BIOMATHEMATICS

Course No: **MM24207DCE** Total Credits: **04**
Semester: **MA/M.Sc. 2nd Semester** Total Marks: **100**
Continuous Assessment: **Marks 20,** Theory: **Marks 80** Time Duration: **2½** hrs

Course objectives: To enable the student to formulate mathematical models of real life situations especially in ecology, physiology and epidemiology.
Course Outcomes: This course will help the students in learning techniques for formulating real-world problems into mathematical models, establishing optimal solutions of problems arising in theoretical biology.

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UNIT -I

Introduction to mathematical modeling, types of modeling, classification of mathematical models, formulation, solution and interpretation of a model, linear growth and decay models, non-linear growth and decay models, population models based on Leslie matrices, continuous population models for single species, logistic growth model, Fibonacci's rabbits, the golden ratio and their relation, compartment models, limitations of mathematical models.

UNIT -II

Basic terminology of Ecology, Mathematical models in ecology: models for interacting populations, types of interactions, Lotka - Voltera system, equilibrium points and their stability, Geometrical interpretation of Predator-Prey interaction, almost linear system, stability analysis of the interactions like prey-predator, competition and symbiosis.

UNIT -III

Epidemiology, Mathematical models on communicable diseases, simple and general epidemic models viz SI, SIS, SIR epidemic disease models, the SIR endemic disease model. Sexually transmitted diseases, HIV, window period, ELISA test for the determination of HIV, AIDS and models on AIDS. Vaccination strategies and control measures.

UNIT -IV

Diffusion in biology: Fick's law of diffusion, Fick's perfusion law, Diffusion through a slab. Bio-fluid mechanics: introduction, various types of fluid flows, viscosity, basic equation of fluid, mechanics, continuity equation, equation of motion, the circulatory system, the circulation in heart, blood composition, arteries and arterioles, models in blood flow, Poiseulle's flow and its applications in blood flow in human body, the pulse wave.

Books Recommended

1. J. N. Kapur, Mathematical Modelling, New Age International Publishers.
2. J.D. Murray Mathematical Biology (An Introduction, Vol. I & II), Springer- Verlag.
3. J.N. Kapur, Mathematical Model in Biology and Medicines.
4. S. I. Rubinow, Introduction to Mathematical Biology, John Wiley andSons, 1975.
5. MA Khanday, Introduction to Modeling and Biomathematics, Dilpreet Publishers New Delhi, 2016.
6. Jaffrey R. Chasnov, Mathematical Biology, Hong Kong Press.