M.Sc. (Mathematics with Applications in Computer Science)
Term End Examination
December 2020
MMT-001(P) : Differential Equations and Numerical Solutions

Time allowed: 1½ hours   ***Maximum Marks 40***

Note: There are two questions in this paper, totalling 40 marks. Answer both of them.

1) Write a program in C language to solve the Laplace equation $\nabla^2 u = 0$ in R, subject to the given R and boundary conditions, using the five point difference formula.   (20)

$$R: \quad \text{square} \quad 0 \le x \le 1, 0 \le y \le 1$$
$$u(x, y) = x^2 - y^2 \text{ on } x = 0, y = 0, y = 1$$
$$\text{and } 3u + 2\frac{\partial u}{\partial x} = x^2 + y^2 \text{ on } x = 1.$$

Take the step length $h = \frac{1}{3}$.

2) Write a C program to solve the Boundary Value Problem   (20)

$$y'' = y - 4xe^x, \quad 0 < x < 1$$
$$y(0) - y'(0) = -1, \quad y(1) + y'(1) = -e + \frac{2}{e}$$

using the shooting method. Use the third order Taylor series method with $h = 0.2$ to solve the resulting Initial Value Problem.