

19. (a) Explain Samuelson's Interaction model.

Or

(b) Explain Gambler's Ruin problem.

20. (a) Explain about balance of signed graph.

Or

(b) Explain the planar graphs.

PART C — ($3 \times 10 = 30$)

Answer any THREE questions.

21. Discuss about the orthogonal trajectories.

22. Explain Richardson's model for Arms Race.

23. Explain in detail about Phillip's stabilization model for a closed economy.

24. Explain the Markov chains.

25. Discuss about the electrical networks and Kirchoff's laws.

S.No. 6878

P 22 MAE 2 B

(For candidates admitted from 2022–2023 onwards)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Mathematics — Elective

MATHEMATICAL MODELING

Time : Three hours

Maximum : 75 marks

PART A — (20 Marks)

I. (A) Choose the correct answer : ($5 \times 1 = 5$)

1. The Logistic law is _____.

(a) $\frac{dN}{dt} = KN(R - N)$ (b) $\frac{dR}{dt} = KN(R - N)$

(c) $\frac{dN}{dt} = KN(R + N)$ (d) $\frac{dR}{dt} = KN(R + N)$

2. The speculative model is _____.

(a) stable (b) highly stable
(c) unstable (d) highly unstable

3. Under the Inverse square law, if the path is a hyperbola, $L =$ _____.

(a) 1 (b) $a(1 - e^2)$
(c) $a(e^2 - 1)$ (d) $\mu \left(\frac{2}{r} + \frac{1}{a} \right)$

4. If two of the roots λ_1, λ_2 are equal, then the complementary function contains only _____ arbitrary constants.

- (a) equal (b) n
(c) $n-1$ (d) $n+1$

5. A graph is called _____ if each of its vertices has same degree.

- (a) Complete (b) Regular
(c) Balanced (d) Duobalanced

(B) Fill in the blanks : (5 × 1 = 5)

6. _____ is the non-linear differential equation for a second order reaction in chemical reactions.

7. Model with removal and immigration is _____.

8. $y = c \cosh \frac{x}{c}$, where we choose x -axis such that $y = c$ when $x = 0$. This is the equation of the _____.

9. In the Harrod model, all the savings made are invested, so that _____.

10. A signed graph is said to be duobalanced if it is _____.

II. Answer the following questions: (5 × 2 = 10)

11. Define Fick's law of diffusion.

12. Define Samuelson's modified investment model.

13. When do you say the motion is critically damped?

14. What is sinking fund factor?

15. Define a digraph with example.

PART B — (5 × 5 = 25)

Answer ALL questions, choosing either (a) or (b).

16. (a) Explain the Logistic law of population growth.

Or

(b) Discuss about a simple compartment model.

17. (a) Explain Age-structured population model.

Or

(b) Explain the motion of a projectile.

18. (a) Derive the equation of the common catenary.

Or

(b) Find the equation of the path described by a particle moving under a central force.