

TRIBHUVAN UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MATHEMATICAL SCIENCES
Bachelor in Mathematical Sciences (B.Math.Sc.)

Course of Study

Code No.: MSMT 252

Paper: **Mathematical Modeling**

Nature: Theory

Full Mark: 75

Pass Mark: 30

Credit: 3

Course Description:

In this course, students will learn how to formulate and analyze mathematical models. The mathematical tools to be handled include dimensional analysis, optimization, numerical simulation, elementary probability and stochastic processes, as well as elementary differential equations. The fields of application include biology, economics, and other areas of science. The necessary mathematical and scientific background will be developed as needed. Students will learn how to simulate models using MATLAB.

Learning Objectives:

Students will learn how to formulate, analyze and simulate mathematical models.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). Students will be encouraged to utilize the computer whenever possible and wherever applicable.

Contents:

Unit 1 Modeling Change

10 hrs

Introduction, Mathematical models, Modeling change with difference equations, Approximating change with difference equations, Solution to dynamical systems, Systems of difference equations.

Unit 2 The Modeling Process, Proportionality and Geometric Similarity

10 hrs

Mathematical models, Modeling using proportionality, Modeling using geometric similarity, Automobile gasoline mileage, Body weight and height, Strength and agility.

Unit 3 Model Fitting

8 hrs

Fitting model to data graphically, Analytical methods of data fitting, Applying the least squares criterion, Choosing a best model.

Unit 4 Optimization of Discrete Models

10 hrs

Continuous optimization modeling, Optimization with linear programming, An overview of optimization modeling, Maximizing profit in furniture business, Linear Programming: geometric, Algebraic, Simplex method.

Unit 5 Exponential Growth and Decay

10 hrs

Calculating and displaying exponential functions, The first order differential equation, Radio active decay, Charging and discharging a capacitor, Exponential models in money matters, A non linear model of population growth, A coupled model of fighting armies,

Reference books

1. Frank R. Giordano, William P. Fox, Steven B. Horton, Maurice D. Weir, *Mathematical Modeling, Principles and Applications*, Cengage Learning, India Edition.
2. Clive L. Dym, *Principles of Mathematical Modeling*, 2nd Edition, Elsevier.

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