Roll No ....

MVSE/MVCT/MBCT/MVCP - 101

M.E./M.Tech., I Semester

Examination, June 2014

Advanced Mathematics /Advanced Mathematics And Numerical Analysis

Time : Three Hours

Maximum Marks : 70

Note : Total number of questions eight. Attempt any five questions.

1. Classify the partial differential equation. Use the difference method, find numerical solution to the following parabolic partial differential equation.

$$\frac{\partial u}{\partial t}-\frac{\partial^2 u}{\partial x^2}=0,\ 0<x<2,\ t>0$$

B.C. : u (0, t) = u (2, t) = 0, t > 0

I.C. : u (x, 0) = sin ($2\pi x$), $0\leq x\leq 2$

Use h = 0.4 and k = 0.1.

2. a) Explain Mellin transform and its applications.

 b) Find the Fourier transform of the following function, if

$$f(x)=\begin{cases}1, & when|x|<a\\ 0, & when|x|>a\end{cases}$$

Hence evaluate $\int_0^{\infty}\frac{\sin a x}{x}dx$.

3. Write the short notes on:
 i) Finite difference method
 ii) Hankel transform
 iii) Fast Fourier transform
 iv) Fourier sine and cosine transforms

4. a) Define fredholm and Volterra integral equations.

 b) Convert the differential equation

$$\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=5\sin x,\ \text{with}$$

y(0) = 1, y'(0) = –2

into an integral equation.

5. a) Explain in brief integro-differential equations with example.

 b) Find the curves on which the functional $\int_0^1\left[(y')^2+12xy\right]dx$, with y(0) = 0 and y(1) = 1 can be extremised.

6. a) Explain in brief method of successive approximations to solve integral equation.

 b) Show that the curve which extremizes the functional $I=\int_0^{\pi/4}\left(y''-y^2+x^2\right)dx$, under the conditions y(0) = 0, y'(0) = 1, y(π/4) = y' (π/4) = $\frac{1}{\sqrt{2}}$ is y = sin x.

7. Discuss the following:
 i) Galerkin method
 ii) Rayleigh-Ritz method.

8. Solve the boundary value problem:

 $y''(x) - y(x) + x = 0$, $(0\leq x\leq 1)$

 with y(0) = y(1) = 0 by Rayleigh-Ritz method.

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