

MASTER'S IN MATHEMATICS WITH  
APPLICATIONS IN COMPUTER SCIENCE

00110

Term-End Examination

August, 2011

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 find an approximate value of  $y(0.6)$  for the initial value problem. 15

$$y' = x^2 - y^2, y(0) = 1$$

using the Adams-Moulton second order method with  $h=0.1$ . Calculate the starting value using second order Taylor series method with the same step length. Use the Newton-Raphson method to solve the resulting difference equations.

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

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$$

with boundary conditions

$u(0, t) = 0, u(1, t) = 0, t > 0$  and initial conditions

$$u(x, 0) = \frac{1}{2} \sin \pi x, \quad \frac{\partial u}{\partial t}(x, 0) = 0,$$

for  $x = 0, 0.2, 0.4, 0.6, 0.8, 1.0$  and  $t = 0, 0.1, 0.2, 0.3, 0.5$ , using an explicit scheme.

$$u_i^{n+1} = 2u_i^n - u_i^{n-1} + r^2 [u_{i+1}^n - 2u_i^n + u_{i-1}^n],$$

$i, n = 1, 2, 3, 4, 5$  where  $r$  is the mesh ratio parameter. Use the central difference approximation to the derivative to obtain initial condition.

---