DECEMBER 2024 **U/ID 32515/UEM5A**

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer any TEN questions.

1. What is the criterion for the successful model?

2. How do you find the distance of the star?

3. What is known as decay model?

4. A colony of bacteria increases according to the law of uninhibited growth. How long will it take for the size of the colony to triple?

5. What is called Linear growth?

6. Expand: SIR and SIS.

7. Write the system of equations governing prey-predator problem.

8. Define simple epidemic model.

9. How to find real valued solutions?

10. Show the linear difference equation with constant coefficients.

11. Write about amortization factor.

12. What is sinking fund factor?

PART B — ($5 \times 5 = 25$ marks)

Answer any FIVE questions.

13. Write the procedure for solving problems through mathematical modelling.

14. Write short notes on limitations of mathematical modelling.

15. You just won the lottery. You put your \$5,000,000 in winnings into fund that has a rate of return of 4%. Each year you use \$300,000. How much money will you have twenty years from now?

16. When a hot cup of coffee is set on a desk, it initially cools very quickly. As the coffee closer to the room temperature, it cools less quickly.

17. Write a note on SIR model with removal.

18. Solve the difference equations
$x_{t+2} - 4x_{t+1} + 4x_t = -t$.

19. Explain the difference equation is applied in actuarial science.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

20. X wishes to invest in a stock with a 10% return annually. How much money will he have at the end of the year?

21. Substances X and Y combine in the ratio 2:3 to form Z. when 45 grams of X and 60 grams of Y are mixed together. 50 gms of Z are formed in 5 minutes. How many grams of Z will be found in 210 minutes? How much time will it like to get 70 gms of Z?

22. Describe a simple epidemic model.

23. Find A_n for $A = \begin{pmatrix} 1 & -5 \\ 1 & -1 \end{pmatrix}$.

24. Discuss the extended Cobweb model for which

$$p_t - p_e = c(1+p)(p_{t-1} - p_e) + cp(p_{t-2} - p_e)$$

where c is the ratio of slopes of supply and demand curves and p (usually $0 \le p \le 1$) represents the expectation of suppliers about price reversal, in the case when roots of the auxiliary equation are complex.

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