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| <b>Subject Code:</b> 1SC2050102 | <b>Subject Title:</b> Elements of Solid State Physics and Error Analysis |
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### COURSE OBJECTIVE:

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

### LEARNING OUTCOMES:

- To know the basic concept of solid state physics.

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

| Unit | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Lectures | Weight (%) |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|
| 1    | <b>Elements of crystallography:</b> Symmetry elements, Classification of crystals, Zone and forms, Miller indices, Lattice types, Effect of symmetry, Atomic packing: packing of equal spheres in two and three dimension, hexagonal lattice, fcc lattice, bcc and Simple Cubic lattice, classification of closed packing, voids, voids in closed packing, Pauling's rule and its applications, Common Crystal structures: simplest crystals CsCl, NaCl, alkali metals, Diamond and hexagonal, Transformation theory.                                                                                | 15       | 25         |
| 2    | Lattice vibrations, Vibration of mono-atomic lattice, First Brillouin zone, group velocity and continuum limit, Lattice with two atoms per primitive cell, Quantization of lattice vibrations, phonon momentum, inelastic scattering of neutrons by phonons.                                                                                                                                                                                                                                                                                                                                         | 15       | 25         |
| 3    | Elastic properties, Stress and Strain components, Dilation, Elastic compliance, Stiffness, Elastic energy density and the relationships, Elastic constants for cubic isotropic crystal, their reduction due to existence of potential of elastic forces, Elastic waves : Waves in [100], [110] and [111] direction, Experimental determination of elastic constants. Intrinsic carrier concentration, Impurity conductivity, Models for impurity semiconductors, Thermo-electric effect, Hall Effect.                                                                                                | 15       | 25         |
| 4    | Types of measured quantities: Discrete quantities, Continuously distributed quantities, Histogram, Normalized histogram, Best estimate of true value of data, Standard deviation of the means, Gaussian distribution, Properties of Gaussian distribution, Determination of mean value for a Gaussian distribution, Determination of standard deviation for Gaussian distribution and problems, Chi-square test for goodness of fit, Criteria for goodness of fit, Determination of parameters in linear relationships, Graphical method, Method of least squares, Linear least square curvefitting. | 15       | 25         |

**Basic Reference book:**

1. Introduction to Solid State Physics by C. Kittel (John Wiley & Sons)
2. Elements of Solid State Physics by J.P. Srivastava (Prentice Hall of India)
3. Solid State Physics: Structure and Properties of Materials by M. A. Wahab (Narosa Publishers).
4. Principles of Solid State Physics by R. A. Levy ( Academic Press)
5. Elementary Solid State Physics by M. A. Omar (Addison-Wesley Publishing Company).
6. Elements of X-ray Diffraction- B. D. Cullity
7. Instrumentation, measurement and analysis. B. C. Nakra and K. K. Chaudhry