



# MATERIALS SCIENCE AND ENGINEERING

## PROF. VIVEK PANCHOLI

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**INTENDED AUDIENCE :** B.E., B.Tech. students of Mechanical, Production Engineering, practicing engineers in manufacturing industry

**INDUSTRIES APPLICABLE TO :** Automobile companies, Auto ancillary companies, Manufacturing companies.

## COURSE OUTLINE :

The course is primarily designed for Mechanical and Production Engineering students. Therefore, focus of the course is on structural materials. The course covers three important parts of materials which students and practicing engineers should know. The course is hoping to address both theoretical and practical aspects of Materials Engineering. To serve this purpose, the course is divided into three broad categories.

- a) Crystallography and crystal defects – It covers crystal systems, crystal structures, indexing of planes and directions, vacancies, dislocations, grain boundaries and microstructures.
- b) Phase diagram and heat treatment – It covers, Gibbs phase rule, one component systems, binary phase diagrams, lever rule, invariant reactions, iron-carbon phase diagram and heat treatment.
- c) Mechanical properties – Elastic and plastic deformation, engineering and true strain and stress, ultimate tensile strength, ductility, toughness, cold/hot working and strengthening mechanisms.

## ABOUT INSTRUCTOR :

Prof. Vivek Pancholi obtained BE (Industrial and Production Engg.) in 1995 from G.S.I.T.S. Indore, M.Tech. (Industrial Tribology) from IIT Delhi in 1997 and PhD in Metallurgical Engineering from IIT Bombay, in 2005. He joined IIT Roorkee as a faculty member in the Department of Metallurgical and Materials Engineering in 2006. He has about 10 years teaching experience at IIT Roorkee. He taught UG core courses like Structural Metallurgy, Phase transformation and Heat treatment, Welding and Casting and, Mechanical Behavior of Materials. He also taught M.Tech. core course on Materials Characterization.. He has published more than 35 research papers in SCI/SCIE indexed journals and completed 05 sponsored research projects. Under his guidance four PhD research scholars completed their thesis and five are working.

## COURSE PLAN :

**Week 1:** Lattice, Crystal structures, Miller indices for planes and directions.

**Week 2:** Microscopes, microstructures and quantitative metallography.

**Week 3:** Defects, diffusion and phase diagram.

**Week 4:** Equilibrium phase diagram, lever rule, phase transformation.

**Week 5:** Iron-carbon phase diagram, TTT and CCT curves, heat treatments.

**Week 6:** Introduction to mechanical properties, cold and hot working.

**Week 7:** Strengthening mechanism Fracture, and Fatigue.

**Week 8:** Creep, ceramics and plastic, NDT techniques, alloy designation.