

# Advanced Metallurgical Thermodynamics - Video course

## COURSE OUTLINE

**Basics:** First, second and third laws of thermodynamics, Maxwell's relations, Clausius-Clayperon equation.

**Solutions:** solution models, regular, sub-regular, cluster variation models, multi-parameter models, quasi-chemical theory, statistical thermodynamics, multicomponent systems.

**Equilibrium Concepts:** Unary, binary and multicomponent systems, phase equilibria, evolution of phase diagrams, metastable phase diagrams, calculation of phase diagrams, thermodynamics of defects.

**Thermodynamics of Phase Transformations:** Melting and solidification, precipitation, eutectoid, massive, spinodal, martensitic, order disorder transformations and glass transition. First and second order transitions..

**Heterogeneous Systems:** Equilibrium constant, Ellingham diagrams and their application to commercially important reactions.

## COURSE DETAIL

Sl. No	Topic	Hours
1.	<b>Basics:</b> First, second and third laws of thermodynamics, free energy, Maxwell's relations, Clausius Clayperon equation, stability.	4
2.	<b>Solutions:</b> Chemical potential, solution models, quasichemical theory, configurational entropy.	6
3.	<b>Equilibrium Concepts:</b> Unary, binary and multicomponent systems, Phase equilibria, Phase rule, evolution of phase diagrams, metastable phase diagrams, calculation of phase diagrams.	10
4.	<b>Thermodynamics of Phase Transformations:</b> Melting and solidification, precipitation, eutectoid, massive, spinodal, martensitic and order disorder transformations. First and second order transitions.	12
5.	<b>Heterogeneous Systems:</b> Equilibrium constant, Ellingham diagrams and their	8



# NPTEL

<http://nptel.iitm.ac.in>

## Metallurgy and Material Science

### Pre-requisites:

Basic course on Metallurgical Thermodynamics

### Additional Reading:

1. Textbook of Materials and Metallurgical Thermodynamics, Ahindra Ghosh.
2. Introduction to Metallurgical Thermodynamics, D.R. Gaskell.

### Hyperlinks:

1. [en.wikipedia.org/wiki/Thermodynamics](http://en.wikipedia.org/wiki/Thermodynamics)
2. [web.mit.edu/16.unified/www/FALL/thermodynamics](http://web.mit.edu/16.unified/www/FALL/thermodynamics)
3. [materials.iisc.ernet.in/~abinand/courses/thermo](http://materials.iisc.ernet.in/~abinand/courses/thermo)

### Coordinators:

**Prof. B.S. Murty**

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	application to commercially important reactions.	
	<b>Total</b>	40

**References:**

- 1. Physical Chemistry of Metals: L.S. Darken and R.W. Gurry
- 2. Thermodynamics of Solids: R.A. Swalin
- 3. Phase Transformations in Metals and Alloys: D.A. Porter and K.E. Easterling
- 4. Principles of Extractive Metallurgy: H.S. Ray