Program	BS Solid State Physics	Course Code	SSP-304	Credit Hours	3 (3-0)

Course Title	Basic Solid State Physics

Course Introduction
Solid State Physics is a major branch of Condensed Matter Physics and provides a theoretical basis to Material science. The course will provide a valuable introduction to Solid State Physics and an overview of crystal structure. The course not only will equip the students with the theoretical knowledge of crystal structure determination methods, but students will also learn X- ray diffraction, Neutron Diffraction, and Electron Diffraction experimental techniques as well. Inaddition, students will also get comprehensive knowledge about atomic bonding and the elastic behavior of the crystal lattice.

Learning Outcomes
With the completion of the course, students will be able to: 1. Understanding the basic theme of Solid State Physics 2. Theoretical knowledge of the Crystal Structure 3. Learning the Experimental techniques to determine the crystal structure 4. Knowledge of atomic bonding in Solids and elastic behavior of crystal lattices

Course Content	
Week 1	Introduction to Condensed Matter Physics/Solid State Physics and its relation with materials Science. Why do we study Solid State Physics? Relationship of Solid State Physics to Other Areas
Week 2	• Crystal Structure: Periodic arrays of atoms • Fundamental types of lattices • Index system for crystal planes • Simple crystal structures
Week 3	Direct imaging of atomic structure; Non-ideal crystal structure; Random Stacking and Polytypism
Week 4	• Reciprocal Lattice: Diffraction of waves by crystals • Scattered wave amplitude; Brillouin zones
Week 5	• Fourier analysis of the basis
Week 6	• Crystal Binding and Elastic Constants: Crystal of Inert Gases
Week 7	• Ionic Crystals; Covalent crystals; Metals; Hydrogen Bonds

Week 8	• Atomic Radii; Analysis of elastic strains
Week 9	• Elastic compliance and stiffness constants; Elastic waves in cubic crystal
Week 10	• Crystal Vibrations: Vibrations of crystals with a monatomic basis
Week 11	• Two atoms per primitive basis; Quantization of elastic waves
Week 12	• Thermal properties, Lattice heat capacity,
Week 13	• Classical model, Einstein Model, Debye model,
Week 14	• the thermal conductivity and resistivity, Umklapp processes
Week 15	• Introduction to Crystal Defects
Week 16	• Point defects (Frenkel defects, Schottky defects, impurity defects), Line defects.

Textbooks and Reading Material

1. Introduction to Solid State Physics (7^{th}Edition), C. Kittle, *John Wiley & Sons, Inc.* (1996).
2. Solid State Physics, J. S. Blakemore, *Cambridge University Press* (1991).
3. Solid State Physics Simulations, Steven Spicklemire, *John Wiley & Sons* (1996).
4. Solid State Physics, Neil W. Ashcroft, *Thomson Press (India)*, 2003).
5. Solid State Physics (2^{nd}Edition), G. Grosso, G. P. Parravicini, Academic Press (2013).

Teaching Learning Strategies

The instructor is required to make use of visualization/animations and symbolic/numerical calculations to teach the concepts. The students are required to solve a large portion of related exercises/questions/problems of the main textbooks.

Assignments: Types and Number with Calendar

At least two assignments and two quizzes. A course project may also be assigned.

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.

2.	Formative Assessment	25%	Continuous assessment includes Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. At least fifty percent of the question paper would involve new problems related to the concepts learned in the course. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.