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

Total No. of Questions : 08

M.Tech. (EE / Power Engineering)   (Sem.–2)
ADVANCED MATHEMATICS
Subject Code : ELE/PEE-507
Paper ID : [E0487]

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

INSTRUCTIONS TO CANDIDATES :
 1.   **Attempt any FIVE questions.**
 2.   **Any missing data may be assumed appropriately.**

1.   a) Find inverse Laplace transform of $\dfrac{1}{(s^2 + a^2)^2}$.   (10)

     b) Using Convolution theorem find inverse Z-transform of $\left(\dfrac{z}{z-1}\right)^3$.   (10)

2.   a) Using convolution theorem, find inverse Fourier transform of $\dfrac{1}{(1+i\omega)(2+i\omega)}$.   (10)

     b) Write a short note on Vander Pol equation.   (10)

3.   Define the N-point Discrete Fourier Transform (DFT) and find the same for the sequence $[\sin(za)]_{j=0}^{N-1}$.   (20)

4.   a) Find the general solution of the system $X' = \begin{bmatrix} 4 & 2 \\ 3 & 3 \end{bmatrix} X$.   (10)

     b) Write a short note on two dimensional Fast Fourier Transform [FFT].   (10)

5.   Explain the Volterra's Predator-Prey model by considering the following points :

     (i) assumptions made in the model (ii) System of equations (iii) nature of critical points.

6.   Explain the stability criteria for the critical points. Determine the type and stability of the critical point of the following system of equations: (20)

$$y_1' = y_2, \quad y_2' = -5y_1 - 2y_2.$$

7. a) A random variable 'x' has the following probability function:

x	-2	-1	0	1	2	3
$p(x)$	0.1	k	0.2	$2k$	0.3	k

Find the value of k and calculate the variance.

b) A die is tossed thrice. A success is getting "1 or 6". Find the mean and standard deviation of the number of successes.   (5+15)

8. a) Define a binomial distribution and derive a formula for finding mean of the distribution.

b) The probability that a pen manufactured is defective is 0.1. If 12 such pens are manufactured, find the probability that

i)   exactly 2 pens are defective.

ii) at least 2 pens will be defective.

iii) none will be defective.   (10+10)