M.Sc Materials Science II Semester(Open Elective Paper)

MSE 457: SCIENCE OF MATERIALS IN DAILY LIFE (Open Elective-1) (3 Credits)

Objectives: Objective of the present course is to give a fundamental knowledge about technologically important materials such as metals, semiconductors, polymers, composite materials, ceramic materials and basic semiconductor devices to the non-materials science students.

Expected course outcomes: This course imparts basic knowledge on the topics studied to the students who are not studying materials science.

Unit I

Conductors: Metals, Alloys, Semiconductors- Definition, elementary ideas of electrical properties, optical properties, mechanical properties, thermal properties. Specific examples of metals- Copper, Aluminium, Iron, Gold, Silver. Uses of metals. Drawbacks of metals. Alloys- advantages of alloying. Examples- brass, bronze, steel, stainless steel, gold alloys, silver alloys and their uses.

Semiconductors: Elemental semiconductors- Silicon, Germanium. Doping- n-type and p-type semiconductors, p-n junctions, I-V Characteristics- diode equation. Qualitative ideas of devices- diodes to ICs. Compound Semiconductors. 14 hours

Unit II

Polymers and composites: Plastics- Introduction. Types of plastics. Rubber- Types of rubber. Vulcanization of rubber. Thermoplastics and thermosets. Fibres- Different types of natural and synthetic fibres – cellulose acetate fibres. Resins, adhesives and polymer coatings. Physical, chemical, mechanical properties and applications of polymers. Recycling of polymers.

Composites- Introduction, types. wood, concrete, FRP and some advanced composites. Properties and applications. 14 hours

Unit III

Ceramics and Glasses: Ceramics- Introduction, classification, raw materials, fabrication methods, properties and applications. Types of ceramics- oxide and non-oxide ceramics. Allotropes of carbon- graphite, diamond and fullerene – structure dependent properties. Primary refractory materials.

Glasses- Introduction, raw materials, manufacture of glass, properties and applications. Types of glasses, properties and applications. Photochromic and photosensitive glasses.

14 hours

References:

1. The Physics of Materials: How Science Improves Our Lives, Solid State Sciences Committee, (National Research Council, 1997)
2. The Science of the World Around Us, Solid State Sciences Committee, (National Research Council, 2007)
3. Materials Science and Engineering – V Raghavan ((PHI Learning Pvt. Ltd., New Delhi 2011)
4. Introduction to Solids – A J Dekker (McMillan India, 1981)
5. Plastics-How Structure determines properties- G Gruenwald (Hanser, New York 1992)
6. Understanding Materials Science- R E Hummel (II Ed.) (Springer-Verlag, New York, 2004)
7. Materials Science- Nagpal G. R (Khanna, Delhi, 1983)
8. Polymer Science –V R Gowarikar, N V Viswanath, Jayadev Sridhar (Wiley Eastern, New Delhi, 1987)
9. Composite Materials-Engineering & Science – F L Mathews & R D Rawlings (Chapman & Hall, 1990)
10. Introduction to Ceramics – W D Kingery, H K Bower and U R Uhlman (John Wiley, 1960)
11. Glasses and vitreous state – J Zarzycki (Cambridge University Press, 1991)