

## PH 201: Physics of Materials (3-0-0: 3)

**Optical Materials:** classification of optical process, optical materials, dispersion equation, optical constants  $n$  and  $k$ , Fresnel equations, characteristic optical physics in the solid state, propagation of light, interband absorption, excitons, luminescence, and luminescence centres.

**Magnetic Materials:** Diamagnetism, Paramagnetism and Ferromagnetism - Antiferromagnetism and Ferrimagnetism - temperature effect - Domains and Hysteresis - Magnetic Anisotropy - Soft and Hard magnetic materials - magnetic materials for recording and computers - Superconductivity and their applications.

**Smart Materials:** Introduction to smart materials, Types of Smart materials, Piezoelectricity, Ferroelectricity, Pyroelectric Phenomena, Introduction to phase transformation, Shape memory alloys and their types, Smart fluids, Electrostrictive and Magnetostrictive materials, Photo-thermo-mechanochromic materials, Auxetic materials, Metallic glasses, Smart Bricks, Smart Concrete.

**Nano Materials:** Introduction to nanomaterials, exciton confinement, types of nanomaterials, properties of nanomaterials (electrical, mechanical, and optical), nanostructures; graphene, carbon nanotubes, fullerenes, surfaces and interfaces in nanostructures, magnetic nanostructures, thermodynamics of nanomaterials, nanomaterials: risks and benefits.

**Bio Materials:** Fundamentals of biomaterials science, concept of biocompatibility, classes of biomaterials used in medicine, Physico-chemical properties of biomaterials: mechanical (elasticity, yield stress, ductility, toughness, strength, fatigue, hardness, wear resistance), tribological (friction, wear, lubricity), morphology and texture, physical (electrical, optical, magnetic, thermal), chemical and biological properties. Application of biomaterials

### Textbooks

1. Mark Fox, "Optical Properties of Solids", Oxford University Press
2. B. D. Cullity and C. D. Graham "Introduction to Magnetic Materials", IEEE Press
3. M.V. Gandhi and B.D. Thompson, "Smart Materials and Structures", Chapman & Hall
4. Y. Gogotsi, "Nanomaterials Handbook", Taylor & Francis Group
5. J. B. Park, and R. S. Lakes "Biomaterials An Introduction", Springer

### References

1. J. Z. Zhang, "Optical Properties and Spectroscopy of Nanomaterials" World Scientific Publishing Co. Prv. Ltd.
2. Richard J. D. Tilley "Colour and the Optical Properties of Materials: An Exploration" Wiley
3. K.T. Ramesh, "Nanomaterials Mechanics and Mechanisms", Springer
4. B. Culshaw, "Smart Structures and Materials", Artech House, Boston