



**MECHANICAL
ENGINEERING**

Heat Treatment & Surface Hardening - II

Type of Course	: New
Course Snapshot	: Core / UG
Course Duration	: 20 hours / 8 weeks
Industry Support	: Heat treatment industries, steel industries, car industries.

COURSE OUTLINE:

Heat treatment is a fundamental principle required for processing of metals and alloys. By controlling time-temperature sequence with/without application of stress, it can modify the structure of the materials, which would influence the properties in a desired way. This principle lies strongly on the basics of thermodynamics and kinetics of phase transformations in metals and alloys, which is the guiding factor for deciding process schedule in Industry.

INSTRUCTOR:

Prof. Kallol Mandal, Prof. Sandeep Sangal
Department of Mechanical Engineering
IIT Kanpur



ABOUT INSTRUCTOR:

Prof. Kallol Mandal is an associate professor in the department of Materials Science and Engineering, IIT Kanpur. His specializations are phase transformations of metals and alloys, corrosion and oxidation behavior and multi-phase steel development.

Prof. Sandeep Sangal is a professor in the department of Materials Science and Engineering, IIT Kanpur. His specializations are phase transformations in steels, development of bainitic rail steels and steriology.

COURSE PLAN:

- Week 1 : Introduction: Heat Treatment of Alloys (Al-alloy and Steel); Theory of Heat Treatment (Why, How, What); Thermodynamic basis for heat treatment of alloys; Phase diagram and phase transformation in alloys
- Week 2 : Theory of Heat Treatment: Thermodynamic basis for heat treatment of alloys; Phase diagram and phase transformation in alloys; Relation between thermodynamics and Kinetics for phase transformation
- Week 3 : Theory of Heat Treatment: Choice of composition and temperature for heat treatment and related phase transformation in Al-alloys
- Week 4 : Theory of Heat Treatment: Choice of composition and temperature for heat treatment and related phase transformation in steel
- Week 5 : Theory of Heat Treatment: Concept of JKMA equation and TTT diagram in alloy system; Heat treatment time and temperature and microstructure/property developed for alloys
- Week 6 : Theory of Heat Treatment: Heat treatment time and temperature and microstructure (stereology); -CCT diagram from TTT diagram and experimental data and its implication to heat treatment for alloys
- Week 7 : Theory of Heat Treatment: CCT diagram from TTT diagram and experimental data and its implication to heat treatment for alloys (Al-alloys and Steels)
- Week 8 : Theory of Heat Treatment: Hardenability and Jominy test; Case hardening of Alloy systems for Steels