



# RAN-0965

## B.Sc. Sem-IV Examination

March / April - 2019

### Mathematical Modelling (E.G.)

(New Course)

(Old or New to be mentioned where necessary)

#### સૂચના : / Instructions

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.  
Fill up strictly the details of signs on your answer book

Name of the Examination:

B.Sc. Sem-IV

Name of the Subject :

Mathematical Modelling (E.G.)

Subject Code No.: 0 9 6 5

Seat No.:

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Student's Signature

#### Instructions:

- (1) All questions are compulsory.
- (2) Follow **usual** notations.
- (2) Figures to the right indicate marks of the question.
- (3) Use of Scientific non-programmable calculator is allowed.
- (4) Total marks **50**

**Que:1** Answer any **FOUR** as directed.

[08]

- (1) Prove the equation for the quadrupling period of population.
- (2) Discuss about the value of 'a' in population growth model.
- (3) In population growth model, if  $a < 0$ , then find the half life period of the population.
- (4) Prove the equation for the quadrupling period of population.
- (5) Find the curves for which the projection of the normal on  $x$ -axis is of constant length.
- (6) Find the orthogonal trajectories of family of curves  $x = ky$ .

**Que:2** Attempt any **TWO**.

[14]

- (1) Derive the mathematical model for growth of science and scientists.

- (2) In the year 1961, the population of the world is  $3.06 \times 10^9$ . Suppose the population increases at the rate of 2% per year, then find the population of the world of the year 1991. Prove that the population of the world becomes double in about 35 years.
- (3) The rate of some types of insects is 40% per month. If initially there are only two insects, then find the population of insects after 2, 6, 10 and 15 months.

**Que:3** Attempt any TWO. **[14]**

- (1) Derive and solve the Mathematical Model for *spread of infectious diseases*.
- (2) In the logistic law of population growth model if  $a = 0.03134$ ,  $b = (1.5887)(10)^{-10}$ ,  $x(0) = 39 \times 10^6$ , find value of  $x(t)$ .
- (3) In the spread of technological innovations model, if  $k = 0.007$ ,  $R = 1000$ ,  $N_0 = 50$ , then find  $N(10)$  and find  $t$  for  $N(t) = 500$ .

**Que:4** Attempt any TWO. **[14]**

- (1) Find the curve for which tangent make a constant angle with the radius vector.
- (2) Find orthogonal trajectories of family of curve  $x^2 + y^1 = a^2$ .
- (3) Find orthogonal trajectories of family of curve  $r = a(1 + \cos\theta)$ .

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