



Register Number:
Date:

**ST JOSEPH'S UNIVERSITY , BENGALURU-27**  
**M.Sc. MATHEMATICS - 4<sup>th</sup> SEMESTER**  
SEMESTER EXAMINATION: APRIL 2024  
(Examination conducted in May/June 2024)  
**MTDE 0622-MATHEMATICAL MODELLING**  
**(For current batch students only)**

**Duration:** 2 Hours

**Max Marks:** 50

This question paper contains **one** printed page.

**I. ANSWER ANY FIVE FULL QUESTIONS.**

1. Discuss the characteristics of Mathematical Models.
2. Discuss the Prey-Predator model.
3. a) Derive the compartment model.  
b) Find the orthogonal trajectories of the families of curve  $y^2 = 4cx$ , where  $c$  is the parameter. (7+3)

OR

Find the equilibrium position and discuss the stability of the following system,

$$\frac{dx}{dt} + y = 2\cos(t), \quad x + \frac{dy}{dt} = 0, \quad \text{given } x(0) = 0 = y(0).$$

4. Deduce the model to describe the battle of Iwo Jima.
5. Deduce the model for the unforced damping in the mass-spring-dashpot system.
6. Solve the difference equation  $x_{t+3} - 5x_{t+2} + 3x_{t+1} + 9x_t = 3^t + 2^t$ .
7. Derive the model for traffic wave propagation along a highway.

\*\*\*\*\***END**\*\*\*\*\*