M. Sc. II Year	MPH-C402				Semester-IV
	SOLID STATE PHYSICS				
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	**3 Hrs**	**30**	**70**	**100**	**04**

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllbus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

CRYSTAL STRUCTURE AND LATTICE VIBRATIONS

Introduction to crystal structure, Ionic bonding, Evaluation of Madelung constant, Covalent crystals, Exchange energy calculation, Molecular bonding and Vander-Waals interaction.

Vibration of one dimentional solid, The linear diatomic lattice, Acoustic and optical modes of vibrations, Phonon, Momentum of phonon, Einstein & Debye models and T^3 Law. **(12 Lectures)**

UNIT-II

DEFECTS IN CRYSTALS AND FREE ELECTRON THEORY

Point defects, Line defects and planer faults, The role of dislocations in plastic deformation and crystal growth, X-ray and electron microscopy techniques for observation of imperfections in crystals.

Energy levels and density of orbits (in one dimension), Fermi-Dirac distribution, Free electron gas in three dimension, Electrical conductivity and effect of impurities, Thermal conductivity of free electron gas, Wiedemann -Franz law. **(12 Lectures)**

UNIT-III

ENERGY BANDS IN SOLIDS AND SEMICONDUCTOR THEORY

Wave function in a periodic lattice and Bloch theorem, Kroning Penny model, The nearly free electron approximation, The tight binding approximations, Number of orbitals in a band, Classifying material as semicondutor and band gap, Intrinsic and extrinsic semiconductor, Mobility, Drift velocity and conductivity of intrinsic semiconductors, Carrier concentration in semiconductors, Impurity semiconductors and thermal ionization of impurites, Impurity states and band model. **(12 Lectures)**

UNIT-IV

TRANSPORT PROPERTIES AND MAGNETIC RESONANCE

Boltzmann transport equation, Sommerfeld theory of electrical conductivity, Relaxation time, Hall effect, Experimental determination of Hall coefficient, Residual resistivity, Temperature dependent resistivity, Principle of magnetic resonance, Nuclear magnetic resonance, Electron spin resonannce, Resonance, Flourescence, Theory of Mössbauer effect, Isomer shift, Quadrupole interaction, magnetic hyperfine interaction. **(12 Lectures)**

UNIT-V

SUPERCONDUCTIVITY AND FERROMAGNETISM

The BCS theory, Transition temperature, Meissner effect, Critical field, Type I and type II superconducting materials, Cooper pairs, Joesphson tunneling, Superconductivity at high temperatures (elementary).

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Spin waves and magnons, Curie-Weiss law for susceptibility. **(12 Lectures)**

Text Books /Reference Books

1. Solid State Physics – C.Kittel
2. Solid State Physics - A.J. Dekker
3. Cryatallography for Solid State Physics- Verma & Srivastava
4. Introduction to Solids - Azaroff
5. Elementary Solid State Physics - Omar
6. Solid State Physics : Aschroft & Mermin
7. Principle of Condensed Matter Physics - Chaikim & Lubensky
8. Introduction to Solid State Physics-Paterson