Academic Council Item No:

Devrukh Shikshan Prasarak Mandal's

Nya. TATYASAHEB ATHALYE ARTS, Ved. S.R. SAPRE COMMERCE & Vid. DADASAHEB PITRE SCIENCE COLLEGE, DEVRUKH [AUTONOMOUS]

Syllabus for T.Y. B.Sc.
Program: B.Sc.
Course: Physics
Credit Based Semester and Grading System with the Effect from
Academic Year 2021-22

Syllabus for B.Sc. Physics (Theory and Practical)
As per credit based system
Third Year B.Sc.2021–2022.

The revised syllabus in Physics as per credit based system for the Third Year B.Sc. Course will be implemented from the academic year **2021–2022.**

Preamble: The systematic and planned curricula from these courses shall motivate and encourage learners to understandbasic concepts of Physics.

Objectives:

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

SEMESTER VI				
Theory				
Course	**UNIT**	**TOPICS**	**Credits**	**Lectures per Week**
USPH601	I	Classical Mechanics	**2.5**	**4**
	II	Classical Mechanics		
	III	Classical Mechanics		
	IV	Classical Mechanics		
USPH602	I	Electronics	**2.5**	**4**
	II	Electronics		
	III	Electronics		
	IV	Electronics		
USPH603	I	Nuclear Physics	**2.5**	**4**
	II	Nuclear Physics		
	III	Nuclear Physics		
	IV	Nuclear Physics		
USPH604	I	Special Theory of Relativity	**2.5**	**4**
	II	Special Theory of Relativity		
	III	Special Theory of Relativity		
	IV	Special Theory of Relativity		
Practicals				
USPH605	Practicals of Course USPH601 + Course USPH602		**2.5**	**6**
USPH606	Practicals of Course USPH603 + Course USPH604		**2.5**	**6**
Project				
USPHPR2	USPH601 + USPH602 + USPH603 + USPH604		**1**	**4**

SEMESTER V

Theory Course - USPH502: Solid State Physics

Learning Outcomes: On successful completion of this course students will be able to:

1. Understand the basics of crystallography, Electrical properties of metals, Band Theory of solids, demarcation among the types of materials, Semiconductor Physics and Superconductivity.
2. Understand the basic concepts of Fermi probability distribution function, Density of states, conduction in semiconductors and BCS theory of superconductivity.
3. Demonstrate quantitative problem solving skills in all the topics covered.

Unit - I Crystal Physics (15 lect.)

The crystalline state, Basic definitions of crystal lattice, basis vectors, unit cell, primitive and non-primitive cells, The fourteen Bravais lattices and the seven crystal systems, elements of symmetry, nomenclature of crystal directions and crystal planes, Miller Indices, spacing between the planes of the same Miller indices, examples of simple crystal structures, The reciprocal lattice and X-ray diffraction.

Ref: Elementary Solid State Physics-Principles and Applications: M. Ali Omar, Pearson Education, 2012 : (1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.6)

Unit -II Electrical properties of metals (15 lect.)

1. Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path
2. Quantum theory of free electrons, Fermi Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, The Fermi distribution function, Heat capacity of the Electron gas, Mean energy of electron gas at 0 K, Electrical conductivity from quantum mechanical considerations, Failure of Sommerfeld's free electron Theory
3. Thermionic Emission

Ref.: Solid State Physics: S. O. Pillai, New Age International. 6th Ed. Chapter 6:

II, III, IV, V, XIV, XV, XVI, XVII, XVIII, XX, XXXV, XXXI.

Unit -III Band Theory of Solids and Conduction in Semiconductors (15 lect.)

1. Band theory of solids, The Kronig- Penney model (Omit eq. 6.184 to 6.188), Brillouin zones, Number of wave functions in a band, Motion of electrons in a one-dimensional periodic potential, Distinction between metals, insulators and intrinsic semiconductors.

   Ref.: Solid State Physics: S. O. Pillai, New Age International, 6th Ed.

   Chapter 6: XXXVI, XXXVII, XXXVIII, XXXIX, XXXX, XXXXI

2. Electrons and Holes in an Intrinsic Semiconductor, Conductivity of a Semiconductor, Carrier concentrations in an intrinsic semiconductor, Donor and Acceptor impurities, Charge densities in a semiconductor, Fermi level in extrinsic semiconductors, Diffusion, Carrier lifetime, The continuity equation, Hall Effect.

   Ref.: Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.: 4.1 to 4.10.

Unit -IV Diode Theory and superconductivity (15 lect.)

1. Semiconductor-diode Characteristics: Qualitative theory of the p-n junction, The p-n junction as a diode, Band structure of an open-circuit p-n junction, The current components in a p-n junction diode, Quantitative theory of p-n diode currents, The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance.

   Ref.: Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.: 5.1 to 5.8

2. Superconductivity: Experimental Survey, Occurrence of Superconductivity, destruction of superconductivity by magnetic field, The Meissner effect, London equation, BCS theory of superconductivity, Type I and Type II Superconductors, Vortex state.

Ref.: Introduction to Solid State Physics-Charles Kittel, 7th Ed. John Wiley & Sons: Topics from Chapter 12.

Main References:

1. Elementary Solid State Physics-Principles and Applications: M.Ali Omar, Pearson Education, 2012.
2. Solid State Physics: S. O. Pillai, New Age International, 6th Ed.
3. Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.
4. Introduction to Solid State Physics - Charles Kittel, 7th Ed. John Wiley & Sons.
5. Modern Physics and Solid State Physics: Problems and solutions New Age International.

Additional References:

1. Solid State Physics: A. J. Dekker, Prentice Hall.
2. Electronic Properties of Materials: Rolf Hummel, 3rd Ed. Springer.
3. Semiconductor Devices: Physics and Technology, 2nd Ed. John Wiley & Sons.
4. Solid State Physics: Ashcroft & Mermin, Harcourt College Publisher.