MMA-C412
MATHEMATICAL MODELING

MM : 100 Sessional 30
Time : 3 hrs ESE 70
L T P Pass Marks 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

The Modeling process: Introduction, Mathematical models, Construction of models, Scientific methods, The iterative nature of model construction, Types of modeling, Some characteristics of mathematical models, Linear growth and decay models: Population growth model, Effect of immigration and Emigration on population size, Decrease of temprature, diffusion, Change of price of a commudity, Non-linear growth and decay model: Simple logistic model, Logistic model for non isolated population, Simple compartment models.

Mathematical modeling of Epidemics: Basic concept, Simple Epidemic model through system of ordinary differential equaiton of first order- A simple epidemic model, SIS model with constant number of carrir, Simple epidemic model with carriers, Model with removal, Model with removal and immigration, Compartment models through system of ordianry linear equations.

Economics based models: Domar Macro model, Domar first debt model, Momar's second debt model, samuelson's investment model, Stability of market equilibrium. Mathematical models in Medicine, arms race and battles: A model for Diabetes Mellitus, Richardson's Model for arms race, Lancester's combat Model, Microbial growth in a chemostat. Product formation due to microbial action,
Mathematical modeling through difference equations: Basic theory of difference equations with constant coefficients, complimentary function, particular solution, Obtaing complimentary function by use of Matrices, Solution of linear difference equation by using Laplace and z-transform. Mathematical modeling through difference equations in Economics and Finance: The Harrod Model, the Cobweb model,

Equation of continuity in fluid flow (Euler's and Langrange's), Equation of continuity in Cartesian, Cylindrical and spherical polar coordinates, Equivalence between Eularian and Langrangian forms of equations of continuity, Euler's Equation of motion..

Air pollution: Introduction, Mathematical model for plume rise, Gaussian model of dispersion, application of Gaussian model.
Models for Blood flow: Navier-stokes equation for the flow of a viscous incompressible fluid, Hagen Poiseuille Flow, Basic concepts about Blood, Cardiovascular system and Blood flow: Constitution of Blood, Viscosity of Blood.

Text /Reference Books

1. F.R. Giordano, M.D. Weir and W.P. Fox, A First Course in Mathematical Modeling, Brooks Cole Publishing
2. J.N.Kapur, Mathematical Modelling, New Age Int.
3. J.N.Kapur, Mathematical models in Biology and Medicine, East-West Press
4. F.Chorlton, A Text Book of Fluid Dynamics, Chorlton Pub.
5 .M.D.Raisinghania, Fluid Dynamics, S. Chand.
6. N.T.J.Bailey , The Mathematical Theory of Epidemics, Hafner Publishing