

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

PHY 201: Paper 2: Heat & Thermodynamics, Waves & Oscillations

Total hours of teaching: 50

1. Thermodynamics

12 hrs

First law of thermodynamics and its applications like $C_p - C_v = R$ & L (latent heat). Work done in isothermal and adiabatic changes. Carnot's heat engine, Carnot's cycle and expression for its efficiency. Principle of refrigeration. Second law of thermodynamics (both Kelvin and Clausius statements), Concept of entropy, entropy change in adiabatic and irreversible processes (during radiation and free expansion). Clausius & Clapeyron latent equations variation in melting and boiling points.

2. Low temperatures

8 hrs

Ideal and real gases. Andrew's experiments, porous plug experiment. Expression for temperature of inversion. Principle of regenerative cooling, Linde's air liquefier, liquid nitrogen and liquid helium and their properties. Production of low temperatures by adiabatic demagnetization method. Concept of absolute zero temperature and third law of thermodynamics.

3. Radiation

8 hrs

Black body radiation and the spectrum of energy distribution, Kirchhoff's law of radiation, Stefan's law, Statements of Wien's displacement law and Rayleigh-Jeans law, Derivation of Planck's law of radiation, deduction of Wien's, Rayleigh-Jeans and Stefan's laws from the Planck's law. Radiation pressure (no derivation). Crookes' radiometer.

4. Oscillations

6 hrs

Review of Simple Harmonic Motion (SHM) - derivations of K.E and P.E at any instant. Expression for frequency from the equation $F \propto -x$ (derivation). Theory of superposition of SHMs at right angles to each other- Lissajous' figures. Forced, free and damped vibrations- write their respective differential equations and discuss their solutions in exponential form (qualitative) Resonance (discuss amplitude and phase at resonance).

5. Waves

6 hrs

Wave motion, General equation for progressive wave in one dimension, differential form of wave equation, derive relation between amplitude and intensity. Wave groups - wave velocity and group velocity, relation between wave velocity and group velocity.

6. Sound

6 hrs

Introduction to sound. Expression for the velocity of a longitudinal wave in a gas. Derivation of Newton's formula and discuss Laplace's correction. Effect of pressure, temperature, humidity and wind on the velocity of sound. Theory of stationary waves and beats. Longitudinal waves in a rod: expression for velocity and its harmonics in free-free rod and rod fixed at the middle (qualitative). Laws of stretched strings, transverse waves in a stretched string- expression for velocity and harmonics.

7. Applied acoustics

4 hrs

Requisites of good auditorium. Absorption coefficient, reverberation time, Sabine's formula with derivation.

Reference Books

1. A text book of Heat by D.S. Mathur
2. A treatise on Heat by Shah and Srivastava
3. Heat and thermodynamics by J.B.Rajam
4. Heat and thermodynamics by Brijilal and Subramanyam.
5. A text book of sound by Braijilal and Subramanyam
6. Sound by Khanna and Bedi
7. Waves and Oscillations by A.P.French

PHYL2: Practical course for Semester II

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 12 experiments from the list mentioned below should be performed in semester II. Of these, one experiment can be open ended type (Course teacher may develop a new innovative experiment and introduce into the course). Open ended experiment must also be considered for examination.

List of experiments

1. Thermal conductivity of poor conductor (rubber)
2. Thermal conductivity of good conductor by Searle's method.
3. Thermal conductivity of a bad conductor by Lee's method.
4. Emissivity of a surface.
5. Latent heat of steam.
6. Specific heat of liquid by cooling-graphical method.
7. J by electrical method.
8. Ratio of specific heats – Clement and Desorme method.
9. Stefan's constant.
10. Verification of Stefan- Boltzmann law.
11. J by continuous flow method.
12. Platinum resistance thermometer-Determination of boiling point of a liquid.
13. Helmholtz resonator.
14. Laws of transverse vibrations of stretched string using sonometer.
15. Determination of velocity of transverse wave in stretched string using sonometer.
16. Relative linear density using Melde's apparatus.
17. Frequency of electrically maintained tuning fork using Melde's apparatus.
18. Velocity of sound for higher mode of vibrations or volume resonator using signal generator.