ED-2764

B.A./B.Sc./B.Sc. B.Ed (Part-III) Examination, 2021

MATHEMATICS

Paper - III (E)

Mathematical Modelling

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

Note : Answer an **two** parts of each question. All questions carry equal marks.

Unit-I

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

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

   (*c*) Explain the concept of mathematical modelling through differential equation of first order.

DRG_59_(3)   *(Turn Over)*

(2)

Unit-II

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

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

(*c*) Compare the average concentration of a medicine in the system when :

   (*i*) Doses D are given at time intervals T, and

   (*ii*) Doses 2D are given at time intervals 2T.

Unit-III

3. (*a*) Find the relation between car velocity u and traffic density ρ for traffic on a highway.

(*b*) Describe mathematical model for spread of technological innovations.

(*c*) Obtain a mathematical model for diabetes mellitus.

Unit-IV

4. (*a*) Solve the following non-linear difference equation :

$$x_{t+1} = x_t + bx_t - dx_t$$

DRG_59_(3)   *(Continued)*

(3)

(b) Discuss the Prey-predator model in population dynamics.

(c) Describe Simple Epidemic model.

Unit-V

5. (a) Classify the following model :

$$\frac{dp_n}{dt} = \lambda p_{n-1}(t) - \mu p_{n+1}(t) - (\lambda + \mu) p_n(t);$$

$$n = 1, 2, 3, \ldots$$

where p_n is the probability of n persons at time t.

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

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

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