Physics
Code No. 312

Introduction

Physics is a fundamental science because it deals with the basic features of the world, such as, time, space, motion, charge, matter and radiation. Every event that occurs in the natural world has some features that can be viewed in these terms. Study of physics is a means of rationally understanding nature. Physics lies behind all technological advancements, such as computer, internet, launching of rockets and satellites, radio and T.V. communications, lasers, etc. It also finds applications in such simple activities of men as lifting a heavy weight or making a long jump. Physics is, thus, an all pervading science and its study helps us in finding answers to whys and hows of our day to day happenings.

Rationale

Keeping in view the issues highlighted in the National Curriculum Framework (NCF) 2005 for School Education, present Physics curriculum has been so designed that it not only focuses on the basic concepts of Physics but relates them to the daily life activities. The applications of the laws of Physics and their effects on daily life have been reflected in the curriculum. The basic themes of Physics which would be of interest to all, particularly to those who are interested in pursuing Physics as a career in life have been selected to form core content of the curriculum. Besides, the curriculum also includes such emerging areas as electronics, communication, nuclear physics which find immense applications in daily life.

Though mathematics is basic to the understanding of most of the problems of physics, in the present course, stress has been given to avoid rigour of mathematics like integration and differentiation. The focus has been to teach concepts of physics rather than mathematical calculations.

Objectives

After completing this course, the learner will be able to:

- develop understanding of concepts, fundamental laws, principles and processes in the area of physics;
- establish relationship between causes and effects of physical phenomenon;
- explain the contributions of physics towards improving quality of life;
- create interest in physics and foster a spirit of enquiry;
- develop experimental skills like taking observations, manipulation of equipment, and communicative skills such as reporting   of observations and experimental results;
- develop problem solving ability e.g. analyzing a situation or data, establishing relationship between cause and effect;

- develop scientific temper of mind by making judgment on verified facts and not opinions, by showing willingness to accept new ideas and discoveries; and

- develop awareness of the dangers inherent in the possible misuse of scientific knowledge.

Scope and job opportunity

This field has a large number of opportunities for employment, some of these are:

- career in engineering and medical

- career in teaching in schools , colleges and universities

- job in research institute and laboratories

- opportunities in aviation industry, defence sector, power generating companies and hospitals.

Eligibility conditions

Age: 15 Years

Qualification: 10th Pass

Medium of instruction: Hindi, English, Urdu, Bengali, Gujarati and Odia.

Duration of the course: 1 Year

Weightage

Theory: 80 Marks

Practical: 20 Marks

Tutor Marked Assignment (TMA): 20% Marks of the theory

Scheme of studies: Theory (240 hours), TMA (self paced)

Scheme of evaluation:

Mode of evaluation	Syllabus/Contents	Duration	Weightage
Tutor Marked Assignment (TMA)	All contents marked as TMA	Self paced	20%
Public/Final examination	All contents marked as PE Practical	3 Hours (Theory) 3 Hours (Practical)	80%

Pass criteria: 33% Marks in each component.

Course content

S. No.	Module/Topics	Duration (in hours)	Module Approach (Theory)	Description of practicals	Weightage (marks)
1.	**Module–I** **Motion, Force and Energy** 1. Physical Worlds and Measurements 2. Motion in a Straight line 3. Laws of motion 4. Motion in a plane 5. Gravitation 6. Work, Energy and Power 7. Motion of a Rigid Body	45	Besides highlighting the importance of universal standard units of measurement, applications of dimensions and vectors in the study of physics have been described in this module. The physics scope, need of measurement, concept of motion and rest, cause of motion and different types of motion has been described with the help of daily life examples. Significance of gravitation, concept of work and energy are highlighted. The basics of the motion of a rigid body and the significance of rotational motion in day to day life have been explained.	To determine the internal diameter and depth of a cylindrical container (like tin can, calorimeter) using a Vernier calipers and find its capacity. Verify the result using a graduated cylinder. To determine the diameter of a given wire using a screw gauge. To determine the radius of curvature of a concave mirror using a spherometer. To find the time period of a simple pendulum for small amplitude and draw the graph of length of the pendulum against square of the time period. Use the graph to find the length of the second's pendulum. To find the weight of a given body using law of parallelogram of vectors.	14

| 2. | **Module–II**
Mechanics of Solids and Fluids
8. Elastic Properties of Solids
9. Properties of Fluids | 20 | The classification of the substances into solids, liquids and gases is done on the basis of intermolecular forces. This module explains the elastic behaviour of the solids and highlights source of elastic behaviour of solids. The mechanical properties of the fluids like buoyancy, surface tension, capillary action etc. have been explained with the help of daily life examples and their applications have been highlighted. | To measure extensions in the length of a helical spring with increasing load. Find the spring constant of the spring extension graph.
To find the time required to empty a burette filled with water, to ½ of its volume, to ¼ of its volume, to 1/8 of its volume and so on. Then plot a graph between volume of water in the burette and time and thus study at each stage that the fractional rate of flow is same (analogy to radio-active decay). | 06 |
| 3. | **Module–III**
Thermal Physics
10. Kinetic Theory of Gases
11. Thermodynamics
12. Heat Transfer and Solar Energy | 25 | Thermal energy theory has been described. Behaviour of gases and the gas laws have been described with the help of kinetic theory of gases. The concept of temperature has been explained by thermal equilibrium. Black | To study the Newton's loaf of cooling by plotting a graph between cooling time and temperature, difference between calorimeter and surroundings.
To determine the specific heat of a solid using the method of mixtures. | 06 |

			Body Radiation, laws of thermodynamics and their applications in our day to day life have been explained in this module. Working of heat engines and refrigerators has been explained. Different modes of transfer of heat and their applications in different situations have been emphasized. The concept of thermal pollution and the issue of green house effect are also dealt with in this module.		
4.	**Module–IV** **Oscillations and Waves** 13. Simple Harmonic Motion 14. Wave Phenomena	20	Besides explaining the terms associated with periodic motion, the harmonic motion has been described with the help of common examples. A qualitative idea of forced oscillations, resonance and damped oscillations has also been given in	To compare the frequencies of two tuning forks by finding first and second resonance positions in a resonance tube. To establish graphically the relation between the tension and length of a string of a sonometer vibrating in its fundamental model resonating with a	06

				the module.	given tuning fork. Use the graph to determine the mass per unit length of the string.	
					To determine the wavelength of sound produced (i) in air column, (ii) the velocity of sound in air at room temperature using a resonance column and a tuning fork.	
5.	**Module–V** **Electricity and Magnetism** 15. Electric Charge and Electric Field 16. Electric Potential and Capacitors 17. Electric Current 18. Magnetism and Magnetic Effect of Electric Current 19. Electromagnetic Induction and Alternating Current	45		The basic concepts of electrostatics and frictional electricity have been described in the module. The electric field and electric potential due to a point charge have been explained. Different types of capacitors, their combinations and applications have been explained. The electric current and thermal and magnetic effects of current are explained in the module. Significance of magnetic effect of current and	To verify the law of combination (series and parallel) of resistances using ammeter- voltmeter method and coils of known resistances. To compare the e.m.f's of two given primary cells by using a potentiometer. To determine the specific resistance of the material of two given wires using a metre bridge. To determine the internal resistance of a primary cell using a potentiometer. To determine the inductance and resistance of a given coil (inductor) using a suitable series	16

			electromagnetic induction has been emphasized. The generation and transmission of current power and the problems of low voltage and load shedding have been explained.	resistance and an AC voltmeter. To study decay of current in a R.C. circuit while charging the capacitor, using a galvanometer and find the time constant of the circuit. To draw the lines of force due to a bar magnet keep (i) N-pole pointing to north (ii) N-pole pointing to South. Locate the neutral points. To determine the internal resistance of a moving coil galvanometer by half deflection method, and to convert it into a voltmeter of a given range, say (0-3V), and verify it.	
6.	**Module–VI** **Optics and Optical Instruments** 20. Reflection and Refraction of Light 21. Dispersion and Scattering of light 22. Wave Phenomena and Light 23. Optical Instruments	25	After giving a brief introduction of reflection of light, the basic concepts like refraction, total internal reflection, dispersion, scattering, of light have been described in the module. The wave properties of light like interference, diffraction and polarization are	To find the value of v for different values of i in case of a concave mirror and find its focal length (f) by plotting graph between $1/u$ and $1/v$. To find the focal length (f) of a convex lens by plotting graph between $1/u$ and $1/v$. To find the focal length (f) of a convex mirror using a convex lens.	14

			also described in a qualitative manner. Further applications of the properties of light have been described to construct various types of optical instruments. Elementary idea of Raman Effect is also discussed.	Determine the focal length of a concave lens by combining it with a suitable convex lens. To draw a graph between the angle of incidence (i) and angle of deviation (D) for a glass prism and to determine the refractive index of the glass of the prism using this graph. To compare the refractive indices of two transparent liquids using a concave mirror and a single pin. To set up an astronomical telescope and find its magnifying power.	
7.	**Module–VII** **Atoms and Nuclei** 24. Structure of Atom 25. Dual Nature of Radiation and Matter 26. Nuclei and Radioactivity 27. Nuclear Fission and Fusion	25	Different atomic models describing the structure of atom have been described and the limitations of these and their modifications have been systematically presented in the module. Nuclei and radio activity have been explained along with their applications. The		08

			peaceful uses of nuclear energy have been described highlighting the latest trends.		
8.	**Module–VIII** **Semiconductor Devices and Communication** 28. Semiconductors and Semiconducting Devices 29. Applications of Semiconductor Devices 30. Communication Systems	35	Semiconductors find a very significant place in almost all the electronic devices. Besides highlighting the basis of semiconductors, different types of semiconductor devices and their applications have been explained in the module. In the present age of information and communication technology, it is essential for all to know the basic of electronics and communication technology. Working principles of communication systems, the communication techniques and media used in daily life have been explained.	To draw the characteristic curve of a forward biased pn junction diode and to determine the static and dynamic resistance of the diode. To draw the characteristics of an npn transistor in common emitter mode. From the characteristics find out (i) the current gain (â) of the transistor and (ii) the voltage gain Av with a load resistance of 1 k Ω.	**10**