



TRANSPORT PHENOMENA IN MATERIALS

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INTENDED AUDIENCE : Undergraduate students of Metallurgical / Materials Engineering and related disciplines.

PREREQUISITES : Mathematics courses at 1st year UG level.

INDUSTRY SUPPORT : Tata Steel, JSW, Vedanta, Aditya Birla Group, Murugappa Group, Amalgamations Group, TCS etc.,

COURSE OUTLINE :

This course will introduce the concepts of fluid flow, heat transfer and mass transfer with behavior and processing of engineering materials as the focus.

ABOUT INSTRUCTOR :

Prof. Gandham Phanikumar doctoral work is on heat transfer, fluid flow and solute transfer during laser processing of dissimilar metals. After joining IIT Madras in 2005, he has been teaching a UG core course on transport phenomena for several years. His research continues to involve concepts of transport phenomena in materials processing.

Further details are at <https://mme.iitm.ac.in/gphani/>

COURSE PLAN :

Week 1 : Mathematical foundations of transport phenomena, introduction to subscript notation & tensors

Week 2 : Control volume formulation and concept of balance

Week 3 : Navier-Stokes equations, exact solutions for simple geometries

Week 4 : Friction factors, empirical relations in fluid flow

Week 5 : Application of fluid flow solutions to materials processing

Week 6 : Governing equations for heat transfer, problem statements

Week 7 : Exact solutions for heat transfer problems

Week 8 : Empirical correlations, heat transfer coupled with fluid flow

Week 9 : Mass balance equations, governing equations

Week 10: Diffusive mass transfer, exact solutions for simple geometries

Week 11: Solute transfer during phase change

Week 12: Convective mass transfer correlations, Similarity across transport phenomena