

# School of Basic and Applied Sciences

Mathematics  
ETE - May 2023

Time : 3 Hours

Marks : 50

## Sem VI - BSCM621 - Mathematical Modelling and Simulation

*Your answer should be specific to the question asked*

*Draw neat labeled diagrams wherever necessary*

1. Define Logistic growth population model. K2 CO1 (2)
2. If the roots of auxillary equations are 1 and -2, write the general solution. K2 CO2 (2)
3. Write SIR epidemic mathematical model for the spread of Cholera disease. K3 CO3 (2)
4. Define Gravitational potential. K3 CO4 (2)
5. What do you mean by a connected graph. K4 CO5 (2)
6. Analyze the dynamics of prey-predator system with constant rate of harvesting. K3 CO1 (5)
7. Consider the second order linear ordinary differential equation  $y'' - 4y' + 4y = 0$  with the initial condition  $y(0) = 1, y'(0) = 1$ . Find the value of y at  $x = 1$ . K4 CO2 (5)
8. Formulate the following situation using a system of differential equations: K6 CO6 (6)  
Let  $S(t)$  be the density of a species whose growth depends on the available biotic resources  $F(t)$ . The biotic density follows a logistic growth model. Let  $N(t)$  be the density of human population in the region on consideration. Assume that humans hunt the species with a rate proportional to the density of species and humans both and consume the biotic resources for their further growth.
9. Classify the following mathematical model with the help of suitable examples: K4 CO3 (8)  
1. Static vs. dynamic  
2. Discrete vs. continuous
10. Find the solution of the given heat equation in an iron rod of length 1 unit: K4 CO4 (8)  
$$u_t = 0.003u_{xx}.$$
$$u(0, t) = u(1, t) = 0,$$
$$u(x, 0) = 50x(1 - x).$$
11. Which graphs shown in the following figure have an Euler path? Explain it K5 CO5 (8)

