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M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE) M.Sc. (MACS)

Term-End Practical Examination

June, 2016

MMT-007 (P) : DIFFERENTIAL EQUATIONS AND NUMERICAL SOLUTIONS

Time : 1½ hours *Maximum Marks : 40*

Note : *There are **two** questions in this paper totalling **30** marks. Answer **both** of them. Remaining **10** marks are for the **viva-voce**.*

1. Write a program in 'C' language to solve the initial value problem **15**

$y' = x^2 + y^3,\ y(1) = 0$

in the internal [1, 2] using the Predictor - Corrector method :

$$P: y_{n+1} = y_n + \frac{h}{24}\left[55y'_n - 59y'_{n-1} + 37y'_{n-2} - 9y'_{n-3}\right]$$

$$C: y_{n+1} = y_n + \frac{h}{24}\left[9y'_{n+1} + 19y'_n - 5y'_{n-1} + y'_{n-2}\right]$$

with $h = 0.2$. Calculate the starting value using the Euler's method with the same step length. Perform two corrector iterations per step.

2. Write a program in 'C' language to solve the equation 15

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, \; 0 \le x \le 4, 0 \le t \le 4 \text{ with}$$

$$u(0, t) = 0, \; u(4, t) = 0, \; u(x, 0) = 0$$

$$\frac{\partial u}{\partial t}(x, 0) = \frac{x}{10}(4 - x)$$

Using the scheme

$$u_i^{n+1} = 2u_i^n - u_i^{n-1} + r^2\left[u_{i+1}^n - 2u_i^n + u_{i-1}^n\right].$$

Use the central difference approximation to the derivative to obtain initial condition. Assume

$h = \frac{1}{4}$ and $r = \frac{1}{3}$ and integrate for one time step.