Syllabus for Bachelor of Technology

Chemical Engineering

Subject Code: 01CH1402

Subject Name: Material Science and Engineering

B.Tech. Year – II (Semester IV)

Objective: Course will cover various aspects related to material, their properties and manufacturing methods used in chemical industries.

Credits Earned: 3 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Understand the basic concept of crystal system as well as defects
2. Analyze the various properties of the engineering materials.
3. Relate the practical importance and relevance of metals and alloys in chemical industry.
4. Utilize the technological methods related to material strength and diffusion concepts.

Pre-requisite of course: None

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (I)	CSE (C)	Viva (V)	Term work (TW)	
3	0	0	3	50	30	20	0	0	100

Contents:

Unit	Topics	Contact Hours
1	**Structure of Crystalline Solids** Amorphous & Crystalline solids, Unit cell, Crystal system and structure, Coordination number, atomic packing factor, Point coordinates, Crystallographic directions, Crystallographic planes-Miller indices. **Imperfections in solids:** Defects and types of defects.	10
2	**Properties of Engineering Materials** **Mechanical Properties:** Isotropy, Anisotropy, Plasticity, Elasticity, Toughness, Resilience, Tensile Strength, Malleability, Ductility, Brittleness, Hardness, Fatigue, Creep, Mechanism of creep, wear resistance. **Electrical Properties:** Resistivity, Conductivity (ionic & electrical), Semiconductors, Superconductivity, Insulators, Ferro electricity, Energy Bands in solids, classification of materials based on band gap. **Magnetic Properties:** Magnetic moment, its origin, Ferro and Ferri-magnetism, dia- and para-magnetism, ferrites, use of magnetic materials.	6
3	**Phase Diagram and Processing of Metal-Alloys** **Phase diagram**: Binary phase diagram, phase diagram for iron-carbon system,	10

	Development of microstructure in iron-carbon alloys. **Processing of Metal-Alloys:** Ferrous alloys and nonferrous alloys, Fabrication of metals, Thermal processing of metals, Corrosion in metal.	
4	**Diffusion mechanisms** Diffusion mechanism, steady state diffusion, non-steady state diffusion, Factors that influence diffusion, Diffusion in ionic and polymeric materials. **Rubber, Lubricants and adhesives** Definition, Characteristics, Types	6
5	**Ceramics and Composites** Ceramics: Ceramic structures, Properties of ceramics, Types and applications of ceramics, Fabrication and processing of ceramics. Composite Materials: particle-reinforced composites, fiber-reinforced composites, structural composites, advantages and applications.	6
	Total Hours	38

References:

1. "Callister's Material Science and Engineering", 2/e R. Balasubramaniam, Wiley India.
2. "Elements of Material Science and Engineering", 6/e, Lawrence H. Van Vlack, Pearson Education.
3. "The Science and Engineering of Materials", 6/e, Donald R. Askeland and Pradeep P. Phule, Cengage Learning.
4. "Principles of Materials Science and Engineering", W F Smith, McGraw Hill.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	35%	25%	20%	-	-

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Design Based Problems (DP)/ Open Ended project (OEP) :

In the beginning of the session, subject faculty will allot an OEP / DP to the students. Students will be free to choose a topic of their choice which will be relevant to the syllabus and they will either prepare a working model/ report / presentation / poster on their topic.

Web Resources:

a. https://nptel.ac.in/courses/113102080

b. https://nptel.ac.in/courses/112108150