

ANNEXTURE 1

P. T. SARVAJANIK COLLEGE OF SCIENCE, SURAT

(Affiliated to Veer Narmad South Gujarat University, Surat)

Syllabus for Knowledge based

Certificate Course on “Mathematical Modeling for Solving Problems”

2 credits course

Total hours: 30



Certificate Course on “Mathematical Modeling for Solving Problems”

Credit : 02

Total Hours : 30

Course Outcomes:

After successful completion of the course a student will be:

1. able to apply mathematical concepts, including Calculus and Differential Equations, mathematical strategies and techniques to solve problems and to analyse specific problems and identify the appropriate mathematics to realize a solution.
2. recognize the connections between mathematics and other disciplines and how mathematical ideas are embedded in other contexts.
3. able to represent real-world systems from science and technology in a mathematical framework.
4. employ appropriate methods to analyse, solve and evaluate the performance of mathematical models.
5. relate the behavior of the output of the mathematical model to the underlying physical or conceptual model of interest.

Prerequisites: Knowledge of Basic Calculus and Differential Equations.

Eligibility: First year B.Sc. Completed.



Certificate Course on Mathematical Modeling for Solving Problems

Course Content	Hours
Unit-1	
Mathematical modeling: Need, techniques, classification and simple illustrations: Simple situation requiring mathematical modeling, the techniques of mathematical modeling, classification of mathematical models, some characteristics of mathematical models, limitation of mathematical modeling.	03
Unit-2	
Mathematical Modeling in Different Branches of Mathematics: Mathematical modeling through geometry, mathematical modeling through algebra, mathematical modeling through trigonometry, mathematical modeling through calculus.	06
Unit-3	
Mathematical Modeling through Ordinary Differential Equations of First Order: Mathematical Modeling through differential equations, Linear growth and decay models (Malthusian law of Population Growth, Interest Compounded continuously, Fick's law of Diffusion, Change of price of Commodity, Effects of Emigration and Immigration on population size, Growth of Science and Scientists, Radio-Active Decay, Newton's law of cooling).	09
Unit-4	
Non-linear growth and decay models: Logistic Law of Population Growth, Spread of Technological Innovations and Infectious Diseases, Rate of Dissolution, Law of Mass Action: Chemical Reactions. Compartment Models: The model of diffusion of glucose in the blood stream. The model of diffusion of medicine in the blood stream. Mathematical Modeling of Epidemic through System of Ordinary Differential Equation of First Order: A simple Epidemic Model (Susceptible-Infected Model), A Susceptible-Infected Susceptible Model, SIS Model with Constant Number of Carriers, Simple Epidemic Model with Carriers, Model with Removal, Model with Removal and Immigration.	12



Recommended Reference Books :

1. J. N. Kapur, Mathematical Modelling, New Age International Publishers, New Delhi (2009).
2. Clive L. Dym, Principles of Mathematical Modelling, Academic Press, 2nd Edition (2006).
3. J. N. Kapur, Mathematical Models in Biology and Medicine, East-West Press Private limited.
4. Leah, Edelstein, Keshet, Mathematical Models in Biology, SIAM publications.

Suggested Teaching Methodology:

Unit 1 to 4 are to be thought as a classroom lectures by using black board/white board or power point slides as and where necessary since it involves theoretical knowledge with related examples of topic to be imparted to students.

Examination Pattern:

The candidates will have to appear in written (descriptive) and/or MCQ Examination after completing the certificate course.

The examiner will evaluate the candidates based on their performance. The suggested marking scheme is given below:

Attendance	10 %
Assignments	20 %
Written (descriptive) and/or MCQ Examination	70 %
Total	100 %

In order to successfully pass in the examination, a candidate needs to score minimum 40 % out of the total marks.

