Physics XI Syllabus
Secondary Education Curriculum
2076
Physics

Grade: 11 | Subject Code: Phy. 101
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 to develop 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 emphasized 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. Physical Quantities	1.1. Precision and significant figures. Dimensions and uses of dimensional analysis.	3
2. Vectors	2.1. Triangle, parallelogram and polygon laws of vectors 2.2. Resolution of vectors; Unit vectors 2.3. Scalar and vector products.	4
3. Kinematics	3.1 Instantaneous velocity and acceleration 3.2 Relative velocity 3.3 Equation of motion (graphical treatment) 3.4 Motion of a freely falling body 3.5 Projectile motion and its applications.	5
4. Dynamics	4.1 Linear momentum, Impulse 4.2 Conservation of linear momentum 4.3 Application of Newton's laws 4.4 Moment, torque and equilibrium 4.5 Solid friction: Laws of solid friction and their verifications.	6
5. Work, energy and power	5.1 Work done by a constant force and a variable force 5.2 Power 5.3 Work-energy theorem; Kinetic and potential energy 5.4 Conservation of Energy 5.5 Conservative and non-conservative forces 5.6 Elastic and inelastic collisions	6
6. Circular Motion	6.1 Angular displacement, velocity and acceleration 6.2 Relation between angular and linear velocity and acceleration 6.3 Centripetal acceleration 6.4 Centripetal force 6.7 Conical pendulum	6

	6.8 Motion in a vertical circle 6.9 Applications of banking.	
7. Gravitation	7.1 Newton's law of gravitation 7.2 Gravitational field strength 7.3 Gravitational potential; Gravitational potential energy 7.4 Variation in value of 'g' due to altitude and depth 7.5 Centre of mass and centre of gravity 7.6 Motion of a satellite: Orbital velocity and time period of the satellite 7.7 Escape velocity 7.8 Potential and kinetic energy of the satellite 7.9 Geostationary satellite 7.10 GPS	10
8. Elasticity	8.1 Hooke's law: Force constant 8.2 Stress; Strain; Elasticity and plasticity 8.3 Elastic modulus: Young modulus, bulk modulus, shear modulus 8.4 Poisson's ratio 8.5 Elastic potential energy.	5
Content Area: Heat and Thermodynamics		
9. Heat and Temperature	9.1 Molecular concept of thermal energy, heat and temperature, and cause and direction of heat flow 9.2 Meaning of thermal equilibrium and Zeroth law of thermodynamics. 9.3 Thermal equilibrium as a working principle of a mercury thermometer.	3
10. Thermal Expansion	10.1 Linear expansion and its measurement 10.2 Cubical expansion, superficial expansion and its relation with linear expansion 10.3 Liquid Expansion: Absolute and apparent 10.4 Dulong and Petit method of determining expansivity of liquid	4

11. Quantity of Heat	11.1 Newton's law of cooling 11.2 Measurement of specific heat capacity of solids and liquids 11.3 Change of phases: Latent heat 11.4 Specific latent heat of fusion and vaporization 11.5 Measurement of specific latent heat of fusion and vaporization 11.6 Triple point	6
12. Rate of heat flow	12.1 Conduction: Thermal conductivity and measurement 12.2 Convection 12.3 Radiation: Ideal radiator 12.4 Black-body radiation 12.5 Stefan-Boltzmann law	5
13. Ideal gas	13.1 Ideal gas equation 13.2 Molecular properties of matter 13.3 Kinetic-molecular model of an ideal gas 13.4 Derivation of pressure exerted by gas 13.5 Average translational kinetic energy of gas molecule 13.6 Boltzmann constant, root mean square speed 13.7 Heat capacities: gases and solids	8
Content Area: Waves & Optics		
14. Reflection at curved mirror	14.1 Real and Virtual images 14.2 Mirror formula	2
15. Refraction at plane surfaces	15.1 Laws of refraction: Refractive index 15.2 Relation between refractive indices 15.3 Lateral shift 15.4 Total internal reflection	4

16. Refraction through prisms	16.1 Minimum deviation condition 16.2 Relation between the angle of prism, minimum deviation and refractive index 16.3 Deviation in small-angle prism	4
17. Lenses	17.1 Spherical lenses, angular magnification 17.2 Lens maker's formula 17.3 Power of a lens	3
18. Dispersion	18.1 Pure spectrum and dispersive power 18.2 Chromatic and spherical aberration 18.3 Achromatism and its applications	3
Content Area: Electricity & Magnetism		
19. Electric Charges	19.1 Electric charges 19.2 Charging by induction 19.3 Coulomb's law- Force between two point charges 19.4 Force between multiple electric charges.	3
20. Electric field	20.1 Electric field due to point charges; Field lines 20.2 Gauss Law: Electric Flux 20.3 Application of Gauss law: Field of a charge sphere, line charge, charged plane conductor	3

21. Potential, potential difference and potential energy	21.1 Potential difference, Potential due to a point, Charge, potential energy, electron volt 21.2 Equipotential lines and surfaces 21.3 Potential gradient	4
22. Capacitor	22.1 Capacitance and capacitor 22.2 Parallel plate capacitor 22.3 Combination of capacitors 22.4 Energy of charged capacitor 22.5 Effect of a dielectric Polarization and displacement.	5
23. DC Circuits	23.1 Electric Currents; Drift velocity and its relation with current 23.2 Ohm's law; Electrical Resistance; Resistivity; Conductivity 23.3 Current-voltage relations; Ohmic and Non-Ohmic resistance 23.4 Resistances in series and parallel 23.5 Potential divider 23.6 Electromotive force of a source, internal resistance 23.7 Work and power in electrical circuits	10
Content Area: Modern Physics		
24. Nuclear physics	24.1 Nucleus: Discovery of nucleus 24.2 Nuclear density; Mass number; Atomic number 24.3 Atomic mass; Isotopes 24.4 Einstein's mass-energy relation 24.5 Mass Defect, packing fraction, BE per nucleon 24.6 Creation and annihilation 24.7 Nuclear fission and fusion	4
25. Solids	25.1 Energy bands in solids (qualitative ideas) 25.2 Difference between metals, insulators and semiconductors using band theory 25.3 Intrinsic and extrinsic semiconductors	3

26. Recent Trends in physics	26.1 Particle physics: Particles and antiparticles, Quarks (baryons and meson) and leptons (neutrinos) 26.2 Universe: Big Bang and Hubble law: expansion of the Universe, Dark matter, Black Hole and gravitational wave	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