Roll No. Total No. of Pages : 02

Total No. of Questions : 07

M.Sc Mathematics (2017 Batch) (Sem.–1)

MATHEMATICAL METHODS

Subject Code : MSM-105

Paper ID : [74724]

Time : 3 Hrs. **Max. Marks : 80**

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of EIGHT questions carrying TWO marks each.
2. SECTION - B & C. have THREE questions in each section carrying SIXTEEN marks each.
3. Select atleast TWO questions from SECTION - B & C EACH.

SECTION-A

1. Answer briefly :

a. Find the inverse laplace transform of $\frac{s}{s^4+s^2+1}$.

b. State the convolution theorem.

c. Establish a relationship between fourier and laplace transforms.

d. Enlist some applications of transforms to boundary value problems.

e. Find the Z transform and radius of convergence of $f(n) = 2^n$, $n < 0$

f. Show that the geodesics on a plane are straight curves.

g. Prove that the sphere is the solid figure of revolution in which given surface area has maximum volume.

h. Define Kernal of the integral equation.

SECTION-B

2. a. Find the Laplace transform of sin 2t sin 3t.

   b. Find the inverse transform of $\dfrac{s^2 - 3s + 4}{s^3}$.

3. a. Define convolution of two functions $f(x)$ and $g(x)$ over the interval $(-\infty, \infty)$ and Convolution theorem for Fourier transforms.

   b. Find the Fourier cosine transform of e^{-x^2}

4. Find the Z transforms of the following :

   a. $(n + 1)^2$

   b. Sin $(3x + 5)$

   c. Cosh $n\theta$

   d. ne^{an}

SECTION-C

5. Solve the boundary value problem $y'' - y' + x = 0$ $(0 \le x \le 1)$, $y(0) = y(1) = 0$ by Rayleigh Ritz Method.

6. Use Galerkin's method to solve the boundary value problem which claims that the curve which extremizes the functional I such that;

   $I = \int_0^{\pi/4} (y''^2 - y^2 + x^2)\, dx$ under the condition $y(0) = 0$, $y'(0) = 1$, $y(\pi/4) = y'(\pi/4) = 1/\sqrt{2}$ is $y = \sin x$. Compare the approximate solutions with exact solutions.

7. Transform the differential equation $y'' + y = x$, $y(0) = 1$, $y'(1) = 0$ to a fredholm integral equation, finding the corresponding Green's function.