



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

**Course Number:** CHEM F333

**Course Title:** Chemistry of Materials

**Instructor-in-charge:** Madhushree Sarkar

**Course Description:** The course will provide a concise overview of the principles of materials science and investigating the relationships between the structures and properties of materials. The discussions will focus on structure-property correlations of Metallic, Ceramic and polymeric materials.

**Scope and Objective of the Course:** The first part of the course will concentrate on the key ideas regarding the structures in solids. The structure of a materials relate to the arrangement of the internal components. Structural arrangement may be classified as "microscopic" and "macroscopic" arrangement. The latter part of the course deals with their properties. A property is the response of a material when exposed to some external stimulus.

**Text Book:**

T1. **Materials Science and Engineering - An Introduction** by William D. Callister 7th Edition

**Reference books:**

R1. **Solid State Chemistry** by Lesley E. Smart and Elaine A. Moore

R2. **Materials Science and Engineering** by Donald R. Askeland and Pradeep P. Fulay

R3. **Materials Science for Engineers** by James F. Shackelford and Madanapalli K. Muralidhara

**Course Plan:**

Lec. No.	Topics to be covered	Learning Objectives	Text
1-4	Crystallography	Unit cells, Lattice, Basis, Crystallographic Points, Directions and Planes, Crystal Systems, Anisotropy, Amorphous Materials	T1: 3.1-3.11
5-11	Crystalline Solids	Metallic Crystal Structure, Linear and Planar Density, Atomic Arrangements, Ceramic Crystal Structure	T1: 4.1-4.15





12	X-Ray Diffraction	Bragg's Law, Powder XRD	T1: 4.20
13-16	Crystal Defects and Dislocations	Vacancies and Interstitials, Dislocations and Grain Boundaries, Grain size Determination	T1: 5.1-5.8, 5.13
17-20	Diffusion	Diffusion Mechanism, Steady-State Diffusion, Non-Steady-State Diffusion	T1: 6.1-6.5
21-26	Phase Diagrams	Phase Equilibria, Binary Isomorphous Systems, Binary Eutectic Systems, Gibbs Phase Rule, Iron-Carbon System	T1: 7.1-7.19;
27-30	Phase Transformation	Kinetics of Phase Transformation, Isothermal Transformation Diagrams, Continuous Cooling Transformation Diagrams	T1: 8.1-8.9
31-34	Mechanical Behavior	Stress and Strain, Elastic and Plastic Deformation, Slip Systems, Mechanism of Strengthening in Metals	T1: 9.5-9.7; 10.1-10.10
35-37	Bonding in Solids and Electronic Properties	Free Electron Theory, Molecular Orbital Theory, Bands in Compounds, Electrical conductivity, origin of valence and conduction band in solids, classification of material, types of semiconductor, time dependent of conductivity, mobility of charge carriers, metal-metal junction, metal-semiconductor junction, n-type and p-type semiconductors	T1: 17.1-17.14
38-40	Magnetic Behavior of material	Magnetic properties of material, atomic magnetism in solid, the exchange interaction, classification of magnetic material, diamagnetics, paramagnetic, ferromagnetism, antiferromagnetism, ferrimagnetism, hysteresis	T1: 18.1-18.6





**Evaluation scheme:**

Component	Duration	Weightage	Date and Time	Remarks
Mid Semester test	90 min	30%	14/3 2:00 -3:30 PM	Closed Book
Tutorials	15 min	25%	Continuous	Closed Book
Comprehensive Examination	3 hours	45%	4/5 FN	\$

\$ Comprehensive examination will have a closed book quiz portion and an open-book section. Only text-books, reference books, class/tutorial notes and course material (if any provided) will be allowed in the open book examination.

**Chamber consultation hours:** To be announced

**Notices:** Notices, if any, concerning the course will be displayed on the **Department of Chemistry Notice Board only.**

**Make up policy:** Make up would be considered only for **regular students having genuine reasons.**

**Instructor in-Charge**

**CHEM F333**

