MATHEMATICAL MODELLING IN BIOLOGICAL AND BIO-MEDICAL APPLICATIONS

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Overview

Mathematical modelling is an art of translating the real life situations, natural phenomena into the language of mathematics. It has wide applications in the field of natural sciences, social sciences and engineering. Mathematical models precisely help us to identify the underlying ideas and assumptions and explains the system behaviour under the effect of different parameters involved. Thus, it is necessary to provide a novel modelling approach and adequate mathematical tools to predict the outcomes of the natural systems correctly. In course of understanding the world around us in a better way researchers are paying significant attention to mathematical modelling and as a result the subject have emerged and still evolving.

Here we will mainly restrict ourselves to the mathematical modelling with its applications to biology, ecology and biomedical problems. If we go through the literature we come across that the study of ecosystems through mathematical models gradually emerged after the pioneering works of Lotka and Volterra. After that several sophisticated tools and techniques have been developed to analyze the mathematical models. Mathematical models are usually composed using several types of differential equations and so it is necessary for the students to have a grip on the theory and applications of different types of differential equations.

The first few lectures of this course are thus planned so that it provides all the theoretical insights needed to tackle the differential equations be it an ordinary differential equation or a partial differential equation. Now to discuss the modelling approaches for biological and bio-medical problems it is important to note that the model formulation is completely system specific and can vary significantly even for the same species under different environment. So it is imperative to have a clear idea of the underlying systems and how the model emerges from them. To this end we intend to build a foundation of the modelling types and possible approaches among the audience through the discussion about the existing literature. Here we will try to relate the origin of the models and the relevance of their out comes in the designated fields. It is to be mentioned that as our main objective is to give suitable answers to real life problems special emphasis will be given to the modelling and their analysis of some problems from different challenging areas like blood coagulation, cardiovascular diseases, cancer development and its treatment etc.

Finally to motivate the students for further studies in this area future research endeavours and some open problems will be discussed.

The primary objectives of the course are as follows:
i) Exposing participants to the area of mathematical modelling.
ii) Providing an overview of the existing literature on the work done so far.
iii) Exposing participants with some new methodology theoretically, practical examples and tutorials.

iv) Enhancing the participants' expertise in the state-of-the-art mathematical modelling in Biology.
v) Future collaborative research with the interested participants.

Modules	**A: 10 hours lectures, 4 hours tutorials : November 20-24, 2017** **Number of participants for the course will be limited to fifty (50).**
You Should Attend If…	▪ **You are a faculty/researcher working on nonlinear dynamics, mathematical biology/ecology.** ▪ **You are from mathematics bacground from, academic institutions, service and government organizations including R&D laboratories.** ▪ **you are either M.Sc./Ph.D. student or a young faculty member interested in enhancing your knowledge of ODE/PDE and intend to work on non-linear dynamics and its applications.**
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $500** **Industry/ Research Organizations: Rs. 5000/-** **Academic Institutions: `** Faculty Member **: Rs. 3,000/-** Students **: Rs. 1,000/-** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Professor Vitaly Volpert is the Directeur de recherche au CNRS, Lyon, France. He has successfully mentored several Ph.D., M.Sc. and Post-doctoral Fellows with whom he has published in reputable refereed and widely read journals about 300 papers and 3 monographs. He is the founder and editor-in-chief of the journal "Mathematical modeling of natural phenomena. He is the recipient of several honors including the Schelkin prize of the Soviet Academy of Sciences. His wide research area includes Partial differential equations of elliptic and parabolic types, reaction-diffusion equations, traveling waves, elliptic operators, Fredholm property, index, topological degree, nonlinear dynamics and patterns formation. Mathematical modeling in combustion, chemical kinetics, polymerization, fluid mechanics, biology, medicine. Biological and medical applications: hematopiesis, leukemia, atherosclerosis, blood coagulation and hemophilia, blood flows, population dynamics, morphogenesis, plant growth etc.

Course Co-ordinator

Dr. Moitri Sen
Phone: 8971359401 (M)
E-mail: moitri@nitp.ac.in , moitri300784@gmail.com

http://www.gian.iitkgp.ac.in/GREGN