Sankalchand Patel University

Faculty of Science & Humanities

Master of Science (Physics) (Sem-3)

In Effect from Academic Year 2022-23

Subject Code:1SC2050303	Subject Title: Crystallography and Material Science

COURSE OBJECTIVE:

Physics is a science to understand the nature. This course is designed to get basic understanding of the physical world.

LEARNING OUTCOMES:

- Develop the understanding of Crystallography and Material science.

Teaching scheme (hours) per week		Credit		University Examination		Internal Examination		Total
Theory	Practical	Theory	Practical	University Assessment	Practical	Internal Assessment	Practical	
4	--	4	--	60	--	40	--	100

Unit	Content	Lectures	Weight (%)
1	Salient feature of Reciprocal lattice, Graphical construction, Vector- algebraic discussion, Relation to inter-planar spacing, Ewald construction, Interpretation of Bragg's law, Reciprocallattice & X- ray diffraction, Laue equation – equivalence of Laue equation and Bragg's law, Projection-Spherical, stereographic & gnomonic. Reciprocal lattice and electron diffraction Electron diffraction pattern and Indexing of polycrystalline and single crystal specimen.	15	25
2	Scattering of X- rays by crystal, Structure factor Equation for an electron, an atom and a unitcell, Structure factor calculation for different structures, X-ray optics, wavelength dispersion,Chemical analysis by X-ray spectrometer. Ferroelectric crystals: Rochelle Salts & BaTiO3, Classification of Ferroelectric, electric displacive transition: Polarization catastrophe, 'Frozen in' Transverse Optical Phonons, Thermodynamic theory of ferroelectric transition, ferroelectric domain, Piezoelectricity, piezoelectric coefficient,simple application with respect to piezoelectric slab.	15	25
3	Polaritons, LST relation, Electron-electron interaction, electron-phonon interaction: polarons, ,optical reflectance, Kramers-Kroning relations, electronic interband transitions,Excitions,Frenkel excitons and Wannier-Mott exciton, Raman Effect in crystals.Integral and Fractional Quantum Hall Effect, Josephson tunneling, supercurrent quantum interference,High temperature superconductors :Rare earth, Bi and Tl-based cuprates and their properties, GMR-CMR materials.	15	25
4	Amorphous semiconductors – Band structure, electronic conduction, optical properties, switching and Xerography. Amorphous Ferro-magnets, Liquid crystals, classification of liquid crystals, properties and applications of liquid crystals, Quasi crystals, Carbon :diamond,graphite,fullerenes and carbon nanotubes, Polymers, classification of polymers, structures of long chain polymer, Nanofluids for improved heat transfer, Ferrofluids: general consideration, properties of ferrofluids, applications of ferrofluids..	15	25

Basic Reference book:

1. Nanomaterials : An introduction to synthesis,properties and applications byDieter Vollath (Wiley-VCH Verlag GmbH & Co.KGaA)

2. Solid state physics:An introduction to solid state electronic devices by Ajay kumar Saxena(Macmillan publishers India limited)
3. Introduction to Solid State Physics - C. Kittel Principles of Solid State Physics - R. A. Levy
4. Solid State Physics- S.O. Pillai
5. Elements of X-Ray diffraction - B.D. Cullity
6. Elementary Solid State Physics - Ali Omar
7. Elements of Solid State Physics - J.P. Srivastava
8. Nano; The Essentials By T. Pradeep (Tata McGraw Hill Publ)
9. Materials Science and Engineering an introduction by William D.Callister.Jr.