

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
K. K. BIRLA GOA CAMPUS
INSTRUCTION DIVISION
SECOND SEMESTER 2018-2019

Course Handout (Part II)

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.: CHE F243

Course Title: MATERIALS SCIENCE AND ENGINEERING

Instructor-in-charge: RICHA SINGHAL

Course Description: The course is an introduction to the principles of materials science and engineering and includes the following topics: atomic structure and bonding; structures of metals, ceramics and polymers; imperfections; diffusion; mechanical properties; mechanical testing; deformation and strengthening mechanisms; failure; phase diagrams; phase transformations; types of materials (metal alloys, ceramics, polymer); synthesis, fabrication and processing of materials; composites, corrosion and degradation of materials.

Scope and objective of the course: The objective of the course is to provide a good knowledge of the structure and properties of engineering materials such as metallic materials, polymers, ceramics and composites, provide good understanding of the relationships between processing parameters and microstructure, and correlation of microstructure with properties, provide understanding of the principles of common methods for mechanical testing of materials, including the capabilities and limitations of these methods.

Text Book:

Materials Science and Engineering, William Smith, J. Hashemi, Ravi Prakash, Tata McGraw Hill fourth edn.

Reference Book:

Materials Science and Engineering-An Introduction, William D. Callister, Wiley, 7th Edition

Course Plan

Lecture No.	Topics	Learning Objectives	Chapters
1	Introduction	Importance of material science and engineering, types of materials, smart materials	TB 1 RB1
2-4	Atomic structure and bonding in solids	Electronic structure overview, types of atomic and molecular bonding	TB 2 RB2

5-7	Crystal and amorphous structure	Bravais lattice, metallic crystal structure, crystallographic planes and directions, amorphous materials	TB 3 RB3
8-11	Solidification and Crystalline imperfections	Solidification of metals and single crystals, defects, experimental techniques for identification	TB 4, RB 4
12-15	Diffusion in solids	Diffusion mechanism, steady and unsteady state, effect of temperature	TB 5 RB5
16-20	Mechanical properties	Stress, Strain, Elastic and Plastic deformation, Tensile tests, Modulus of Elasticity, Poisson's ratio, Yield strength, Tensile strength, Ductility, Toughness, Hardness, Design/Safety Factors	TB 6.2-6.4, RB 6
21-27	Phase diagrams	Phase rule, lever rule, eutectic alloy system, peritectic alloy system	TB 8
28-33	Polymeric materials	Polymers, Plastics, Elastomers, Thermoplastics, Thermosetting plastics, Polymerization, Chemistry of polymer molecules, Molecular structure, shape, isomerism, polymer crystallinity, Mechanical and thermal properties	TB 10.1, 10.2, 10.4, 10.5, 10.9 RB 13, 14.2, 14.9, 14.11-14.14
34-36	Thermal properties	Heat capacity, thermal expansion, thermal conductivity, thermal shock	RB 19.1-19.5
37-39	Electrical properties	Electrical conduction, semi-conductivity, Dielectric behavior	TB 14, RB 17
40-42	Nanomaterials	Introduction to nanomaterials and nanotechnology	

Evaluation scheme:

Component	Duration	Weightage (%)	Date & Time	Venue	Remarks
Mid-term	90 Min	3%	15/03/2019 (4-5.30 pm)	**	CB
Continuous evaluation (Quiz/Assignment)/Attendance	--	25 + 5 %	(Surprise-unannounced)		CB/OB
Comprehensive Exam	3 Hours	40 %	06/05/19 (FN)		CB

Make-up Policy: No make-up will be given for surprise quizzes and assignments under any circumstance. Make up for other components will be given only in genuine cases. In all cases prior intimation must be given to IC.

Notices: All notices concerning this course will be uploaded on Moodle.

Instructor-in-charge
CHE F243