Roll No. ....

D–3704

B. Sc. (Part III) EXAMINATION, 2020

MATHEMATICS

(Optional)

Paper Third (E)

(Mathematical Modelling)

Time : Three Hours]   [*Maximum Marks : 50*

Note : Attempt any *two* parts of each question. All questions carry equal marks.

Unit—I

1. (a)   Consider the following differential equations :

    (i) $x' = x$

    (ii) $x' = x - t$

    Using syncline, draw slope field by hand for each equation.

    (b)   Find the unique solution of the differential equation :

    $$\frac{dy}{dx} = x + y$$

    passing through $(0, 1)$.

    (c)   Describe the mathematical model for spread of technological innovations.

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Unit—II

2. (a)   Discuss discrete population model for single species.

    (b)   Discuss the single species population models.

    (c)   Describe age-structured population model.

Unit—III

3. (a)   Discuss the Lanchester's combat model.

    (b)   Discuss the Richardson's model for Arms Race.

    (c)   Describe mathematical model for one-way traffic problem.

Unit—IV

4. (a)   Find the four state eight period fixed points.

    (b)   Compare deterministic and probabilistic epidemic models.

    (c)   Describe P. D. E. model for stochastic epidemic process with no removal.

Unit—V

5. (a)   Explain mathematical model for logistic population growth.

    (b)   Show that if $p = q = \frac{1}{2}$, the solution of :

    $$p_n = p\, p_{n+1} + q\, p_{n-1}$$

    is $p_n = 1 - \frac{n}{a}$.

    (c)   Discuss a formal model for consensus and negotiation in environmental management.

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