Reg.No					



## FOURTH SEMESTER M.SC (APPLIED MATHEMATICS & COMPUTING) END SEMESTER EXAMINATION – JUNE 2021

SUB: MATHEMATICAL MODELING (Elective)- MAT-5009 Time: 2 hours Max Marks 40

Note: a) Answer any FOUR full questions. b) All questions carry equal marks (5+5)

- 1A. Take an example of your choice and explain the characteristics of mathematical modelling.
- 1B. Derive a Richardson's model for the arms race and explain its characteristics WITH AN EXAMPLE.
- 2A. Explain simple compartment model.
- 2B. A tank contains 100 liters of fresh water. Two liters of brine, each contain 1 gm of dissolved salt run into tank per minute, and the mixture kept on stirring runs out at the rate 1 liter per minute. Find the amount of salt present when the tank contains 150 liters of brine
- 3A A sky driver equipped with parachute and other essential equipment falls from rest toward the earth. The total weight of the man plus the equipment is 160 lb. before the parachute opens, the air resistance is numerically equals to (½).V, where V is velocity. The parachute opens, 5 sec after the fall begins, and after it opens, the air resistance is numerically equal to (5/8) V<sup>2</sup>. Find the velocity before and after parachute opens
- 3B Find the orthogonal trajectories of the family of curve  $r^2 = a^2 \cos 2\Theta$
- 4A. Two coils of a transformer are identical with resistance R , inductance L, inductance M and voltage E. Determine the current in the coils at any time. Assume that there is no current initially.

- 4B. Multi species model with an example.
- 5A. In an L-R-C circuit, the charge q on a plate of condenser is  $L \frac{d^2q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = Esinpt$  and  $p^2 = \frac{1}{LC}$ . Assuming suitable data, obtain current at any time t.
- 5B. Two particles of mass m gm are suspended from the two springs one below the other with same stiffness k. After the system comes to rest, the lower mass is pulled by 1cm. downwards and released. Discuss their motion.
- 6A Solve by Z-transforms method  $X_{n+1} = 7 X_n + 10 Y_n$  $Y_{n+1} = X_n + 4 Y_n \qquad \text{with } X_0 = 3 \text{ , } Y_0 = 2$
- 6B. Explain Gambler ruin problem with a specific example.