PHY7203: MATERIALS SCIENCE

1. Course Name: Materials Science

2. Course Code: PHY7203

3. Credit Units: 3

4. Course Description:

This course discusses the different characteristics of materials and how they can be used in the manufacturing industry. Different processing methods are also addressed **.**

5. Course Objectives:

At the end of the course, the students should be able to:

- Discuss the elasticity of different materials.
- Describe crystal defects.
- Describe materials in terms of their thermal properties.
- Use different processing methods.

6. Course Outline:

Content	Hours
Elasticity: Tensor notation; Strains, displacements, stresses, stiffness and compliance constants; Symmetrics; Equilibrium and compatibility equations in three dimensions; Traction and displacement boundary conditions; Plane stress and plane strain; Cantilevers and beams; Polar co-ordinates; Torsion; Pressure vessels; Holes, cracks and stress concentration. Creep, fatigue and fracture, strain hardening.	5
Crystal Defects: Crystal structures; Interatomic forces and crystal defects- dislocations, lattice vacancies, diffusion, and colour centres.	7
Thermal properties of solids: Phonons, thermal conductivity, thermal expansion; Equation of State of solids; Optical properties of solids.	7

Ceramic materials: Structural imperfections, surfaces, interfaces and grain boundaries; Atomic mobility; Phase transformations; Grain growth and sintering; Microstructure- property (physical and mechanical) relationships.	5
Metallic materials- Internal structure and mechanical properties; Plastic deformation and hardening mechanisms; Fracture, fatigue and creep.	5
Polymers: structures of polymeric solids; Rubber elasticity and viscoelasticity; Forming; Thermal properties, crystallization, glass transformation; Theories of folding; Properties and morphology- Electrical, optical and chemical properties.	10
Composite materials: Fibres and Matrices; Fibre matrix interface; Geometrical aspects.	6
Total	**45**

7. Mode of Delivery:

This course will consist of lecture sessions and there will also be data analysis using theories leant.

8. References:

1. William D. Callister Jr. Material Science and Engineering: An introduction. John Wiley and sons, Inc., New York (2000)(Textbook)
2. Donald R. Askeland. The Science and Engineering and Materials. Publisher: Chapman and Hall, London 1996
3. Lawrence H. Van Vlack. Elements of Material Sceince and Engineering.Addison-Wesely publishing company, Massachusets, London, Tokyo (1980)