MAY 2022 **U/ID 32515/UEM5A**

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Write classification of mathematical model.

2. Define hypocycloid.

3. What is meant of Radio – Active decay?

4. If $x(t)$ be the amount at time $'t'$ and be the rate of interest, what is the formula to find the compound interest continuously?

5. What is generalization of logistic model?

6. Write down any two assumptions of prey – predator models.

7. Write a short notes on diabetes mellitus model.

8. State logistic growth model.

9. Solve $x_{t+2} - 7x_{t+1} + 12x_t = 0$.

10. Write simple epidemic models in difference equations.

11. Prove that if $K > 0$ $Z(u_{n-K}) = Z^{-K} z(u_n)$ where $Z(u_n) = \sum_{n=0}^{\infty} u_n z^{-n}$.

12. Write the equation of the "Amount of the commodity produces this year and available for sale is linear function of the price of commodity in the last year (by cobweb model).

PART B — (5 × 5 = 25 marks)

Answer any FIVE questions.

13. Explain self – consistency of models and complexity of models.

14. Obtain the equation of epicycloid.

15. Explain a simple compartment model.

16. Draw some trajectories for the model $\frac{dx}{dt} = x[1 - 0.1]y$; $\frac{dy}{dt} = -y[1 - 0.1]x$.

17. Show that the model represented by $\frac{dx}{dt} = x(4 - x - y)$; $\frac{dy}{dt} = y(15 - 5x - 3y)$, $x \geq 0$, $y \geq 0$ has a position of equilibrium, this position is stable in two species can coexist.

18. Prove that $X(t+1) = A(X(t))$ where $X(t) = \begin{pmatrix} x_1(t) \\ \vdots \\ x_n(t) \end{pmatrix}$, $A = \begin{pmatrix} a_{11} & a_{12}... & a_1 n \\ \vdots & & \\ a_{n1} & a_{n2}... & a_{nn} \end{pmatrix}$ to be stable it is necessary that $|A| < 1$, $-n <$ trace $A < n$.

19. Explain the Harrod model.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. Write the procedure for solving problems through mathematical modeling.

21. Formulate the mathematical model to explain a medicine in blood stream.

22. Discuss the model related to change of price of a commodity.

23. Obtain the complementary function by use of matrices.

24. Show that the necessary and sufficient condition for both roots of $m^2 + a_1 m + a_2 = 0$ to be less than unity in absolute magnitude are $1 + a_{1l} + a_2 > 0$, $1 - a_1 + a_2 > 0$, $1 - a_2 > 0$.