convolution Theorem for Fourier transforms.

     b)   Using Parseval's identity, prove that $\int\limits_{0}^{\infty} \dfrac{x^2}{(x^2+1)^2} dx = \dfrac{\pi}{4}$.

3.   a)   Find the Z-transform of

        i) $\text{Cosh}\, n\theta$

        ii) $a^n \cosh n\theta$

     b)   Show that $Z\left(^{n+p}C_p\right) = \left(1 - \dfrac{1}{z}\right)^{-p-1}$

4. a) Solve the following using Gauss Elimination Method

$$10x - 7y + 3z + 5u = 6$$

$$-6x + 8y - z - 4u = 5$$

$$3x + y + 4z + 11u = 2$$

$$5x - 9y - 2z + 4u = 7$$

b) Solve using Crout's triangularization

$$3x + 2y - 7z = 4$$

$$2x + 3y + z = 5$$

$$3x + 4y + z = 7$$

5. a) Solve by Jacobi Iteration method

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

b) Using Gauss-Seidal method solve the following :

$$2x + y + 6z = 9$$

$$8x + 3y + 2z = 13$$

$$x + 5y + z = 7$$

6. a) Prove that the transformation $\omega = \sin z$, maps the family of lines $x = $ constant and $y = $ constant into two families of confocal central conics.

b) Find the transformation which maps the semi-infiniteship of width π bounded by the lines $v = 0$, $v = \pi$ and $u = 0$ into the upper half of z-plane.

7. a) Prove that the sphere is the solid figure of revolution which, for a given surface area, has maximum volume.

b) State and prove Hamilton's principle.

8. Define Barchistochrone problem and hence solve it.