Mahindra University, Hyderabad
École Centrale School of Engineering
MINOR I Examinations, September 2024 (2022 Batch)
Program: B. Tech. (Common to CM and NT)
Year: III Semester: I
Subject: Computational Methods for PDE (MA 3115)

Date: 11/09/2024 Time: 2:00 PM-03:30 PM
Time Duration: 1.5 hours Max. Marks: 15

Instructions:

1. Answer all the questions.
2. Marks will not be awarded for guess work.
3. All the answers that belong to a particular question should be answered in one place in your answer booklet.
4. Scientific calculators are permitted.

Q 1:

Marks: 05

Solve the first order quasi-linear PDE, $\frac{\partial u}{\partial x} + u\frac{\partial u}{\partial y} = u,\ u(0,y) = 2y.$

Q 2:

Marks: 05

Solve the 1D linear advection equation

$$\frac{\partial u}{\partial t} + \frac{\partial u}{\partial x} = 0,\ u(0,t) = t,\ t > 0$$

and

$$u(x,0) = \begin{cases} x^2, & 0 \le x \le 2 \\ x, & x > 2. \end{cases}$$

Q 3:

Marks: 05

Discuss the stability of following BTCS scheme for solving $\frac{\partial u}{\partial t} + a\frac{\partial u}{\partial x} = 0,\ a > 0,$

$$\frac{U_{p,q+1} - U_{p,q}}{\Delta t} + a\frac{(U_{p+1,q+1} - U_{p-1,q+1})}{2\Delta x} = 0.$$