GLOBAL INITIATIVE OF ACADEMIC NETWORKS

ONE-WEEK SHORT TERM COURSE ON

INTRODUCTION TO MATHEMATICAL THEORY OF COMPLEX FLUIDS

(Sponsored by Ministry of Human Resource Development (MHRD), Under the Scheme 'GIAN')

(17 November 2017 –22 November 2017)

MOTIVATION

The main objective of this course is to understand the mathematical theory of complex fluids, which includes a discussion of non-Newtonian fluids, mixtures and suspensions. The course begins with a treatment of fundamentals of vectors, tensors, deformations and constitutive modeling and then transitions into the theory of complex fluids. Our attempt will be to showcase all aspects of the subject including an examination of fundamental mathematical issues – theoretical and computational - as well as applications. Modern day applied mathematics is no longer an individual effort restricted to pen and paper, or even a computer calculations. Cutting edge research in applied mathematics is often an interdisciplinary team effort involving mathematicians and scientists from other disciplines. Applied mathematicians are also starting to do their own table-top experiments, so they may become better acquainted with the system which is being investigated. Along with imparting information about the mathematical issues in complex fluids, this course will also talk about development of skills to sustain a successful research career in applied mathematics. This involves learning to identify new, relevant and meaningful problems by understand experimental data, developing collaborations with researcher in applied fields and becoming familiar with the literature. Week one of the course will focus on the development of the foundational ideas while most of week two will focus on applications of complex fluids in industrial settings, human biology, bio-locomotion and energy. The tutorials will be used as a forum to work on problems, conduct physical experiments, read published papers and conduct panel discussions with interdisciplinary experts in a variety of fields.

OBJECTIVES

The main objectives of this course are to:

i) Expose the participants to the fundamentals of vector and tensor calculus, fundamental theory of continuum mechanics and complex fluids, including non-Newtonian fluids and complex mixtures.

ii) Provide examples of complex fluid flow in industrial and biological fluid mechanics.

iii) Help participants learn about the state of the art in applied mathematics research in complex fluids though examining recent papers in the field of complex fluids.

iv) Get participants to learn to navigate the changing world of applied mathematics research, learn to understand how to identify good, sustainable research problems of interest to the larger international applied mathematical community.

This course is intended to provide graduate students, teachers, and researchers working in aerospace, automotive, chemical, civil, mechanical engineering, and applied mathematics, and engineering physics, as well as numerical analysts and materials scientists with the ideas behind about the mathematical issues in complex fluidsand their use in engineering and applied sciences.

Course Contents	• Vector Analysis , Tensor Analysis • Fundamentals of Continuum Mechanics: Deformation, Incompressibility, Conservation laws • Navier-Stokes equation: theory, exact solutions. • Navier-Stokes equation: solutions, numerical methods, stability theory. • Singularity theory and approximate methods for viscous flows. • Nonlinear Viscous and Viscoleastic Fluid Models, Modeling mixtures, suspensions and other complex liquids. • Applications: Biological fluid dynamics, Industrial applications
Who Can Attend?	• Senior Under Graduate students, Graduate students (pursuing Masters & Ph. D degrees), Postdoctoral Fellows of Engineering & Sciences; • The course has been designed to introduce, update and improve understanding of the faculty members in new IITs, IISERs and academic institutions in the country about the best practices and recent advances in the field; • Practicing engineers and scientists working in industries, as well as, in government research organizations
Fees	**Participants from Abroad**: US $100 **Industry/ Research Organizations**: Rs. 3000/- **Faculty Members / Researches:** Rs. 1000/- **Students(pursuing Bachelors / Masters courses/Ph. D.):** Rs500/- • Registration fee only includes attendance to sessions, course material and lecture notes. • The course fee does not include accommodation. However, the participants will be provided accommodation on payment basis in the institute guest house based on availability • The registration fee has to be paid by DD drawn in favor of Director, NIT Kurukshetra, payable at SBI NIT Kurukshetra . . To register or for any questions please send an email to asvravikanth@gmail.com

Registration Process

Registration for GIAN courses is not automatic because of the constraints on maximum number of participants allowed to register for a course. Inorder to register for one or multiple non-overlapping courses, you have to apply online using the following steps:

Stage1:
Web (Portal) Registration: Visit GIAN Website at the link:
http://www.gian.iitkgp.ac.in/GREGN/index and create login user ID and Password. Fill up blank registration form and do web registration by paying Rs. 500/- on line through Net Banking/ Debit/ Credit Card. This provides the user with life time registration to enroll in any no. of GIAN courses offered.

Stage2:
Course Registration (Through GIAN Portal): Log in to the GIAN portal with the user ID and Password created. Click on "Course Registration" option given at the top of the registration form. Select the Course titled "**INTRODUCTION TO MATHEMATICAL THEORY OF COMPLEX FLUIDS**" from the list and click on "Save" option. Confirm your registration by Clicking on "Confirm Course".

Only Selected Candidates will be intimated through E-mail by Course Coordinator. They have to remit the necessary course fee in the form of DD drawn in favor of "The Director, NIT Kurukshetra-136 119" payable at NIT- Kurukshetra**.**

The last date of registration is 10 November 2017.

Number of participants for the course is limited to 30.

Course Faculty

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Prof. Ashuwin Vaidyais aAssociate Professor, Department of Mathematical SciencesMontclair State University, Montclair, NJ, USA. Prof Vaidyahas authored nearly 50 journal papers and book chapters on various aspects of complex fluid flow.His research interests covers a wide variety of subfields ofFluid mechanics (including Newtonian and Non-Newtonian fluids), Fluid-Structure interaction, Bio-fluid dynamics and Hydrodynamic stability. He has also published papers on the subject of Non-equilibrium Thermodynamics, Pattern formation, Nonlinear dynamics, Network Analysis and the

Philosophy of Science. As an educator, he is deeply interested and committed to infusing creativty into the teaching and learning of Mathematics and has authored several papers on this subject. He currently serves on the editorial board of the journal *Applied Mathematics and Computation* published by Elsevier.

Prof. Ashuwin Vaidyacan be contacted by email onvaidyaa@montclair.edu

Course Coordinator & Contact Information

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Dr. A. S. V. Ravi Kanth is a Associate Professor, Department of Mathematics National Institute of Technology Kurukshetra, India. He has published more than 40 research articles in reputed international journals. His research interests include Numerical Methods with analysis for Singular Boundary Value Problems, Singular Perturbation Problems, Fractional Differential Equations.