Roll No. ....

U03C15

Y–2224

B. Sc. (Part III) EXAMINATION, 2015

MATHEMATICS

(Optional)

Paper Third (E)

(Mathematical Modelling)

Time : Three Hours]   [Maximum Marks : 50

Note : Attempt any *two* parts from each question. Each part carries equal marks.

Unit—I

1. (a) For the differential and delay-difference equation model given below, verify the given equilibrium positions and characteristic equations

    $$\frac{dN}{dt} = bN - dN^2; \quad \overline{N} = \frac{b}{d}; \quad \lambda + b = 0.$$

   (b) Explain a model for growth of population inhibited by cumulative effect of population.

   (c) Find the unique solution of the differential equation $\frac{dy}{dx} = 2x + 3\sqrt{x}$ whose graph passes through (4, 26).

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Unit—II

2. (a) Describe mathematical model for spread of technological innovations.

   (b) Describe mathematical model for the effect of environmental pollution on forestry resources.

   (c) Describe mathematical model for infectious diseases.

Unit—III

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

   (b) Obtain the equation of continuity for traffic flow on a Highway.

   (c) Discuss whether the velocity of propagation can be equal to the velocity of a car.

Unit—IV

4. (a) Describe Simple Epidemic model.

   (b) Describe mathematical model for simple majority voting.

   (c) Explain a Predator-Prey system with viral infection and anorexia response.

Unit—V

5. (a) Obtain mathematical model for pure birth process.

   (b) Suppose the population of a city doubles its original size in 50 years and triples it in 100 years. Can the population be increasing at a rate proportional to the number present ? Why ?

   (c) Explain the mathematical model for Urban waste water management planning.

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