Course-Plan

School : School of Engineering
Department : Mechanical Engineering Dept.
Course Code : ME 203
Course Name : Material Science

Instructor: Dr. Sanjib Banerjee

1. Abstract:

- The course offers the basic details of Material Science. The general topics like crystallography, dislocations, strengthening mechanisms, phase diagrams, solidification, heat treatments etc. are covered.
- The classification, properties and applications of different ferrous and non-ferrous materials are then discussed in detail.
- The significance of the course lies on the in-depth knowledge in Materials Engineering, where Design and Manufacturing Technology initiates with the proper selection of materials.

2. Objectives:

- To give detailed knowledge in material science
- To increase interest on advanced materials.
- To understand the criteria for selection of materials during design and manufacturing.

3. Prerequisites of the course:

Basic knowledge on Physics is preferable.

4. Course outline:

- Crystal Systems and Lattices. Crystallography, crystals and types, Miller Indices for directions and planes, voids in crystals, packing density, crystal imperfections – point defects, line defects and surface defects.
- Characteristics of dislocations, generation of dislocation; bonds in solids and characteristics of metallic bonding. Deformation mechanisms and strengthening mechanisms in structural materials, Hot working and cold working of metals – recovery, re-crystallization and grain growth, Fracture, fatigue and creep phenomenon in metallic materials.
- Phase Diagrams; Principles and various types of Phase diagrams. Principles of solidification – structural evaluation during solidification of metals and alloys. Heat treatment of steels and CCT diagrams – Pearlitic, Martensitic, bianitic transformation in steel during heat treatment.

- General classifications, properties and applications of alloy steel, stainless steel, cast iron and non-ferrous materials like copper based alloys, aluminum based alloys, nickel based alloys. Composites, ceramics, Electronic properties of materials.

5. (a) Time-Plan:

Topic	Content	Contact Hours	
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	• Crystal Systems and Lattices. Crystallography, crystals and types, Miller Indices for directions and planes, voids in crystals, packing density, crystal imperfections – point defects, line defects and surface defects.	5	
	• Characteristics of dislocations, generation of dislocation; bonds in solids and characteristics of metallic bonding.	2	
	• Deformation mechanisms and strengthening mechanisms in structural materials.	5	
	• Phase Diagrams; Principles and various types of Phase diagrams.	5	
	• Principles of solidification – structural evaluation during solidification of metals and alloys.	3	
	• Heat treatment of steels and CCT diagrams – Pearlitic, Martensitic, bianitic transformation in steel during heat treatment.	5	
	• Hot working and cold working of metals – recovery, re-crystallization and grain growth.	2	
	• Fracture, fatigue and creep phenomenon in metallic materials.	3	
	• General classifications, properties and applications of alloy steel, stainless steel, cast iron and non-ferrous materials like copper based alloys, aluminum based alloys, nickel based alloys. Composites, ceramics.	10	
	Total contact hours	40	

Text Books:

a. W. D. Callister, Material Science and Engineering - An Introduction, Wiley, 2002.

Reference Books:

a. V. Raghavan, Materials Science and Engineering, Prentice Hall, 1996
b. W. F. Smith, Principles of Materials Science, McGraw Hill, 1996

5. (b) Evaluation Plan:

Test No.	Marks	Duration (minutes)
Test I	20	-
Test II	20	-
Test III	20	-
Test IV (End Term)	40	120
Total Marks	100	

All the tests will be held as per the schedule notified by the Controller of Examinations, Tezpur University

6. Pedagogy:

Students should visualize the material science aspects and expertise in material selection for different manufacturing applications.

7. Expected outcome:

Towards the end of the course the student would be able to:

- Identify the general and advanced Engineering materials, their properties and applications.
- Explain the need of advanced and non-conventional materials.
- Identify the criteria for selection of materials during design and manufacturing.
- Correlate material properties with design considerations.
- Present the outcome carried out in the form of group projects on material characterization and different manufacturing aspects.