TRANSPORT PHENOMENA

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TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 12 weeks (18 Jan' 21 - 09 Apr' 21)
EXAM DATE : 25 Apr 2021

PRE-REQUISITES : Undergraduate level courses in Fluid Mechanics, Heat Transfer

INTENDED AUDIENCE : Chemical,Mechanical,Biotechnology, Nanotechnology

INDUSTRIES APPLICABLE TO : Most of the process industries recognize this as a fundamental course dealing with the unified treatment of seemingly different transport operations. The concepts will enhance the lateral thinking capabilities of the students and seamlessly integrate the concepts for their use in a multitude of processes and problems. This aspect will also be of value to the upcoming technology driven companies involved in micro-device fabrication, sensors, and in the general microfluidics domain.

COURSE OUTLINE :
This is a fundamental subject for all Chemical Engineering students and is also important in disciplines as diverse as Mechanical Engineering, Biotechnology and Nanotechnology. Over the last few decades, the subject has revolutionized the way engineering science is taught. This course deals with the unified treatment of the different transport processes, ubiquitous in industry as well as in nature.

ABOUT INSTRUCTOR :
Prof. Sunando DasGupta is a professor of Chemical Engineering and was the Dean of Sponsored Research at the Indian Institute of Technology Kharagpur. He obtained his Bachelor's degree from the Jadavpur university, Masters from IIT Kanpur and PhD from the Rensselaer Polytechnic Institute, USA in 1992.

COURSE PLAN :

Week 1: Fundamental concepts in momentum transfer, shell balance, governing equations and relevant boundary conditions

Week 2: Formulation and solution of momentum transfer in laminar flow

Week 3: Navier-Stokes equation and its applications, solutions of momentum transfer problems in different geometries

Week 4: Formulation and solution of heat transfer in laminar flow

Week 5: Development and use of energy equation

Week 6: Transient conduction - lumped capacitance, analytical solutions and other methods.

Week 7: Formulation and solution of mass transfer in laminar flow. Development and use of species balance equation

Week 8: Introduction to convective flow, natural convection, relevant examples from heat and mass transfer

Week 9: Boundary Layer concepts, boundary layer thicknesses (disturbance, displacement and momentum), Blasius solution for flow over a flat plate

Week 10: Use of momentum integral equation, turbulent boundary layers, fluid flow about immersed bodies, drag

Week 11: Mathematical treatment of the similarities between heat, mass and momentum transfer, similarity parameters, and relevant analogies

Week 12: Solution of coupled heat, mass and momentum transfer problems based on analogy