

# Grade 12 Syllabus

## Content Area: Mechanics

### 1. Rotational dynamics [7 Teaching hours]

- 1.1 Equation of angular motion, Relation between linear and angular kinematics
- 1.2 Kinetic energy of rotation of rigid body
- 1.3 Moment of inertia; Radius of gyration
- 1.4 Moment of inertia of a uniform rod
- 1.5 Torque and angular acceleration for a rigid body
- 1.6 Work and power in rotational motion
- 1.7 Angular momentum, conservation of angular momentum.

### 2. Periodic motion [6 Teaching hours]

- 2.1 Equation of simple harmonic motion (SHM)
- 2.2 Energy in SHM
- 2.3 Application of SHM: vertical oscillation of mass suspended from coiled spring
- 2.4 Angular SHM, simple pendulum
- 2.5 Oscillatory motion: Damped oscillation, Forced oscillation and resonance.

### 3. Fluid statics [9 Teaching hours]

- 3.1 Fluid statics: Pressure in a fluid; Buoyancy
- 3.2 Surface tension: Theory of surface tension; Surface energy
- 3.3 Angle of contact, capillarity and its applications
- 3.4 Fluid Dynamics: Newton's formula for viscosity in a liquid; Coefficient of viscosity
- 3.5 Poiseuille's formula and its application
- 3.6 Stokes law and its applications
- 3.7 Equation of continuity and its applications
- 3.8 Bernoulli's equation and its applications.

## **Content Area: Heat and Thermodynamics**

### **4. First Law of Thermodynamics** [6 Teaching hours]

- 4.1 Thermodynamic systems
- 4.2 Work done during volume change
- 4.3 Heat and work; Internal energy and First law of thermodynamics
- 4.4 Thermodynamic processes: Adiabatic, isochoric, isothermal and isobaric
- 4.5 Heat capacities of an ideal gas at constant pressure and volume and relation between them
- 4.6 Isothermal and Adiabatic processes for an ideal gas.

### **5. Second Law of Thermodynamics** [6 Teaching hours]

- 5.1 Thermodynamic systems and direction of thermodynamic processes
- 5.2 Second law of thermodynamics
- 5.3 Heat engines
- 5.4 Internal combustion engines: Otto cycle, Diesel cycle; Carnot cycle
- 5.5 Refrigerator
- 5.6 Entropy and disorder (introduction only)

## **Content Area: Wave and Optics**

### **6. Wave motion** [2 Teaching hours]

- 6.1 Progressive waves
- 6.2 Mathematical description of a wave
- 6.3 Stationary waves

### **7. Mechanical waves** [4 Teaching hours]

- 7.1 Speed of wave motion; Velocity of sound in solid and liquid
- 7.2 Velocity of sound in gas
- 7.3 Laplace's correction
- 7.4 Effect of temperature, pressure, humidity on velocity of sound.

## **8. Wave in pipes and strings** [4 Teaching hours]

- 8.1 Stationary waves in closed and open pipes
- 8.2 Harmonics and overtones in closed and open organ pipes
- 8.3 End correction in pipes
- 8.4 Velocity of transverse waves along a stretched string
- 8.5 Vibration of string and overtones
- 8.6 Laws of vibration of fixed string.

## **9. Acoustic phenomena** [5 Teaching hours]

- 9.1 Sound waves: Pressure amplitude
- 9.2 Characteristics of sound: Intensity; loudness, quality and pitch
- 9.3 Doppler's effect.

## **10. Nature and propagation of Light** [3 Teaching hours]

- 10.1 Huygen's principle
- 10.2 Reflection and Refraction according to wave theory

## **11. Interference** [2 Teaching hours]

- 11.1 Phenomenon of Interferences: Coherent sources
- 11.2 Young's double slit experiment.

## **12. Diffraction** [3 Teaching hours]

- 12.1 Diffraction from a single slit
- 12.2 Diffraction pattern of image; Diffraction grating
- 12.3 Resolving power of optical instruments.

## **13. Polarization** [3 Teaching hours]

- 13.1 Phenomenon of polarization
- 13.2 Brewster's law; transverse nature of light
- 13.3 Polaroid.

## **Content Area: Electricity and Magnetism**

### **14. Electrical circuits** [6 Teaching hours]

14.1 Kirchhoff's law

14.2 Wheatstone bridge circuit; Meter bridge

14.3 Potentiometer: Comparison of e.m.f., measurement of internal resistances of a cell

14.4 Super conductors; Perfect conductors

14.5 Conversion of galvanometer into voltmeter and ammeter; Ohmmeter

14.6 Joule's law

### **15. Thermoelectric effects:** [3 Teaching hours]

15.1 Seebeck effect; Thermocouples

15.2 Peltier effect: Variation of thermoelectric e.m.f. with temperature; Thermopile

### **16. Magnetic field** [9 Teaching hours]

16.1 Magnetic field lines and magnetic flux; Oersted's experiment

16.2 Force on moving charge; Force on a conductor

16.3 Force and Torque on rectangular coil, Moving coil galvanometer

16.4 Hall effect

16.5 Magnetic field of a moving charge

16.6 Biot and Savart law and its application to (i) a circular coil (ii) a long straight conductor (iii) a long solenoid

16.7 Ampere's law and its applications to (i) a long straight conductor (ii) a straight solenoid (iii) a toroidal solenoid

16.8 Force between two parallel conductors carrying current- definition of ampere

### **17. Magnetic properties of materials:** [5 Teaching hours]

17.1 Magnetic field lines and magnetic flux

17.2 Flux density in magnetic material; Relative permeability; Susceptibility

17.3 Hysteresis

17.4 Dia,-para- and ferro-magnetic materials.

### **18. Electromagnetic Induction:** [6 Teaching hours]

18.1 Faraday's laws; Induced electric fields

18.2 Lenz's law, Motional electromotive force

18.3 A.C. generators; Eddy currents

18.4 Self-inductance and mutual inductance

18.5 Energy stored in an inductor

18.6 Transformer.

### **19. Alternating Currents** [6 Teaching hours]

19.1 Peak and rms value of AC current and voltage

19.2 AC through a resistor, a capacitor and an inductor

19.3 Phasor diagram

19.4 Series circuits containing combination of resistance, capacitance and inductance

19.5 Series resonance, quality factor

19.6 Power in AC circuits: power factor

## **Content Area: Modern Physics**

### **20. Electrons** [4 Teaching hours]

20.1 Milikan's oil drop experiment,

20.2 Motion of electron beam in electric and magnetic fields

20.3 Thomson's experiment to determine specific charge of electrons

### **21. Photons** [3 Teaching hours]

21.1 Quantum nature of radiation

21.2 Einstein's photoelectric equation; Stopping potential

21.3 Measurement of Plank's constant

## **22. Semiconductor devices** [6 Teaching hours]

22.1 P-N Junction

22.2 Semiconductor diode: Characteristics in forward and reverse bias

22.3 Full wave rectification

22.4 Logic gates; NOT, OR, AND, NAND and NOR.

## **23. Quantization of energy** [8 Teaching hours]

23.1 Bohr's theory of hydrogen atom

23.2 Spectral series; Excitation and ionization potentials

23.3 Energy level; Emission and absorption spectra

23.4 De Broglie Theory; Duality

23.5 Uncertainty principle

23.6 X-rays: Nature and production; uses

23.7 X-rays diffraction, Bragg's law.

## **24. Radioactivity and nuclear reaction** [6 Teaching hours]

24.1 Alpha-particles; Beta-particles, Gamma rays

24.2 Laws of radioactive disintegration

24.3 Half-life, mean-life and decay constant

24.4 Geiger-Muller Tube

24.5 Carbon dating

24.6 Medical use of nuclear radiation and possible health hazard.

## **25. Recent trends in physics** [6 Teaching hours]

*Seismology:*

25.1 Surface waves: Rayleigh and Love waves

Internal waves: S and P-waves

Wave patterns of Gorkha Earthquake 2015

25.2 Gravitational Wave

Nanotechnology

Higgs Boson