

Model Question Paper

COURSE: M.TECH.

BRANCH: ELECTRICAL ENGINEERING

SEMESTER: 1 .

SUBJECT: ADVANCED MATHEMATICS

Duration: 3:00 hrs

Max marks: 100

Note: Attempt all questions.

1. Attempt any four parts of the following. **5x4 = 20**

A. Find the eigen value of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

B. Solve the following system by using the Gauss-Jordan elimination method

$$x + y + z = 5, 2x + 3y + 5z = 8, 4x + 5z = 2.$$

C. Solve the system of equations using the Gauss-Seidel Method.

$$45x_1 + 2x_2 + 3x_3 = 58, -3x_1 + 22x_2 + 2x_3 = 47, 5x_1 + x_2 + 20x_3 = 67. \text{Obtain the result correct to three decimal places.}$$

D. Apply Crout's method to solve the equation:

$$3x + 2y + 7z = 4, 2x + 3y + z = 5, 3x + 4y + z = 7.$$

E. Explain the procedure to find the largest eigen value of the matrix by any iterative method.

2. Attempt any two parts of the following.

10x2=20

A. Find the temperature in a bar of length 2 whose ends are kept at zero and lateral surface insulated if the initial temperature is $\sin \frac{\pi x}{2} + 3\sin \frac{5\pi x}{2}$.

B. Solve the linear partial differential equation $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = x + y$.

C. Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$ under the conditions: $u = 0$ when $x = 0$ and $x = \pi$,

$$\frac{\partial u}{\partial t} = 0 \text{ when } t = 0 \text{ and } u(x, 0) = x, 0 < x < \pi.$$

3. Attempt any two parts of the following.

10x2=20

A. Find the Laplace transform of $\frac{1 - \cos t}{t^2}$.

B. Using Convolution theorem find $L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\}$, $a \neq b$.

C. Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & |x| < 1 \\ 0 & |x| > 1 \end{cases}$ and hence, Evaluate

$$\int_0^\infty \left(\frac{x \cos x - \sin x}{x^2} \right) \cos \frac{x}{2} dx.$$

4. Attempt any two parts of the following.

10x2=20

A. Use convolution theorem to evaluate $Z^{-1} \left[\frac{z^2}{(z-a)(z-b)} \right]$. Also find $Z\{a^n * a^n\}$

B. If $F(z) = \frac{2z^2+5z+14}{(z-1)^4}$, evaluate u_0, u_1, u_2 and u_3 .

C. Find the inverse Z-transform of $\frac{z^3+2z^2+29z}{(z-1)(z+3)^2}$.

5. Attempt any two parts of the following.

10x2=20

A. Find the moment generating function of the random variable X having the probability density

function $f(x) = \begin{cases} x & 0 \leq x < 1 \\ 2-x & 1 \leq x < 2 \\ 0 & \text{otherwise} \end{cases}$. Also find the mean and variance of X using M.G.F.

B. Six coins are tossed 6400 times. Using Poisson distribution, find the approximate probability of getting six heads x times and 2 times.

C. A random variable X has the density function $f(x) = \begin{cases} ax & 0 \leq x \leq 1 \\ a & 1 < x \leq 2 \\ -ax + 3a & 2 < x \leq 3 \\ 0 & \text{otherwise} \end{cases}$. Determine a

and compute $P(X \leq 1.5)$.