Devi Ahilya University, Indore, India Institute of Engineering & Technology				MSc – II Year (Applied Mathematics) with Specialization in Computing & Informatics Semester- IV			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
AM4EM2: Mathematical Modelling	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	**1**	**-**	**3**	**1**	**-**	**4**
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- To provide rigorous instruction in fundamental mathematical concepts and skills presented in the context of real-world applications.
- Gain a working knowledge of core techniques behind mathematical modelling and develop a basic ability to quantify certain phenomena associated with the physical sciences.
- Represent real-world systems in a mathematical framework..

Prerequisites: Basics of algebra, differential equation, difference equations andgraphs.

COURSE OF CONTENTS

UNIT I

Concept of models: Types of models- Iconic, analogue and symbolic models, Classification of models, Meaning and formulation of mathematical models, example.

Mathematical modeling through algebra: Retail pricing model, Student assessment problems, Electricity tariff model, EOQ model for inventory control.

UNIT II

Mathematical Modelling through Ordinary Differential Equations of First order: Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems. Population Dynamics – Epidemics – Compartment Models.Domar's macro model; Domar's debt model

UNIT III

Mathematical Modelling through Ordinary Differential Equations of Second Order: Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models. Samuelson's capital Investment model, Philips stabilization model for closed economy.

UNIT IV

Mathematical Modelling through Difference Equations: Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory. Models based on linear difference equations -Cobweb model, Harrod Domar growth model, Consumption model, Samuelson's multiplier- accelerator model.

UNIT V

Mathematical Modelling through Graphs: Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

Learning Outcomes:

Upon completing the course, students will be able to:

- Tocreate mathematical models of empirical or theoretical phenomena in domains such as the physical, natural, or social science.

- Draw inferences from models using mathematical techniques including problem solving, quantitative reasoning, and exploration using multiple representations such as equations, tables, and graphs;
- Not only take an analytical approach to problems but also use computer programming and statistical analysis skills to efficiently model systems.

BOOKS RECOMMENDED:

[1] J.N. Kapur, Mathematical Modelling, New Age International, 1988.
[2]Martin Brann C.S Coleman, DA Drewc(Eds) differential equation models.
[3] C.L.Liu, Elements of Discrete Mathematics, McGraw-Hill Education, 2nd ed., 1986.
[4]Edward A. Bender, Introduction to Mathematical Modelling, Dover Publications, 1st ed., 2000.
[5] D.N. Burghes, A.D. Wood, Mathematical Models in the social, management, and life sciences, New York: Halsted Press, 1980.
[6] Zafar Ahsan, Differential Equations and Their Applications, 2nd Ed.,Prentice-Hall of India Pvt. Ltd, 2004.
[7] Michael D Alder, An Introduction to Mathematical Modelling, HeavenForBooks.com, 2001.