Syllabus for B.Sc. VI Semester
Optional Physics
PHY 601: Paper 6.1: Nuclear physics, Solid State Physics, Astrophysics & Biophysics

Total hours of teaching: 42 hrs

1. **Nuclear Physics** **4 hrs**

Nucleus composition; mass, charge, size, density, spin and magnetic moment. Binding energy of nucleus. nuclear force; characteristics of nuclear forces, Yukawa theory – qualitative. Nuclear models; liquid drop model and shell model (qualitative).

2. Radioactivity **4 hrs**

Radioactivity decay law, half life and mean life with derivations Radioactive particles α, β and γ and their characteristics, Alpha decay - Gamow's theory (brief description), Beta decay- Fermi theory (brief description), neutrino hypothesis and Gamma-decay.

3. **Nuclear Instruments** **4 hrs**

Detectors of nuclear radiation: Geiger –Muller Counter and Scintillation Counters. Particle accelerators: Construction and theory of Cyclotron and Betatron.

4. **Alternate energy Sources** **6 hrs**

Conventional and non-conventional energy sources, ecological and sociological perspective. Wind energy, tidal energy and bio-energy (qualitative). Nuclear energy: Nuclear reaction,
Q – value. Nuclear fission, nuclear reactors, nuclear fusion, thermonuclear reaction.

5. **Crystal Structure** **4 hrs**

Concept of lattice, unit cell, Bravais lattice, crystal, crystal planes and Miller indices, structure of NaC1. X-ray diffraction-Bragg's law derivation, types of X-ray diffraction techniques (qualitative),

6. **Electrical and thermal properties of solids** **6 hrs**

Free electron theory of metals, Expression for electrical and thermal conductivities.
Concept of Fermi energy and its variation with temperature (qualitative). Specific heats of solids: Dulong and Petit law, Einstein and Debye theories (main features and results).

7. Magnetic properties of solids **4 hrs**

Define magnetic moment. Diamagnetism (explain origin) - Langevin classical theory, Paramagnetism - curies law, ferromagnetism, hysteresis loop, Weiss theory (main features).

8. Superconductivity **5 hrs**

Discovery of superconductivity, zero resistivity, Meissner effect, give examples of metals exhibiting superconductivity, persistent current, critical fields, type I and type II of superconductors, London's penetration depth, Results of BCS theory. High temperature superconductors, applications of superconductors.

9. **Astrophysics** **5 hrs**

Light year and parsec; luminosity of stars, apparent & absolute magnitudes. Colour and surface temperature of stars. spectrall classification of stars, HR diagram, Formation and

evolution of stars (qualitative); end stages of stars – white dwarfs, neutron stars and black holes (qualitative).

Reference books

1. Introduction to solid state physics by C Kittel.
2. Solid State physics by A J Dekkar.
3. Introduction to solid state physics by J S Blackmore
4. Modern physics by R Murugeshan.
5. Nuclear physics by D C Tayal.
6. Non –Conventional Energy Source by G D Rai.
7. Energy Technology by S Rao and B B Rarulekar.
8. Introductory Nuclear physics by Kenneth Crane (john Wiley).
9. An Introduction to Astrophysics by Baidyanath Basu.
10. Astronomy by Fundamentals and Frontiers –R jastrow and M H Thompson.
11. Biophysics by Vasanth Pattabhi and N Gautham.
12. Essentials of Biophysics by P Narayanan.

PHYL6.1: Practical course for Semester VI

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 15 marks be conducted at the end of practical course in the semester.
3. Minimum of 6 experiments should be performed in semester VI.

List of experiments

1. Analysis of random error: Poisson distribution, statistics of nuclear counting.
2. Characteristics of GM tube.
3. Verification of inverse square law using GM tube.
4. Determination of half life using GM tube.
5. Study of 4 bit binary counter (Using IC 7483)
6. Maping of Constallations.
7. Field Effect Transistor.
8. Phase shift oscillator using transistor.
9. Astable multivibrator using transistor.
10. Determination of self inductance of a coil using Anderson's bridge.
11. Frequency response of an RC coupled single stage CE amplifier.- determination of bandwidth.
12. Frequency response of emitter follower.- determination of bandwidth.
13. Determination of voltage gain, current gain, input impedance, output impedance of an emitter follower.
14. Hartley oscillator using transistor
15. Seven segment display using LED.