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DMM-3336

B. Sc. (Mathematics) (Sem. IV) Examination

March / April - 2016

Mathematical Modeling - II

(Elective Generic)

(Old Course)

Time : **2** Hours] [Total Marks : **50**

Instructions :

(1)

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

Name of the Examination :

☛ **B. Sc. (Mathematics) (Sem. IV)**

Name of the Subject :

☛ **Mathematical Modeling - II *(Old Course)***

☛ Subject Code No. : **3 3 3 6** ☛ Section No. (1, 2,.....) : **NIL**

Seat No. :

Student's Signature

(2) All questions carry equal marks and are compulsory.

(3) Follow usual notations.

1 Answer the following questions : (Any **two**) **5**

(a) Write the differential equation for Newton's cooling law when the temperature of the surrounding media is zero.

(b) How long does it take for a given amount of money to get double 12% per annum compounded annually?

(c) In the change of price of commodity model $p(e)-p(t)=(p(e)-p(0))e^{-kt}$, discuss what happens if $t \to \infty$.

2 (a) Derive mathematical model for radioactive decay and solve it. 8

OR

(a) Derive mathematical model for effect of immigration and emigration on population size and solve it. 8

(b) If Rs. 10000 is invested at 6% per annum. Find what amount has been deposited after six years, if the rate of interest is compounded quarterly and continuously? 7

OR

(b) In an archeological wooden specimen, only 25% of the original radio carbon - 12 is present. When was it made? 7

3 (a) Derive mathematical model for Newton's law of cooling and solve it. 8

OR

(a) Derive mathematical model of Fick's law of diffusion and solve it. 8

(b) The concentration of potassium in kidney is $0.0025\, mg/cm^3$. The kidney is placed in a large vessel. In which potassium concentration is $0.1140\, mg/cm^3$. In 1 hour the concentration of kidney increases to $0.0027\, mg/cm^3$. After how much time will the concentration be $0.0035\, mg/cm^3$? 7

OR

(b) A body where temperature is initially 300°C is placed in a large block of ice, its temperature at the end of 5 and 6 minutes. **7**

4 (a) Derive mathematical model for susceptible - infected persons. **8**

OR

(a) Mathematical model for susceptible - infected susceptible person. **8**

(b) Integrate $\frac{dI}{dt} = BI(N+1-I)$; when $t=0,\ I(0)=1$ then prove that $I(t) = \frac{(n+1)e^{(n+1)\beta t}}{n+e^{(n+1)\beta t}}$. **7**

OR

(b) Integrate **7**

$\frac{ds}{dt} = -\beta s(n+1-s)$; when $t=0,\ s(0)=n$ then prove that

$s(t) = \frac{n(n+1)}{n+e^{(n+1)\beta t}}$.