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Microstructural Design and Development of Engineering Materials

Instructor

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Email:

Department: Materials Engineering

Course Time:

Lecture venue:

Detailed Course Page:

Announcements

Brief description of the course

The course focuses on the role of microstructure on properties of engineering materials. The theoretical basics will include elements of microstructure, methods of controlling microstructure, and how these affect properties. Case studies will be presented. The course focuses on engineering materials for structural applications. The course is intended for 1st/2nd year Master's/PhD students with a materials background, 3rd/4th year UG students, and 5th year BS-MS students.

Prerequisites

Master's and PhD Students: Should have credited either MT209, or MT253

UG students: Should have credited UMT202, UMT205 and UMT301

Syllabus

Review of crystal defects and their thermodynamics, effect of microstructure of mechanical properties such as strength, ductility, creep and fatigue resistance, and fracture toughness, a review of methods of controlling microstructure - processing routes (wrought, cast, powder), phase transformations (nucleation and growth, martensitic transformation) and heat treatments (recovery, recrystallization, grain growth, ageing and

coarsening). case studies on engineering alloys such as steels and Ni-base superalloys and engineering ceramics like TiN and YSZ.

Course outcomes

- An appreciation for the importance of microstructure on properties of structural materials.

- An overview of the various schemes available to control microstructure

- A survey of engineerign materials and the role of microstructure.

Grading policy

50% from two midterms

50% from finals

Assignments

Resources