



A-3044

Second Year B. Sc. (Sem. III) Examination
March/April – 2015

Mathematical Modelling - I (E.G.-IDS-Mathematics)
(New Course)

Time : 2 Hours]

[Total Marks : 50

Instructions :

(1)

नीचे दशांशके निशानीवाणी विगतो उत्तरवही पर अवश्य लपवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
Second Year B. Sc. (Sem. III)	<input type="text"/>
Name of the Subject :	<input type="text"/>
Mathematical Modelling - I (E.G.-IDS-Mathematics) (New)	<input type="text"/>
Subject Code No. : <input type="text"/> 3 <input type="text"/> 0 <input type="text"/> 4 <input type="text"/> 4	<input type="text"/>
Section No. (1, 2,.....): Nil	<input type="text"/>
	Student's Signature

- (2) All questions are compulsory.
(3) Figures to the right indicate marks of the corresponding question.
(4) Follow usual notations.

1 Answer the following questions : (any two) 5

(1) In the spread of technological innovations model,

$$\frac{N}{R-N} = \frac{N_0}{R-N_0} e^{kRt}. \text{ Discuss what happens if } t \rightarrow \infty.$$

(2) Find orthogonal trajectories of $r = a\theta$.

(3) Find orthogonal trajectories of $y = ae^x$.

2 (a) Derive mathematical model for growth of science and scientist and solve it. 8

OR

(a) Derive mathematical model for population growth and solve it. Discuss the case when $a = 0$. 8

(b) Suppose the population of the world now is 4 billion and its doubling period is 35 years. If the surface area of the earth is 1,860,000 billion square feet, how much space would each person get after 1050 years ? 7

OR

- (b) Find the relation between doubling, tripling and quadrupling times for population. 7
- 3 (a) Derive mathematical model for spread of technological innovations and solve it. 8
- OR**
- (a) Derive mathematical model for Logistic law for population growth and solve it. 8
- (b) In the spread of technological innovations model if $k = 0.007$, $R = 1000$, $N(0) = 50$, find $N(10)$ and find when $N(t) = 500$. 7
- OR**
- (b) Cigarette consumption in a country increased from 50 per capita in 1900 A D to 3900 per capita in 1960 A D. Assuming that the growth in consumption follows a logistic law with a limiting consumption of 4000 per capita, estimate the consumption per capita in 1950. 7
- 4 (a) Find orthogonal trajectories of family of curve $x^2 + y^2 = 2ax$. 8
- OR**
- (a) Find orthogonal trajectories of confocal conics 8
- $$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1, \lambda \text{ being parameter.}$$
- (b) Find orthogonal trajectories of family of curve $y = ae^{-2x}$. 7
- OR**
- (b) Find orthogonal trajectories of family of curve $x^2 + y^2 = a^2$. 7
-