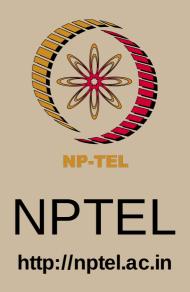# NOC:Phase field modelling: the materials science, mathematics and computational aspects - Video course

COURSE OUTLINE

This course is a tutorial introduction to phase field modelling. Phase field models are used to model microstructure evolution in a wide variety of systems; for example, they can be used to study microstructural evolution during solidification, solid-solid phase transformations and plastic deformation. In this course, we will primarily concentrate on modelling solid-solid transformations using phase field models. Specifically, we will discuss the materials science, mathematical and computational aspects of phase field modelling. The computations will be carried out using GNU Octave, a freeware for scientific computations.

COURSE DETAIL

Week	Topics
1.	Thermodynamics: Some Basics
2.	Diffusion and Spinodal Decomposition: Some Basics
3.	Solving Classical Diffusion Equation and Failure of Classical Diffusion Equation
4.	GNU Octave: Some Preliminaries
5.	Analytical Solution of Diffusion Equation

NPTEL

http://nptel.ac.in

Metallurgy and Material Science

Pre-requisites:

Mathematical methods and materials thermodynamics; structure of materials, phase transformations, diffusion and computer programming are preferred.

Coordinators:

Dr. M.P. Gururajan
Department of Metallurgical Engineering and Materials ScienceIIT Bombay

6.	Numerical Solution to the Diffusion Equation I
7.	Numerical Solution to the Diffusion Equation II and Introduction to Symmetry and Group Theory
8.	Symmetry, Group Theory and Variational Calculus
9.	Cahn-Hilliard Equation
10.	Interfacial Energy and Allen-Cahn Equation
11.	Applications I: Spinodal Decomposition, Order-disorder Transformation, Gibbs-Thomson, Grain and Precipitate Growth
12.	Applications II: Precipitate Growth, Grain Growth in Multi-grain Systems and Grain Boundary Grooving

References:

1. Porter and Easterling, Phase transformations in metals and alloys
2. Kreyzig, Advanced Engineering Mathematics
3. Quarteroni and Saleri, Scientific computing using Matlab and Octave