BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI–
HYDERABAD CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017
COURSE HANDOUT (PART II)

12th May 2016

Course No. : **ME F213 & MF F213**
Course Title : **Materials Science and Engineering**
Instructor-in-Charge : **Dr. Sujith R**

Course Description: The course gives an introduction to materials science and its structure at the atomic and microscopic level. The relation between structure and properties of materials is also highlighted. The course mainly discusses about the structure and properties of different types of materials such as metals, ceramics and polymers.

Scope and Objectives: This course aims to provide the relation between structure and properties of metallic materials. Concept of phase transformation, phase diagrams and its influence on the properties of metals. Methods of improving properties by thermal, mechanical treatment and importance of non-metallic materials like polymers, ceramics and composites.

Prescribed Text Book

T1. Callister William D & R. Balasubramaniam, Materials Science and Engineering, Wiley Student Edition, 7th Edition, 2007.

Reference Books

R1. William F Smith, Javad Hashmi and Ravi Prakash, Materials Science and Engineering, Fourth Edition, Tata McGraw Hill Education Private Limited, New Delhi.

R2. George E. Dieter, Mechanical Metallurgy, SI Metric Edition McGraw Hill Book Company, London.

R3. R. A. Higgins, Applied Physical Metallurgy, Sixth edition, Viva Low priced students edition, New Delhi.

R4. Thomas. H. Courtney, "Mechanical Behavior of Materials" McGraw Hill Publication Company, Materials Science series, II Edition (2000).

R5. Material Science and Engineering by V. Raghavan, Fifth Edition, Prentice-Hall of India Private Limited (2004).

Lec No.	Topics	Learning Objective	Reference to Text book	Self study material.
1	Introduction	Classification of Materials and its Properties	T:1:1-1.6	R1: 1.1 - 1.6 Class Notes
2-5	Crystallography and Metallic structures	Unit cell, Crystallographic directions and planes, FCC, BCC, Linear and planar densities, close-packed crystal structures	T:3.1-3.10 T4.1-4.9	R1:3.1-3.10 Class Notes
6-7	Polymers and applications.	Types of polymers, structure and applications.	T 13.1 - 10, 14.20, 4.18 - 4.19	R1 :10 Class Notes
8-9	Ceramic materials and applications	Types of ceramics, structure and applications.	T : 4.10 - 4.15, 4.17	R1 : 11 Class Notes

Lec No.	Topics	Learning Objective	Reference to Text book	Self study material.
10-12	X-ray diffraction	Determination of crystal structure, Bragg's Law, diffraction technique	R5: 3.4 - 3.6 T: 4.20	Class Notes
13-15	Crystal Imperfections	Vacancies and interstitials, dislocations and grain boundaries	T:5.1-5.10	R2, 4: Class Notes
16-18	Phase diagrams	Phases, microstructure, phase equilibrium, Isomorphous system, Gibbs Phase rule, Phase transformation	T1 :7.1-7.17	R3: 9. Class Notes
19-21	Iron-Iron Carbide phase diagram	Fe-Fe_3C Phase diagram, Alloy steel. Cast iron,	T:7.18-7.20 T:.9.1-9.2	R3:11. 13, 15 Class Notes
22	Non ferrous metals and alloys	Copper, Aluminium, Magnesium, Titanium and alloys	T1: 9.3	R3:Ch16,17, 18 Class Notes
23-25	Phase Transformations	Avrami rate equations, Isothermal transformation, Continuous cooling transformation diagrams	8.1-8.6	R3:12.50-12.52. Class Notes
26-28	Mechanical Properties of materials.	Tensile testing and influence of structure, elastic, plastic deformation and instability.	T: 9.5-9.10	R2Ch 8,9,&10 Class Notes
29-32	Failure of metals.	Fracture, DBTT & Fractography. S-N Curve, Creep.	T:11.2-11.15	R4:9.1-9.4. Class Notes
33-35	Composites	FRP, MMC, PMC and other types and applications.	T : 15	R1: 12. Class Notes

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
1	Test I	60 Min	20		CB
2	Test-II	60 Min.	20		CB
3	Comprehensive exam.	180 Min.	40		CB
4	Assignments	-.	20		OB

Note:

1. **Chamber Consultation hour:** To be announced in class by instructors.
2. **Mid-Semester grading**: It will be announced normally in the month of March. It is done in the same manner as that of the final grading.
3. **Notices:** All notices concerning this course will be displayed on CMS.
4. Programmable calculators are **strictly not** allowed during any of the evaluation components.
5. **Make-up Policy**: Make-up will be granted only to genuine cases. For cases related to illness, proper documentary evidence is essential. Prior permission is necessary if the student is out of station on the test date.

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