

**Syllabus for B. Sc Semester V  
Optional Physics**

**PHY 502: Paper -5.2 Statistical mechanics, Quantum mechanics & Electronics-I**

Total teaching time: 42 hours

**1. Statistical Mechanics**

**6 hrs**

Statistical ideas in physics, Phase space, ensemble, ensemble average, probable and most probable distributions, Boltzman equipartition theorem (derivation), Gibb's paradox (no derivation) Stirling's approximation, Maxwell- Boltzmann, Bose-Einstein and Fermi-Dirac distribution functions and their comparison (qualitative- no derivations).

**2. Elements of Quantum mechanics**

**8 hrs**

Origin of quantum theory –Compton effect –expression for Compton shift. Concept of de Broglie's matter waves. Expression for de Broglie's wavelength, Davisson & Germer experiment. Heisenberg uncertainty principle–illustrations of Gamma ray microscope & diffraction at a single slit.

**3. Wave mechanics**

**8 hrs**

Wave function and its physical interpretation, Schrodinger time– independent wave equation, Eigen values and Eigen functions. Problems: particle in one-dimensional box (derive Eigen values and Eigen functions), linear harmonic oscillator (derive Eigen values and Eigen functions), concept of zero point energy.

**4. Band theory of solids**

**8 hrs**

Formation of energy bands in bands, the concepts of valence band, conduction band and energy gap in semiconductors, electrical conductivity of conductors, semiconductors and insulators (qualitative). Intrinsic and extrinsic semiconductors. Deviation of expression for electrical conductivity and energy gap in semiconductors. Hall effect, Hall coefficient.

**5. Semiconductor devices**

**6 hrs**

PN junction, rectifiers (half wave, full wave & bridge). Filters (Land pi-section filters), Zener breakdown and avalanche breakdown, Zener diode as voltage regulator. Transistor action, configurations (CE, CB & CC) and relation between  $\alpha$  &  $\beta$ . Transistor amplifier in CE-mode.

**6. Special purpose Diodes and Display Devices**

**6 hrs**

Photo diode, Solar Cell, LED, application of LED in display, liquid crystal, type of liquid crystals, liquid crystal display (LCD), comparison between LED and LCD. 7- Segment display.

## **PHYL5.2: Practical course for Semester V**

### **Instructions**

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 V.

### **LIST OF EXPERIMENTS**

1. Charge of electron by dispersion method.
2. Specific charge of electron by Thomson's method.
3. Co-efficient of linear expansion of material of razor (blade) by LASER diffraction method.
4. Determination of refractive index using LASER.
5. Determination of  $o \mu$  and  $e \mu$  using LASER
6. Diffraction grating using LASER- determination of wavelength of laser light.
7. Determination of temperature coefficient of resistance of a wire.
8. Calibration of thermistor and determination of temperature coefficient of resistance and unknown temperature.
9. Planck's constant – using photocell.
10. Thermionic emission – Verification of Child's law.
11. Input, output and transfer characteristics of a transistor in CE Configuration.
12. Spectral response of a LDR.
13. Ionization potential of Xenon / Mercury.
14. Excitation and ionization potentials.
15. Hall Coefficient.