

PHYSICS EDUCATION

Code:.....

GRADE- XI

Full Marks: 75

Teaching hours: 150

I. Introduction

This physics education curriculum is designed to provide prospective teachers to be students with suitable knowledge and awareness of the physical world relevant to those who wish to continue their studies to a higher level in science education. It is intended that teachers to be students who follow this syllabus will have an opportunity to see physics within the overall framework of physical world and as a contribution to life in modern society in relation to school age learners (students).

At all times the quantitative as well as qualitative aspects of physics education must be (emphasized) stressed. This will involve the derivation of suitable mathematical models and equations. The course will emphasize the use of SI system of units and its applications of physics.

The need for teachers to be students take active participation in the learning process through suitable experimentation, demonstration and school curriculum related activities by teachers leading to the understanding of the basic concepts.

II. General Objectives

At the completion of this syllabus, the prospective teachers should be able to:

- a. familiarize and acquire scientific knowledge and advancements in physics education;
- b. present and consolidate the learning of physics achieved in the secondary level;
- c. stimulate and sustain an interest in physics and its application;
- d. show that physics is a coherent and developing framework of knowledge, based on fundamental theories of structure and processes of the physical world;
- e. provide a basic knowledge and understanding of the principles and applications of physics which contribute to the quality of life in a technologically based society;
- f. encourage students to apply, quantitatively and qualitatively, their knowledge and understanding of physical principles to familiar and unfamiliar situations and
- g. practice in class the presentation of suitable lessons related to school curriculum.

III. Specific Objectives

At the completion of all the units of this syllabus, the prospective teachers will be able to

1. recall facts, vocabulary, conventions, physical quantities and units in which they are measured;
2. write, explain definitions, laws, concepts, theories and models;
3. describe the use, application and implications of physical facts and principles;
4. translate information from one form to another;
5. present information in the language of physics;
6. draw conclusions and formulate generalizations and
7. derive appropriate equations, formulas from the given conditions.

COURSE UNITS, TITLES, AND CONTENTS

Unit-I : Mechanics

Teaching hours –45 hrs

- **Measurement** – Needs, System of units, Simple Dimensions, Significant figures, Accuracy of measurement.
- **Scalar and vector quantities** - Meaning-Unit vector, Null vector. Distinction between them with examples.
- **Addition and Resolution of vectors** – Addition and resolution of vectors, Composition of vectors by its rectangular components. (with reference to displacement of velocity, force and momentum)
- **Motion** – Rest, Motion, Speed, Velocity, Acceleration (definition, types, examples, representation). Equations of uniformity, Accelerated motion derivation, Problem solving based on equation only. Laws of motion (statements, types, examples with everyday life only). Linear momentum, Conservation of momentum (definition, examples, problem solving). Projectile motion, General derivation of time of flight, maximum height, horizontal range, application in daily life. Circular motion, Centripetal force, Centrifugal reaction force.
- **Gravitation** – Gravitational force, Newton’s laws of gravitation, Mass and average density of earth, Variation of ‘g’ with altitude and depth, Earths mass and its average density (meaning, derivation and calculations), Weight and weightlessness (meaning, examples), Freefall.
- **Work, Power and Energy** – Work (definition, unit, treatment, work done against gravitational force, examples). Power (definition, unit and examples). Energy (P.E, K.E, definitions, unit, derivations, inter conversion, conservation of energy with examples). Various sources of energy (brief account of various sources, implication, future needs of Nepal, Energy crisis).
 - a) **Teaching Learning Activities** – Lecture, Demonstration and Student activity-Verification of law of parallelogram, Demonstration, Measuring, Project work, Determination of ‘g’, survey of energy crisis in the community and alternative sources of energy used.
 - b) **Teaching Materials** – Scale, Vernier Callipers

Unit-II : Hydrostatics

Teaching hours – 5hrs

- Pressure, Variation in atmospheric pressure, Archimede’s Principle
 - a) **Teaching and Learning Activities** – Lecture, Demonstration, Verification of Archimede’s Principle, Student Activity and Determination of density of solids.
 - b) **Teaching Materials** – Hydrostatic Balance, Spring Balance.

Unit-III : Wave motion and sound

Teaching hours – 25hrs

- **Vibratory motion** – Simple Harmonic motion, meaning, characteristics, derivation of expression for displacement, velocity, acceleration and time period of a particle executing SHM, Simple pendulum and its laws, Derivation of its time period.

- **Waves** – Meaning, Types (Transverse, Longitudinal, Standing), Simple treatment with examples, Waves as carrier of energy, Compressional waves (simple way), Sound waves.
 - **Speed of sound** – Newton’s formula and Laplace correction, Audible sound – Audible frequency range, Sound Intensity – Characteristics of sound, Musical and Noise (loudness, intensity level, pitch quality, simple treatment).
- a) **Teaching and Learning Activities** – Lecture and Demonstration of waves in spring, Experimentation and Student Activity.
- b) **Teaching Materials** – Spring

Unit-IV : Optics

Teaching hours – 15hrs

- **Reflection and refraction of light** – Mirror, Glass Slab, Lens, Prism (definition, function, uses)
 - **Lens** – Image formation, focusing by refraction, Magnification, Magnifying power, Power of lens, Dispersion, Spectrum.
 - **Optical instruments** – Simple microscope, Compound microscope, Telescope (Astronomical /refracting), Meaning, Construction, Working and Magnifying Power.
- a) **Teaching and Learning Activities** – Lecture, Demonstration, Experimentation, Verification of laws of reflection and refraction of light, Demonstration of spectrum and Magnifying power and Project work.
- b) **Teaching Materials** – Mirror, Glass slab, Prism, Lens.

Unit-V : Magnetism and Electricity

Teaching hours – 15hrs

- **Magnetic elements** – Declination, Inclination, Horizontal components of earths field (definition, meaning only)
 - **Magnetic effect of current** – Oersted’s experiment, Maxwell’s cork Screw rule, Right hand rule, Amperes swimming rule. (meaning and examples)
 - **Faraday’s laws of electromagnetic induction** – Lenz’s law, Self Induction (meaning and statement), Transformer (meaning, type, theory, power losses in a transformer and uses).
 - **AC Generator, Dynamo** – Meaning, Principle, Simple Construction, Working and Derivation of induced emf.
 - **DC Generator** – Meaning, Principle, Simple construction, working only.
- a) **Teaching and Learning Activities** – Lecture, Demonstrations, Experimentation, Student Activity, Project Work.
- b) **Teaching Materials** – Charts, Models.

Unit-VI : Heat

Teaching hours – 15hrs

- **Concept of heat and temperature and its units**
 - **Thermometry** – Temperature, Scales, Kinetic interpretation, Definition, Scale, Types, Significance of scale.
 - **Thermal Expansion** – Linear, Volume Expansion, meaning, Expansion, Derivation, Bimetallic Thermostat (meaning and uses)
 - **Specific heat** – Solids, Liquids, Meaning, Determination, Measurement.
- a) **Teaching and Learning Activities** – Lecture, Demonstrations of bimetallic strip, Experimentation, determination of linear expansion and Student activity.

b) **Teaching Materials** – Bimetallic strip.

Unit-VII : Electrostatic Force

Teaching hours – 5hrs

- Introduction, Types of charge, Insulator and Conductor, Quantization of electric charge (basic treatment only)
- a) **Teaching and Learning Activities** – Lecture, Demonstration, Experimentation and Student Activity.
- b) **Teaching Materials** -Testing of charges

Unit-VIII : Modern Physics

Teaching hours – 10 hrs

- **Cathode Rays, X-Rays, Radioactivity** – Meaning, Properties, Uses only.
- **Nuclear Reaction** – Meaning, Type, Simple theoretical treatment only.
- **Nuclear reactions in the Sun** – Brief account only.
- a) **Teaching and Learning Activities** – Lecture, Demonstration, Experimentation, Student Activity.
- b) **Teaching Materials** - Charts, Demonstrations, Survey of X-Rays in community.

Unit-IX : Astronomy

Teaching hours – 15 hrs

- **Important constituents of the Universe** (Solar System, Stars, Galaxies (meaning and types)).
- **Astronomical Instruments** – Meaning, Types, Description, Uses, Advantages
- **Solar System** – Distance, Size, Rotation, Mass, Surface temperature, Atmosphere, Significance of study. (Simple descriptive treatment, Comparative study)
- **Galaxy** – Meaning and types
- **Stars** – Birth and Death of stars (different stages) and Significance.
- a) **Teaching and Learning Activities** – Lecture and Demonstration, Survey, Project.
- b) **Teaching Materials** - Charts, Models, Observation appliances.

**PHYSICS EDUCATION
PRACTICAL**

Full Marks : 25

Teaching hours:2periods/week

This list of practical activities for class eleven (science education) includes those experiments which are to be demonstrated and those which the students themselves are to do. The two categories have not however been separated.

Objectives :

After completing the practical course students will have skill in:

1. developing skills of making careful observations, collecting data and calculating the results of activity /experiments.
2. developing the abilities to interpret the results of the activity /experiments and understand implications of the results.
3. developing skills of setting up appropriate apparatus for activity/ experiments.
4. improving apparatus suitable for school level activity.

List of activities /experiments

1. Measurement of weight, length, volume, density (2)
2. Simple experiments involving timing and oscillations. (1)
3. Simple activities to study the expansion solids and liquids. (2)
4. Optic experiments requiring the plotting of rays of light using pins.
5. Optic experiments with mirrors, lens, slabs and prism. (3)
6. Suitable experiments on heat (thermometry, expansion). (1)
7. Prepare models and charts of solar system. (2)
8. Study electrostatic properties by improvised apparatus. (1)
9. Prepare improvised apparatus related to school curriculum. (Heat, Mechanics, Magnetism, Electricity, Light, Electrostatics) (6)
10. Study magnetic properties of iron, steel. (1)
11. Prepare working model of electric motor. (2)
12. Magnetize given material using direct current. (1)

Note: (No. of Activities /Experiments) eg. (2)

Evaluation Scheme

Out of the total coverage Theory portion will cover 75% and rest 25% will be covered by practical.

In theory portion Questions will be of two groups

Long questions each carrying 9.5 marks 2 to be attempted out of 4 choices. 19

Short questions each carrying 4.0 marks 14 to be attempted out of 20 choices. 56

Total : 75

Theory 75 marks

Units	Title	Short questions		Long questions	
		To be attempted	Choices	To be attempted	Choices
Unit I	Mechanics	14	5	2	1
Unit II	Hydrostatics		1		
Unit III	Wave motion and sound		3		1
Unit IV	Optics		2		
Unit V	Magnetism and Electricity		2		1
Unit VI	Heat		2		
Unit VII	Electrostatic Force		1		
Unit VIII	Modern Physics		2		1
Unit IX	Astronomy		2		
	Total		20		4

Practical Marks

1)	Experiment (Theory 2, Obs. 4, Results 4)-	10
2)	Activity (School Curriculum) improvisation, item preparation-	8
3)	Oral /Viva –	3
4)	Note book –	4
		25

Textbooks/ references

- 1) J.M Pradhan ,Text book of Practical Physics, Ratna Pustak Bhanbar
- 2) N. Subrahmanyam Brij Lal Principle of Physics, S.Chand and Company
- 3) J.M Pradhan, Text book of Physics
- 4) Gurdeep and Naurala, Physics for class XI and XII .

**Physics Education
Grade XI
(Sample Model Questions)**

F.M. — 75

P.M. — 27

Time — 3 hrs

Candidates are required to give their answers in their own words as far as practicable.

Group A

Short answer questions

Answer any fourteen questions only

(4×14=56)

1. Define Dimension. Explain significant figure with a suitable example.
2. Explain the terms Scaler and vector quantities. Explain vector addition with example.
3. Define centripetal force. Calculate the force acting on body moving with a uniform speed along a circular path.
4. Explain projectile motion with the help of a suitable illustration. Show that the horizontal range is maximum when the projectile makes an angle of 45° .
5. State Newton's Law of Gravitation. Derive a relation between 'g' and 'G'.
6. State and explain Archimedes principle with a suitable example. Mention the law of liquid pressure.
7. Derive an expression for a particle executing a simple harmonic motion.
8. Explain with suitable example the laws of simple pendulum.
9. Calculate the length of a second's pendulum on a planet named 'X' of mass 6.1×10^{27} gm and radius 6.37×10^8 . (given $G=6.6710^{-8}$ cgs unit)
10. Prove the relation. $i+e=A+D$ for a prism.
11. Define magnification and lens. How far from a convex lens of focal length 20 cm. Would an object be placed in order to get an image enlarged three times? Illustrate your answer.
12. Explain the terms Declination, Dip and the horizontal component of earth's field with suitable Illustrations.
13. Explain the magnetic effect of current on the basis of Oersted's experiment and Right Hand Rule.
14. Explain the main differences between Heat and Temperature with suitable activities.
15. Derive a mathematical relation for coefficient of linear expansion of a solid.

16. Explain with suitable illustration the phenomenon of charging by friction.
17. List the properties of X-ray.
18. Explain with suitable illustration the difference between nuclear fusion and nuclear fission.
19. Explain the importance of astronomical instruments.
20. Define Galaxy. Explain the classification and significant features of each galaxy.

Group B

Long questions

Answer any two only

2×9.5=19

21. Define force, work energy and power along with their units. State the principle of conservation of momentum with suitable illustration.
A pump can hoist 9,000kg of coal per hour from a mine 120 m deep. Calculate the power of the pump in watts assuming its efficiency to be 75%.
22. Explain the working principle of a hydraulic press with the help of a labeled diagram.
A cylinder of 25cm length and having a cross section area of 8 square cm is filled with water. Calculate the pressure and the thrust of water on the bottom of the cylinder.
23. Explain the phenomenon of Total Internal Reflection. Why is it so named ? Show that for a convex lens $1/f=1/u+1/v$. Explain the term magnetic elements.
24. Describe historical development of astronomical instrument from Sundial, Astrolab, Armillary sphere and Quadrant. Mention the basic principle of a reflecting telescope.