



JB-3143

Second Year B. Sc. (Sem. III) Examination

March/April – 2013

Interdisciplinary Subject (IDS)

(Mathematical Modelling) (New Course)

Time : 3 Hours]

[Total Marks : 70

Instructions :

(1)

नीचे दृशावेव निशानीवाणी विगतो उत्तरवाडी पर अवश्य कभवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="Second Year B. Sc. (Sem. 3)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="Interdisciplinary Subject (IDS) (New)"/>	<input type="text"/>
Subject Code No. : <input type="text" value="3"/> <input type="text" value="1"/> <input type="text" value="4"/> <input type="text" value="3"/>	<input type="text"/>
Section No. (1, 2,.....) : <input type="text" value="Nil"/>	<input type="text"/>
	Student's Signature

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

1 Answer the following questions : 10

- (1) Discuss the values about 'a' in population growth model.
- (2) Find orthogonal trajectories of family of straight lines $y=mx$.
- (3) In the model of spread of technological innovation, if $K=0.007$, $R=1000$, $N_0=50$ then find t for $N(t)=500$.
- (4) Write only principle for the model of rate of dissolution.
- (5) Find orthogonal trajectories of family of curves, $x=ky$.

2 (a) Write mathematical model for Malthusian law of population growth. 8

OR

- (a) Derive mathematical model for growth of science and scientist. 8
- (b) Find the relation between doubling, tripling and quadrupling times for a population. 7

OR

- (b) In the year 1961, the population of the world was 3.06×10^9 . Suppose that the rate of increase of population is 2% per year. Find the population in the year 1991. Prove that the population of world becomes double after about 35 years. 7

- 3 (a) Derive mathematical model for logistic law of population growth. 8

OR

- (a) Derive mathematical model for spread of technological innovations. 8
- (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 logistic law with a limiting consumption of 4000 per capita, estimate the consumption per capita in 1950. 7

OR

- (b) Substances X and Y combine in the ratio 2:3 to form Z. 7
When 45 grams of X and 60 grams of Y are mixed together, 50 grams of Z are formed in 5 minutes. How many grams of Z will be formed in 210 minutes ?

- 4 (a) Derive mathematical model for rate of dissolution. 8

OR

- (a) Derive mathematical model for logistic law of population growth. 8

- (b) Find orthogonal trajectories of family of curves $r = 2a \cos \theta$. 7

OR

- (b) Find orthogonal trajectories of family of curves $r = ae^{\theta \cot \alpha}$. 7

- 5 (a) Find orthogonal trajectories of family of curve $y^2 = 4cx$. 8

OR

- (a) Find orthogonal trajectories of confocal conics 8

$$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1, \quad \lambda \text{ being parameter.}$$

- (b) Find orthogonal trajectories of family of curves $y = ax^2$. 7

OR

- (b) Find orthogonal trajectories of family of curves $y = ax^3$. 7
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