



### Transport Phenomena in Materials

Metallurgy and Material Science

**Instructor Name:** Prof. Gandham Phanikumar

**Institute:** IIT Madras

**Department:** Metallurgy and Material Science

**About Instructor:** Gandham Phanikumar's 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/>

**Pre Requisites:** : Mathematics courses at 1st year UG level

**Core/Elective:** : Core

**UG/PG:** : UG

**Industry Support** : Tata Steel, JSW, Vedanta, Aditya Birla Group, Murugappa Group, Amalgamations Group, TCS etc.,

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

#### COURSE PLAN

SL.NO	Week	Module Name
1	1	Mathematical foundations of transport phenomena, introduction to subscript notation & tensors
2	2	Control volume formulation and concept of balance
3	3	Navier-Stokes equations, exact solutions for simple geometries
4	4	Friction factors, empirical relations in fluid flow
5	5	Application of fluid flow solutions to materials processing
6	6	Governing equations for heat transfer, problem statements
7	7	Exact solutions for heat transfer problems
8	8	Empirical correlations, heat transfer coupled with fluid flow
9	9	Application of heat transfer solutions to materials processing
10	10	Governing equations for mass transfer, problem statements
11	11	Exact solutions for mass transfer problems, empirical correlations, application to materials processing
12	12	Coupled phenomena in heat transfer, fluid flow and mass transfer