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Roll No

MVSE-101

M.E./M.Tech. I Semester

Examination, November 2018

Advance Mathematics and Numerical Analysis

Time : Three Hours

Maximum Marks : 70

Note : i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Explain Mellin transform and its applications. 7

   b) Obtain the Fourier Transform for the function 7

   $f(x) = |x| \text{ in } \quad -\pi < x < \pi$

2. a) Obtain the Fourier cosine series for 7

   $f(x) = x \sin x, \text{in } 0 < x < \pi$

   b) Define second order linear partial differential equation and classify $u_{xx} + 4u_{xy} + (x^2 + 4y^2)u_{yy} = \sin(x + y)$ 7

3. a) Define Hankel Transform and find Hankel Transform of

$$f(x) = \begin{cases} a^2 - x^2, & 0 < x < a \quad n = 0 \\ 0, & x > a \quad n = 0 \end{cases} \quad 7$$

   b) Prove that $H\left(\frac{\sin ax}{a}\right) = \frac{a}{s(s^2 - a^2)^{\frac{1}{2}}}$ for $n = 1$ 7

4. a) Show that $y(x) = 1$ is a solution of the Fredholm integral equation $y(x) + \int_0^1 x(e^{xt} - 1)y(t)\,dt = e^x - x$ 7

   b) Using iterative method, solve the Volterra integral equation $y(x) = 2(1 + x^2) - \int_0^x xy(t)\,dt$ 7

5. a) Using the method of successive approximations, solve the integral equation $y(x) = 1 + \int_0^x y(t)dt$ 7

   b) Prove that the shortest distance between two points in a plane is a straight line. 7

6. Using Galerkin's method, solve the boundary value problem $y'' = 3x + 4y, y(0) = 0, y(1) = 1$. 14

7. Write the note on each of the followings:

   a) Green's function 5

   b) Finite difference method 4

   c) Abel's integral equations 5

8. a) Solve the Euler's equation for the functional 7

$$\int_{x1}^{x2} (1 + x^2 y')y'\,dx$$

   b) Using Rayleigh-Ritz method, solve the boundary value problem $y'' - y + x = 0; (0 \le x \le 1), y(0) = 0, y(1) = 0$. 7

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