Course Type	Course Code	Name of Course	L	T	P	Credit
DE	**NMCD527**	Mathematical Ecology	3	0	0	3

Prerequisite

- One should have idea about first order ODEs, PDEs, Existence and Uniqueness of solutions. Basics of Matrix theory and Linear Algebra.

Course Objective

- Mathematical models are used extensively in many areas of the Biological/Ecological Sciences. This course aims to give an ample knowledge of the constructions/formulations and analysis of such models in Population Ecology/epidemiology.

Learning Outcomes

Upon successful completion of this course, students will:

- have a broad understanding of how to model real life situations for a single population.
- It also provides broad idea about continuous, discrete and delay situations.
- It helps students in understanding the concept of formulating the model of two, three and many interacting populations.
- It helps to understand how to effectively analyze the evolutionary trend of such models and its stability behaviour.
- It helps students in formulating the spatial and spatiotemporal dynamics.
- It gives broad idea about well-known Lotka integral equations and its real applications.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	Single species models, Exponential, logistic, Gompertz growth, Harvest model and Discrete-time model.	8	It provides idea about how to model the real life situations for a single population. It gives broad Idea about continuous, discrete and delay situations.
2	Interacting population model, prey-predator, competition, mutualism models. Model with three and multispecies systems. Kolmogorov Analysis. Equilibria and Stability Analysis, time series analysis.	9	It provides idea of formulating the model of two, three and many interacting populations. How to effectively analyze the evolutionary trend of such models and its stability behaviour.
3	Spatially structured models, Reaction–diffusion systems, Dynamics of exploited populations.	9	It helps students in formulating the spatial and spatiotemporal dynamics. Also in understanding the dynamics of exploited populations.
4	Age-structured models, models of spread, sex-structured models, two sex models, Leslie matrix.	9	It helps to understand the modeling and dynamics of age and sex structured model.
5	The Lokta integral equation, The McKendrick-von Foerster PDE. Gender-Structured Models.	7	It gives broad idea about well-known Lotka integral equations and its real applications
Total		**42**	

Text Books:

1. M. Kot, Elements of Mathematical Ecology. Cambridge University Press, 2001.
2. J. D. Murray, Mathematical Biology I: An Introduction, Springer-Verlag, 1989.

Reference Books:

1. R.K. Upadhyay, S.R. K. Iyengar, Introduction to mathematical modeling and chaotic dynamics. Chapman and Hall/CRC, 2013.
2. H. Malchow, S.V. Petrovskii, E. Venturino Spatiotemporal Patterns in Ecology & Epidemiology: Theory, models and Simulation. Chapman and Hall/CRC, 2008.