

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE – PILANI, HYDERABAD CAMPUS
FIRST SEMESTER 2019-2020
(COURSE HANDOUT: PART-II)

20th July 2019

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	: DE G631
Course Title	: MATERIALS TECHNOLOGY AND TESTING
Instructor-in-Charge	: PIYUSH CHANDRA VERMA
Instructor	: SUJITH R

1. **Course Description:** Study of characteristics and technology of metals, plastics, rubbers, ceramics, polymers, composites, optical fibers and other modern engineering materials and their application with particular reference to railways. Destructive and nondestructive testing techniques and their applications in Railways.
2. **Scope and Objective of the Course:** This course is for higher degree students and is intended to focus their attention to the nature of different classes of the engineering materials. Study includes characteristics of metals, polymers, ceramics, composites, biomaterials and their applications. Methods of testing the materials (destructive and non-destructive), understanding corrosion and selection of the materials for a given application, considering environmental social and economic issues are included.

At the end of the course the student will be able apply the core concepts in materials technology to effectively choose the material as per the design requirements and do the necessary characterization.

3. Textbooks:

1. **William F. Smith, Javed Hashemi and Ravi Prakash, Materials Science and Engineering** In SI Units, McGraw-Hill Companies, New Delhi Fourth Edition, Special Indian Edition, 2008.

Reference books:

1. William D Callister Jr. **Materials Science and Engineering: An Introduction**, John Wiley & Sons, Singapore, Seventh Edition, (2008).
2. Marc Andre Meyers, Krishan Kumar Chawla **Mechanical Behavior of Engineering Materials** Cambridge University Press (2009).
3. Reza Abbaschian, Lara Abbaschian, Robert E Reedhill **Physical Metallurgy Principles**, Fourth Edition (2014).
4. Ravi Prakash **Nondestructive Testing Techniques** New Age, India, 2007.

4. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Book Chapter
1-4	Introduction to Materials Science	Classification of materials on the basis of type of bonds - Crystal structures -Single crystals and Polycrystalline materials - Isotropy and Anisotropy - Amorphous/glassy materials	Chapter 2 and 3 of T1
5-12	Introduction to deformation behavior	Theoretical shear strength of crystals - Defects in crystals - Critical resolved shear stress - Deformation of polycrystals - Strengthening mechanisms – Stress strain response of metals/ceramics/polymers from tensile testing and compression testing	Chapter 6 of T1
13-20	Differentiate between ductile and brittle fracture, Estimate the fracture toughness of material	Fracture in ceramics and metals – Theoretical strength of a solid – Crack initiated fracture – Fracture toughness and material class – The Charpy impact test – Fracture toughness estimation methods	Chapter 7 of T1 Chapter 11 of R1 Chapter 9 of R2 Chapter 21 of R3
21-25	Compare and contrast the various creep mechanisms, Develop methods to estimate the creep	Creep mechanisms – Intergranular creep fracture – Design and material considerations – Failure in superplastic materials – Creep test	Chapter 6 and 7 of T1 Chapter 11 of R2
26-29	Interpret the fatigue failure features, Evaluate the fatigue life of a component	Characteristics of fatigue fracture, Evaluation of fatigue resistance, Creep fatigue interactions – Fatigue of composites and polymers – Fatigue testing	Chapter 6 and 7 of T1 Chapter 12 of R2
30-36	Distinguish between oxidation and reduction chemical potential, Compute the cell potential and metal oxidation rate, Describe the nature of hydrogen embrittlement	Corrosion of Metals, electrochemical considerations, standard emf series, Nernst equation. Forms of corrosion. Corrosion prevention.	Chapter 13 of T1, Chapter 13 of R2
37-39	Appreciate that biomaterials have different properties to man-made materials, Aware of why some biomaterials have developed specific properties	Mechanical properties of bone, Bio-tribology Bone replacement, Selecting implant materials, Materials Selection	Class notes
40-42	Compare and contrast the various non-destructive evaluation methods	Visual inspection, Magnetic particle Inspection, Radiography, Ultrasonic, Phased array and Acoustic emission	R4

5. Evaluation Scheme:

Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-Semester Exam	1 h 30 min	20	30/9 , 09:00 – 10:30 AM	CB
Surprise Test / Quiz	---	15		OB
Assignment		10		OB
Laboratory component		15		OB
Comprehensive Examination	3 hours	40	04/12 FN	CB

Expert lecture on Biomaterials

***Chamber Consultation Hour:** To be announced in the class room.

- 6. Notices:** All notices concerning this course shall be displayed only on the CMS
- 7. Make-up Policy:** Make-up shall be given only to the genuine cases with prior confirmation. Request for the make-up tests, duly signed by the students, should reach the under signed well before the scheduled test.
- 8. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-Charge
DE G631**