INTRODUCTION TO SOFT MATTER

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TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (15 Feb' 21 - 09 Apr' 21)
EXAM DATE : 24 Apr 2021

PRE-REQUISITES : Basic fluid/solid mechanics courses will be helpful, although not required

INTENDED AUDIENCE : Mechanical Engineering, Chemical Engineering, Aerospace Engg, Physics, Interdisciplinary sciences

COURSE OUTLINE :
This is an introductory course on soft matter/complex fluid. A review of preliminaries of continuum mechanics, which are required for dealing with soft matter and general concepts of viscous and elastic deformations and relevant models are covered. Experimental approaches to soft materials such as creep response and stress relaxation are also discussed.

ABOUT INSTRUCTOR :
Prof. Aloke Kumar received his Bachelors and Masters degrees from the Indian Institute of Technology, Kharagpur, India in 2005 and his Ph.D in Mechanical Engineering from Purdue University, West Lafayette, USA in 2010. His doctoral work is one of the founding works in the area of opto-electrofluidics. After completing his doctoral work, Dr. Kumar joined the Oak Ridge National Laboratory (ORNL) as a Eugene Wigner Fellow. After his post-doctoral work, Dr. Kumar joined University of Alberta's Mechanical Engineering Department, where he was the Canada Research Chair in Microfluidics for Biological Systems. He recently moved to the Indian Institute of Science, where he is re-establishing his Soft Matter Lab with a focus on bacterial biofilms and polymeric flows. He has co-authored over 50 scientific manuscripts (38 peer-reviewed journal articles, 10 book chapters and 2 invited journal articles). He has published in reputed journals like Nanoscale, Lab-on-a-Chip, Langmuir and Physical Review Letters. Eight of his papers have also been journal cover articles (Soft Matter, Lab-on-a-Chip, Applied Physics Letters & Green Chemistry).

COURSE PLAN :

Week 1 : Historical context and Deborah number

Week 2 : Classical elastic and viscous materials

Week 3 : Viscoelastic materials

Week 4 : Viscoelastic materials (contd.)

Week 5 : Macromolecules and viscoelasticity

Week 6 : Shear thickening/thinning fluids

Week 7 : Typical experimental results

Week 8 : Typical experimental results (contd).