



MAT 663 – Mathematical and Computational Modeling

Course Code & Number	Course Name	Credit Hours	Lec.	Lab.	Tut.	Prerequisites
MAT 663	Mathematical and Computational Modeling	4	3	0	1	MAT 631

Syllabus:

Mathematical modeling tools: Needs and Techniques of mathematical modeling; Idea of mathematical modeling; Steps in mathematical modeling, Characteristics of mathematical modeling.

Case Studies: Models in mechanical vibration (Spring mass system, pendulum problems). Models in population dynamics (One species model, logistic model, growth model in time delays, Predator-Prey models, Volterra-Lotka models). Models of chemical processes, Electrical network and Diffusion processes, Traffic Flow Models.

Modeling dynamical systems: Differential equations and their numerical solutions, linear and nonlinear dynamics, stability, convergence, attractors.

Physical systems: System types and characteristics behaviour, Continuous-time, discrete Vs time and discrete, event systems, linear and nonlinear systems.

Exploration of behaviour through simulation: developing simulations of dynamical systems using Matlab /Simulation: representation and visualization of simulation experiments, analyzing behavioural characteristics for a range of classes of physical and computational systems eg. Predictor- prey models, evolutionary systems and cellular system.

References

1. J. N. Kapur; *Mathematical modeling*; 1st Edition, New Age International Pvt Ltd Publishers, 2008. **(Main Reference)**
2. M. M. Gibbons; *A concrete approach to Mathematical modeling*; 1st Edition, Wiley-Interscience, 2007.
3. H. Neunzert and A. Siddiqui; *Topics in Industrial Mathematics*; 1st Edition, Kluwer Academic Publishers, 2000.

