Physics XI Syllabus
Secondary Education Curriculum
2076
Physics

Grade: 12 | Subject Code: Phy. 102
Credit hrs: 5 | Working hrs: 160

Introduction

This curriculum presumes that the students joining grade 11 and 12 science stream come with diverse aspirations, some may continue to higher-level studies in specific areas of science, and others may join technical and vocational areas or even other streams. The curriculum is designed to provide students with a general understanding of the fundamental scientific laws and principles that govern the scientific phenomena in the world. It focuses on developing scientific knowledge, skill competencies and attitudes required at the secondary level (grade 11-12) irrespective of what they do beyond this level, as envisioned by national goals. Understanding of scientific concepts and their application, in day-to-day context as well as the process of obtaining new knowledge through a holistic approach to learning in the spirit of the national qualification framework, is emphasised in the curriculum.

In particular, this curriculum aims to provide sufficient knowledge and understanding of science for all learners to become confident citizens in the technological world. It helps the students to recognise the usefulness and limitations of laws and principles of physics and use them in solving problems encountered in their daily lives along with a sound foundation for students who wish to study physics or related professional or vocational courses in higher education. It also helps to develop science-related attitudes such as a concern for safety and efficiency, concern for accuracy and precision, objectivity, a spirit of enquiry, inventiveness, appreciation of ethnoscience, and willingness to use technology for effective communication. It also promotes awareness of the principles and laws of science that are often the result of cumulative efforts and their studies and applications are subject to economic and technological limitations and social, cultural and ethical perceptions/acceptance.

The curriculum prepared in accordance with National Curriculum Framework is structured for two academic years in such a way that it incorporates the level-wise competencies, grade-wise learning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

Contents

Unit	Content	Teaching hours
Content Area: Mechanics		
1. Rotational dynamics	1.1 Equations 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	7
2.Periodic motion	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	6
3. Fluid statics	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 Poiseullie'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	9
Content Area: Heat and Thermodynamics		
4. First law of Thermodynamics	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 processes.	6

	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	5.1 Thermodynamics systems and direction of thermodynamic processes 5.2 Second law of thermodynamics 5.3 Heat engines 5.4 Internal combustion engines: Carnot cycle, Otto cycle, Diesel cycle 5.5 Refrigerator 5.6 Entropy and disorder (Introduction only)	6
Content Area: Waves and Optics		
6.Wave motion	6.1 Progressive waves 6.2 Mathematical description of a wave 6.3 Stationary waves	2
7. Mechanical waves	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	4
8. Waves in pipes and strings	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 wave along a stretched string 8.5 Vibration of sting and overtones 8.6 Laws of vibration of fixed string	4
9. Acoustic phenomenon	9.1 Sound waves, Pressure amplitude 9.2 Characteristics of sound: Intensity, Loudness, Quality and Pitch 9.3 Doppler's effect	5

10. Nature and propagation of light	10.1 Huygen's principle 10.2 Reflection and Refraction according to wave theory	3
11. Interference	11.1 Phenomenon of Interference, Coherent sources 11.2 Young's double slit experiment	2
12. Diffraction	12.1 Diffraction from a single slit 12.2 Diffraction pattern of image, Diffraction grating 12.3 Resolving power of optical instruments	3
13. Polarisation	13.1 Phenomenon of Polarisation 13.2 Brewster's law, Transverse nature of light 13.3 Polaroid	3
Content Area: Electricity & Magnetism		
14. Electrical circuits	14.1 Kirchhoff's law 14.2 Wheatstone bridge circuit: Metre bridge 14.3 Potentiometer: Comparison of emf, Measurement of internal resistance of a cell 14.4 Superconductors, Perfect conductors 14.5 Conversion of galvanometer into voltmeter and ammeter; Ohmmeter 14.6 Joule's law	6
15. Thermoelectric effects	15.1 Seebeck effect, Thermocouples 15.2 Peltier effect: Variation of thermoelectric emf with temperature, Thermopiles	3
16. Magnetic field	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 application to (i) a long straight conductor (ii) a straight solenoid (iii) a toroidal solenoid	9

	16.8 Force between two parallel conductors carrying current, Definition of ampere	
17. Magnetic properties of materials	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	5
18. Electromagnetic Induction	18.1 Faraday's law; Induced electric fields 18.2 Lenz's law, Motional electromotive force 18.3 AC Generators; Eddy currents 18.4 Self inductance and Mutual inductance 18.5 Energy stored in an inductor 18.6 Transformers	6
19. Alternating currents	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 circuit containing combination of resistance, capacitance and inductance 19.5 Series resonance, Quality factor 19.6 Power in AC circuits, Power factor	6
Content Area: Modern Physics		
20. Electrons	20.1 Millikan'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 electron	4
21. Photons	21.1 Quantum nature of radiation 21.2 Einstein's photoelectric equation; Stopping potential 21.3 Measurement of Planck's constant	3
22. Semiconductor Devices	22.1 P-N Junction 22.2 Semiconductor diodes; Characteristics of forward bias and reverse bias 22.3 Full wave rectification 22.4 Logic gates: NOT, OR, AND, NAND and NOR	6

23. Quantisation of energy	23.1 Bohr's theory of hydrogen atom 23.2 Spectral series, Excitation and Ionisation potentials 23.3 Energy levels, Emission and absorption spectra 23.4 de Broglie hypothesis, Duality 23.5 Uncertainty principle 23.6 X-rays: Nature, production and uses 23.7 X-ray diffraction, Bragg's law	8
24. Radioactivity and Nuclear reactions	24.1 Alpha-particles, Beta-particles and Gamma rays 24.2 Laws of radioactive disintegration 23.3 Half life, Mean life and Decay constant 23.4 Geiger-Muller Tube 23.5 Carbon dating 23.6 Medical uses of nuclear radiations and possible health hazards	6
25. Recent trends in physics	25.1 Seismology: - Surface waves: Rayleigh waves and Love waves - Internal waves: S-waves and P-waves - Wave patterns of Gorkha Earthquake 2015 25.2 Gravitational waves, Nanotechnology and Higgs boson	6

Practical and Project work (32 hrs)

Practical work should be based on a list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for practical work and project work will be as follows:

S. N.	Criteria	Elaboration of criteria
1.	Laboratory experiment	Correctness of apparatus setup/preparation
		Observation/Experimentation
		Tabulation
		Data processing and Analysis

		Conclusion (Value of constants or prediction with justification)
		Handling of errors/precaution
2.	Viva-voce	Understanding of objective of the experiment
		Skills of the handling of apparatus in use
		Overall impression
3.	Practical work records and attendance	Records (number and quality)
4.	Project work	Reports (background, objective, methodology, finding, conclusion
		Presentation