GG-345

B. Sc. (Hons)/M.Sc.

EXAMINATION, Dec. 2017

(Seventh Semester)

(Dual Degree) (Main & Re-appear)

MATHEMATICS

MAT-519-H

Mathematical Modelling

Time : 3 *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit IV

7. Derive a stochastic model comprising linear Birth-death-Immigration and Emigration process. **15**

8. Explain Non-linear birth-death process of population growth. **15**

Unit I

1. (a) What are characteristics of Mathematical Model ? Explain. **8**

(b) Using mathematical modelling through algebra show that square of periodic time to planets are proportional to the cubes of the radii of orbits. **7**

2. (a) Write a note on simple compartment model. **8**

(b) If the temperature of air is 30ºC and the substance cools from 100ºC to 70ºC in 15 min., find when the temperature will be 40ºC. **7**

Unit II

3. (a) Solve Domer Debt model when $y'(t) = \beta y(t)$ and discuss the behaviour of $\frac{D(t)}{Y(t)}$ as $t \to \infty$. **8**

(b) Solve simple epedemic model. **7**

4. (a) Explain SIS model with constant no. of carriers. **8**

(b) Solve simultaneous equation :

$t\frac{dx}{dt} + y = 0, \quad t\frac{dy}{dt} + x = 0,$ given $x(1) = 1$ and $y(-1) = 0$. **7**

Unit III

5. (a) Introduce Microbes and write the application and use of microbes. **8**

(b) Explain the model of diabetes millitus. **7**

6. (a) Discuss the case of complete disarmament in Richordon's model for arms race. **8**

(b) Show that the fighting strength of an army depends on the square of its numerical strength and directly on the fighting quality of individuals. **7**