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**

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.

(1) Derive the mathematical model for growth of science and scientists.   [14]

(2) In the year 1961, the population of the world is 3.06×10^9. 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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