PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

22MA4E1 : MATHEMATICAL MODELLING
Semester : IV

Course Code	22MA4E1	Course Delivery Method	Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	3	Semester End Exam Marks	70
Total Number of Lecture Hours	45	Total Marks	100
Year of Introduction : 2021-22	Year of offering : 2023-24	Year of Revision: 2023-24	Percentage of Revision :5%

Course Objectives : The objectives of this course is to enable students with the basic Mathematical modelling skills such as formulation of Mathematical Models, Solving the Mathematical Models and interpreting the solutions of Mathematical Models.

COURSE OUTCOME	Upon successful completion of this course, students will be able to:
CO1	Understand different classifications of Mathematical Models
CO2	Formulate and solve Mathematical Models of Ordinary differential equations
CO3	Formulate and solve Mathematical Models through systems of ordinary differential equations
CO4	Formulate and solve Mathematical Models through difference equations
CO5	Formulate and solve Mathematical Models through Graphs.

Mapping of Course Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**2**	**0**	**0**	**0**	**0**	**0**	**0**
CO2	**0**	**0**	**0**	**0**	**0**	**3**	**0**
CO3	**0**	**0**	**0**	**0**	**0**	**3**	**0**
CO4	**0**	**0**	**3**	**0**	**0**	**0**	**0**
CO5	**0**	**0**	**0**	**0**	**0**	**0**	**3**

UNIT – I

Mathematical Modelling - Need, Techniques, Classifications and simple illustrations: Simple situations requiring Mathematical Modelling, Classification of Mathematical Models, Some characteristics of Mathematical Models.

Mathematical Modelling through Ordinary differential equations of first order: Mathematical Modelling through differential equations, Linear growth and Decay Models, Non linear growth and Decay Models, Compartment Models, Mathematical Modelling in dynamics through ordinary differential equations of first order, Mathematical Modelling of Geometrical problems through ordinary differential equations of first order.

(Sections 1.1 to 1.4 of Ch. 1 and Sections 2.1 to 2.6 of Ch. 2 of [1])

UNIT – II

Mathematical Modelling through systems of ordinary differential equations of first order:

Mathematical Modelling in population dynamics, Mathematical Modelling of epidemics through systems, Compartment Models through systems, Mathematical Modelling in Economics, Mathematical Models in Medicine etc, Mathematical Modelling in Dynamics.

(Sections 3.1 to 3.6 of Ch.3 of [1])

UNIT – III

Mathematical Modelling through Ordinary differential equations of Second order:

Mathematical Modelling of planetary motions, Mathematical Modelling of circular Motion and Motion of satellites, Mathematical Modelling linear differential equations of second order.

(Sections 4.1 to 4.4 of Ch.4 of [1])

UNIT – IV

Mathematical Modelling through difference equations:

The need for Mathematical Modelling through difference equations, Some simple Models, Basic theory of Linear difference equations with constant coefficients, Mathematical Modelling through difference equations in Economics, Finance, Population dynamics, Genetics and Probability theory, Miscellaneous examples.

(Sections 5.1 to 5.6 of Ch.5 of [1])

UNIT – V

Mathematical Modelling through Graphs:

Situations that can be modelled through graphs, Mathematical Models in terms of directed graphs, Mathematical Models in terms of Signed graphs, Mathematical Models in terms of weighted graphs , and Mathematical Models in terms of un oriented graphs.

(Sections 7.1 to 7.5 of Ch.7 of [1])

PRESCRIBED BOOK:

1. J N Kapur, Mathematical Modelling, New Age International Publishers, 2008

REFERENCE BOOKS:

1. Sandip Banerjee, Mathematical Modelling- Models, Analysis and Applications

2. W.J.Meyer , Concepts of Mathematical Modelling , Mc Graw Hill. 1985

Course has Focus on : Foundation

Websites of Interest : 1. www. nptel.ac.in
2. www.epgp.inflibnet.ac.in
3. www.ocw.mit.edu

PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

M.Sc. Mathematics
Fourth Semester
22MA4E1-MATHEMATICAL MODELLING

Time:3 hours **Max. Marks: 70**

SECTION - A

Answer all questions. **(5x4=20)**

1 a) Classify the Mathematical Models. (CO1, L1)

(OR)

b) Write some characteristics of Mathematical Models. (CO1, L1)

2 a) Define compartment model with an example. (CO2, L2)

(OR)

b) Give an example of a Mathematical Model in Economics (CO2, L2)

3 a) Explain Kepler's laws of planetary Motions. (CO3, L2)

(OR)

b)Define Linear difference equation and give an example. (CO3, L2)

4 a) Give an example of a Mathematical Model through difference equations. (CO4, L2)

(OR)

b) Define complete graph and give an example. (CO4, L2)

5 a) Define directed graph and weighted digraph with examples. (CO5, L2)

(OR)

b) Define planar graph and oriented graph with examples. (CO5, L2)

SECTION - B

Answer the following questions. All questions carry equal marks. (5X10=50)

6 a) Find the Orthogonal trajectories of the families of curves $y^2+x^2-2ax=0$ (CO1,L3)

(OR)

b) Explain briefly about Non Linear growth and decay Models with examples. (CO1,L3)

7 a) Explain briefly about Prey –Predator Models with examples. (CO2,L3)

(OR)

b) Show that the Model represented by $\frac{dx}{dt} = x(4-x-y), \frac{dy}{dt} = y(15-5x-3y), x \geq 0, y \geq 0$ has a position of equilibrium, this position is stable and two species can coexist. (CO2,L3)

8 a) Solve $x^{11}+8x^{1}+36x=24\cos 6t$ and discuss the behavior of the solution as t approaches Infinity. (CO3,L3)

(OR)

b) Explain briefly about Mathematical Modelling of planetary motions under the inverse square law. (CO3, L3)

9 a) Solve $x_{t+2}-7x_{t+1}+12x_t=0$ and discuss the behavior of the solution as x tends to ∞. (CO4, L3)

(OR)

b) Explain the concept of Mathematical Modelling through difference equations in genetics. (CO4,L3)

10 a) Explain about Konigberg Problem and suggest deletion or addition of minimum number of bridges which may a lead a solution of the problem. (CO5, L4)

(OR)

b) Explain the concept of Mathematical Modelling in terms of weighted digraphs with an example. (CO5, L4)

*****