PHYSICS
Grade: XI

Full marks: 100 (75T + 25 P)
Pass Marks: 27T + 8P
Teaching hours: 150T +50P
Nature of course: Theory +Practical

1. Introduction

The curriculum in Physics is designed to provide students with an understanding of the scientific laws and principles of the physical world. As expected this curriculum will provide an opportunity to the students to see physics as a contribution to life in modern society.
The course demands emphasis on conceptual understanding of the physical phenomena. This will involve the proper utilization of suitable mathematical models and equations. The applications of the physics together with the social and environmental aspects need to be emphasized whenever possible. The students are expected to actively participate in the learning process trough experimentation supplemented by demonstration, discussions and problem solving.
The practical component of this course is designed to supplement learning through the application of the learned theory. The students will handle simple apparatus to do simple measurements, verifies physical laws and apply their knowledge of physics to real life example.

2. Objectives

2.1 General objectives

The general objectives of this course are:

a. to provide students with sufficient understanding and knowledge of the fundamental principles of physics and their applications;
b. to develop the skills of experimenting, observing, interpreting data evaluating evidence and formulating generalizations and models; and
c. to explain the social, economic, environmental and other implications of physics and appreciate the advancement of physics and its applications as essential for the growth of national economy.

2.2 Specific Objective

Upon completion of this course, the students will be able to:

1. describe physics as a coherent and developing framework of knowledge based on fundamental theories of the structure and process of the physical world;
2. explain phenomena in terms of theories and models;
3. apply quantitatively and qualitatively the knowledge and understanding of physical principles and theories;
4. translate information from one from to another;
5. present information in the language of physics or other appropriate form; and

6. design simple experiment to develop relations among physical quantities and draw conclusions.

3. Course contents

Unit -1 Mechanics **70 teaching hours**

1. Physical Quantities – Need for measurements; system of units; S.I. unit; Precision and significant figures; Dimensions; Main uses of dimensional equations. (3 hrs)
2. Vectors-Graphical presentation of vectors; Addition and subtraction of vectors: Parallelogram, triangle and polygon laws of vectors; Resolution of vectors; Unit vectors; Scalar and vector products. (6 hrs)
3. Kinematics- Uniform and non-uniform motion; average velocity and acceleration, Instantaneous velocity and acceleration; Equation of motion (graphical treatment); Motion of a freely falling body; Relative velocity; Projectile motion. (3 hrs)
4. Laws of Motion-Newton's laws of motion; Inertia, force, linear momentum, impulse, Conservation of linear momentum; Free-body diagrams; Solid frictions: Laws of solid friction and their verifications; Application of Newton's laws: Particles in equilibrium, dynamics of particles. (8 hrs)
5. Work, and Energy -Work; work done by a constant force and a variable force; Power; Energy: Kinetic energy; work- energy theorem, Potential energy; conservation of energy; Conservative and non-conservative forces; elastic and inelastic collision. (4 hrs)
6. Circular Motion-Angular displacement, velocity and acceleration; Relation between angular and linear velocity and acceleration; Centripetal acceleration, centripetal force; Conical pendulum; Motion in a vertical circle; Motion of cars and cyclist round a banked track. (5 hrs)
7. Gravitation-Newton's laws of gravitation; acceleration due to gravity, g; Mass and weight; gravitational field strength, variation in value of 'g' due to altitude, depth and rotation of earth; Weightlessness; Motion of a satellites: Orbital velocity, height and time period of a satellite, geostationary satellite, potential and kinetic energy of a satellite; Gravitational potential: Gravitational potential energy; Escape velocity; Black holes. (9 hrs)
8. Equilibrium- Moment of forces; Torque; Torque due to a couple; Center of mass; Center of gravity; Conditions of equilibrium. (2 hrs)
9. Rotational Dynamics- Rotation of rigid bodies; Equation of angular motion; Relation between linear and angular kinematics; Kinetic energy of rotation of rigid bodies; moment of inertia: Radius of gyration, Moment of inertia of a uniform rod; Torque and angular acceleration for a rigid body; Work and power in rotational motion; angular momentum; Conservation of angular momentum. (8 hrs)
10. Elasticity – Hooke's law: Force constant, Verification of Hooke's law; Stress; Strain; Elasticity and plasticity; Elastic modulus: Young modulus and its determination, Bulk modulus, Shear modulus, Poisson's ratio, Elastic potential energy. (6 hrs)
11. Periodic motion – Oscillatory motion; Circle of reference; Equation of Simple Harmonic Motion (SHM); Energy in SHM; Application of SHM; Motion of a body suspended from coiled spring, angular SHM; simple pendulum; Damped oscillation; Forced oscillation and resonance. (6 hrs)
12. Fluid mechanics- Fluid statics: Density; Pressure in a fluid; Archimedes Principle; Buoyancy

Surface tension: Molecular theory of Surface tension; Surface energy; Angle of contact and capillarity; Measurement of coefficient of surface tension by capillary tube method.
Fluid Dynamics: Newton's formula for viscosity in a liquid; Coefficient of viscosity; Laminar and turbulent flow; Poiseuille's formula (method of dimensions); Stokes law and its applications; Measurement of viscosity of viscous liquid; Equation of continuity; Bernoulli's equation and its applications. (10 hrs)

Unit-2 Heat and thermodynamics 40 teaching hours

1. Heat and temperature- Concept of temperature; Thermal equilibrium,
   Thermal expansion: linear expansion, cubical expansions and their relation: Measurement of linear expansivity,
   Liquid Expansion: Absolute and apparent expansion of liquid, Measurement of absolute expansivity by Dulong and Petit method. (5 hrs)
2. Quantity of heat: Heat capacity and specific heat capacity; Newton's law of cooling; Measurement of specific heat capacity of solids by the method of mixture and of liquids by the method cooling.
   Change of phases: Latent heat; Specific latent heat of fusion, and vaporization and their measurements by the method of mixture. (5 hrs)
3. Thermal properties of matter- Equation of state: Ideal gas equation; P-V diagram; Molecular properties of matter; Kinetic- molecular model of an ideal gas: Derivation of pressure exerted by gas, average translational kinetic energy of a gas molecule; Boltzman constant, Root mean square speed; Heat capacities: heat capacities of gases and solids. (8 hrs)
4. Hygrometry- Saturated and unsaturated vapor pressure; Behavior of saturated vapor; Boiling point; Triple point and critical point; Dew point, Absolute humidity; Relative humidity and its determination. (3 hrs)
5. Transfer of heat- Conduction, Thermal conductivity and its determination by Searle's method;
   Convection: convective coefficient
   Radiation: Ideal radiator; Black body radiation; Stefan-Boltzmann law (4 hrs)
6. First law of thermodynamics- Thermodynamic systems; Work done during volume change, Heat and work; Internal energy and First law of thermodynamics; Thermodynamic processes: Adiabatic, Isochoric, Isothermal, Isobaric processes; Heat capacities of ideal gas at constant pressure and volume and relation between them; Isothermal and Adiabatic processes for an ideal gas. (9 hrs)
7. Second law of thermodynamics- Direction of Thermodynamic processes; Second law of thermodynamics; Heat engines; Internal combustion engines: Otto Cycle, Diesel cycle; Carnot cycle; Kelvin temperature scale; Refrigerators; Entropy and disorder (introduction only) (6 hrs)

Unit-3 Geometrical Optics **20 teaching hours**

1. Photometry, Reflection at curved mirrors- Convex and concave mirrors; Image in Spherical mirrors, Mirrors formula; Real and Virtual images. (2 hrs)
2. Refraction at plane surfaces- Laws of refraction: Refractive index; Relation between refractive indices; Lateral shift; Total internal reflection and its applications; critical angle; optical fiber. (3 hrs)
3. Refraction through prisms- Minimum deviation; Relation between Angle of prism, minimum deviation and refractive index; Deviation in small angle prism. (3 hrs)
4. Lenses- Spherical lenses; thin lens formula; Lens maker's formula; Power of a lens; Combination of thin lenses in contact. (4 hrs)
5. Dispersion- Spectrum; Spectrometer; Pure spectrum; Dispersive power; Achromatic lenses; Condition for achromatic lenses in contact, Chromatic aberration Spherical aberration; Scattering of light-blue color of the sky. (3 hrs)
6. Optical instruments- The human eye; Defects of vision and their correction; Visual angle; Angular magnification; Magnifier; Camera; Compound microscope, Astronomical Telescope (reflection and refractive type) (5 hrs)

Unit-4 Electrostatics **20 teaching hours**

1. Electrostatics- Electric charge: Electric charges; Conductors and insulators; Charging by induction, Coulomb's law- Force between two point charges, Force between multiple electric charges. (3 hrs)
2. Electric field- Electric fields; Calculation of electric field due to point charges; Field lines.
   Gauss Law: Electric Flux; Gauss Law and its application: Field of a charged sphere, line charge, plane sheet of charge. (7 hrs)
3. Potential: Potential and potential difference, Potential due to a point charge; Equipotential lines and surfaces; Potential gradient; Potential energy, Electron volt. (3 hrs)
4. Capacitance and dielectrics- Capacitance and capacitor; Charging and discharging of capacitor through a resistor; Parallel plate capacitor; Combination of capacitors; Energy of charged capacitor; Effect of a dielectric; Molecular theory of induced charges; Polarization and displacement. (7 hrs)

A student will perform 20 experiments and 4 activities from the given list:
General instruction: Students are expected to learn general ideas of errors, order of accuracy and graphical analysis.

List of Experiments

A. Mechanics

1. Use of Vernier calipers:
   a. Determination of the length, the internal and external diameter of a given tube and calculation of its volume and density.
   b. Determination of the volume and density of a given rectangular block and verification of the results using a graduated cylinder.
   c. Determination of the internal diameter, depth and volume of a beaker or calorimeter.
2. Use of Spherometer:
   a. Determination of the thickness of a given rectangular thin glass plate and calculation of its area using a graduated cylinder.
   b. Determination of the radii of curvatures of a watch glass.
   c. Determination of the focal length of a spherical mirror
3. Use of Screw gauge:
   a. Determination of the diameter of a tube (or of a rod) and a small spherical bob and calculation of their densities.
   b. Determination of the length, volume and density of a tangle of wire.
4. Determination of the coefficient of friction for the two surfaces by (i) the horizontal plane method and (ii) an inclined plane method.
5. Verification of the principle of moments and the determination of a mass of a given body
6. Use of Simple pendulum:
   a. Determination of the length of a seconds pendulum and the value of 'g' in the laboratory.
   b. Verification of law of length and determination of the value of 'g' in the laboratory by log- log plot of lime period versus length of the pendulum
7. Verification of Archimedes' Principle and determination of the specific gravity of a solid heavier than and insoluble in water
8. Determination of the specific gravity of
   (a) A liquid
   (b) A solid lighter than and insoluble in water
   (c) A solid heavier than and soluble in water
9. Use of Boyle's law apparatus:
   a. Verification of Boyle's Law
   b. Determination of the atmospheric pressure in the laboratory without reading a barometer and verification of the result by reading a barometer.
10. Use of Young's modulus apparatus
    a. Verification of Hooke's Law
    b. Determination of Young's modulus of elasticity of the material of a given wire
11. Determination of the surface tension of water by capillary tube method

12. Determination of the coefficient of viscosity of liquid by Stoke's method

B. Heat

13. Calibration of a given thermometer and determination of the correct temperature of tap water.
14. Use of Pullinger's apparatus
    Determination of the linear and cubical expansivity of a rod
15. Use of Regnault's apparatus:
    a. Determination of the specific heat capacity of a solid by the method of mixture.
    b. Determination of the specific heat capacity of a liquid by the method of mixture.
16. Determination of the specific heat capacity of a liquid by the method of cooling.
17. Determination of latent heat of fusion of ice.
18. Determination of latent heat of vaporization of water.
19. Determination of the melting point of a solid by
    (i) Cooling curve method
    (ii) Capillary tube method
20. Determination of the thermal conductivity of a good conductor by Searle's method.

C. Geometrical Optics

21. Reflection of light:
    a. Verification of the laws of reflection of light.
    b. Verification of the law of rotation of light.
22. Use of rectangular glass slab:
    a. Verification of the laws of refraction of light.
    b. Study of the variation of lateral shift with angle of incidence and determination of the thickness of the slab.
23. Use of Travelling Microscope :
    Determination of the refractive index of glass slab
24. Determination of the refractive index of a prism by (i) symmetry method.(ii) I-D curve method.
25. Determination of the focal length of
    a. A concave mirror.
    b. A convex mirror
26. Determination of the focal length of
    a. A convex lens by double pin method
    b. A convex lens by displacement method
27. Determination of the focal length of a concave lens by using convex lens
28. Determination of the refractive index of the material of a plano- convex lens

List of Activities

1. To study the variation in the range of a jet of water with angle of projection
2. To study the effect of detergent on surface tension by observing the capillary rise
3. To study the factors affecting the rate of loss of heat of a liquid
4. To study the nature and size of the image formed by a convex lens using a candle and a screen.

5. To study the conservation of energy of a ball rolling on inclined plane.

Note: The above are only the specimens of activities. In order to arouse creativity, the students must be encouraged to take up new activities (other than mentioned above) in consultation with the teacher concerned.

Laboratory Manual

I. Certificate Level Physics Practical Guide, U.P. Shrestha, Ratna Pustak Bhandar, Kathmandu
II. Elementary Practical Physics, Dr. Narayan Hari Joshi, Taleju Prakashan

4. Teaching strategies:

- Lecturing
- Group interaction
- Problem solving
- Demonstration
- Evaluation

5. Instructional materials

OHP, LCD, demonstration kits, writing boards etc.

6. Evaluation Scheme (Theory)

Unit	Teaching Hours	LAQ	SAQ	Numerical Problem	Mark Distribution			Total
					LAQ	SAQ	Numerical problems	
Mechanics	70	3/4	6/7	3/4	12	12	12	36
Heat and Thermodynamics	40	2/3	2/3	2/3	8	4	8	20
Geometrical Optics	20	1/2	1/2	1/1	4	2	4	10
Electrostatics	20	1/2	1/2	1/1	4	2	3	9
Total	150	7/11	10/14	7/9	28	20	27	75

Note:

LAQ: Long answer Questions

SAQ: Short answer Questions

a. In the table numerator denotes the number of questions to be attempted and denominator denotes the number of questions asked. For example, 3/4 means 3 questions are to be answered out of 4 questions.
b. Short answer questions should cover the entire course as far as possible. These questions should be of conceptual type.

Practical

Every student will perform at least 20 experiments and 4 activities during the academic year.

7. **Evaluation Scheme for Practical examination:**

One experiment	12 Marks
One activity	03 Marks
Practical record of experiments and activities	5 marks
Viva on experiment and activity	5 Marks
Total	**25 Marks**

Textbook:

1. University Physics, Sears F.W, M.W. Zemansky, H.D. Young and R.A. Freedman, 11th edition, Pearson Education Singapore, 2004

Reference books:

1. Advanced Level Physics, Nelkon and Parker, Heimesmann Education book Ltd., 2000.

Advanced Level Physics Tom Duncan, John Murray Ltd, 200

PHYSICS
Grade: XII

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Pass Marks: 27T + 8P
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Nature of course: Theory +Practical

1. Introduction

The curriculum in Physics is designed to provide students with an understanding of the scientific laws and principles of the physical world. As expected this curriculum will provide an opportunity to the students to see physics as a contribution to life in modern society.
The course demands emphasis on conceptual understanding of the physical phenomena. This will involve the proper utilization of suitable mathematical models and equations. The applications of the physics together with the social and environmental aspects need to be emphasized whenever possible. The students are expected to actively participate in the learning process trough experimentation supplemented by demonstration, discussions and problem solving.
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2. Objectives

2.1 General objectives

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2.2 Specific Objective

Upon completion of this course, the students will be able to:

1. describe physics as a coherent and developing framework of knowledge based on fundamental theories of the structure and process of the physical world;
2. explain phenomena in terms of theories and models;
3. apply quantitatively and qualitatively the knowledge and understanding of physical principles and theories;
4. translate information from one from to another;

5. present information in the language of physics or other appropriate form; and
6. design simple experiment to develop relations among physical quantities and draw conclusions.

3. Course Content

Unit-1 Waves and Optics **40 Teaching Hours**

Waves (23 Hrs)

1. Wave motion- Wave motion; Longitudinal and transverse waves; Progressive and stationary waves; Mathematical description of a wave. (4 hrs)
2. Mechanical waves- Speed of wave motion; Velocity of sound in solid and liquid; Velocity of sound in gas; Laplace's correction; Effect of temperature, pressure, humidity on velocity of sound. (5 hrs)
3. Wave in pipes and strings- Stationery waves in closed and open pipes; Harmonics and overtones in closed and open organ pipes; End correction in pipes; Resonance Tube experiment; Velocity of transverse waves along a stretched string; Vibration of string and overtones; Laws of vibration of fixed string. (6 hrs)
4. Acoustic phenomena- Sound waves: Pressure amplitude; Characteristics of sound: Intensity; loudness, quality and pitch; Beats; Doppler's effect; Infrasonic and ultrasonic waves; Noise pollution: Sources, health hazard and control. (8 hrs)

Physical Optics (17 Hrs)

1. Nature and propagation of Light- Nature and sources of light; Electromagnetic spectrum; Huygen's principle, Reflection and Refraction according to wave theory; Velocity of light: Foucault's method; Michelson's method. (6 hrs)
2. Interference- Phenomenon of Interferences; Coherent sources; Young's two slit experiment; Newton's ring. (4 hrs)
3. Diffraction- Diffraction from a single slit; Diffraction pattern of image; Diffraction grating; Resolving power of optical instruments. (4 hrs)
4. Polarization- Phenomenon of polarization; Brewster's law; transverse nature of light; Polaroid. (3 hrs)

Unit-2 Electricity and Magnetism **55 Teaching Hours**

Current Electricity (20 Hrs)

1. D.C. Circuit- Electric Currents; Drift velocity and its relation with current; Ohm's law; Electrical Resistance; Resistivity; Conductivity; Super conductors; Perfect Conductors; Current-voltage relations; Ohmic and Non-Ohmic resistance; Resistances in series and parallel, Potential Divider, Conversion of galvanometer into voltmeter and ammeter, Ohmmeter; Electromotive force: Emf of a source, internal resistance; Work and power in electrical circuits; Joule's law and its verification. (9 hrs)

2. Electrical circuits-Kirchhoffs laws; Wheatstone bridge circuit; P.O.Box, Meter Bridge; Potentiometer; Comparison of e.m.f's., measurement of internal resistance of a cell. (7 hrs)
3. Thermoelectric Effect- Seebeck Effect; Thermocouples, Peltier effect: Variation of thermoelectric emf with temperature, Thermopile, Thomson effects. (2 hrs)
4. Chemical effect of current- Faraday's laws of electrolysis; Faraday's constant, Verification of Faraday laws of electrolysis. (2 hrs)

Magnetic Field of current (35 Hrs)

1. Magnetic Field-Magnetic field lines and magnetic flux; Oersted's experiment; Force on moving charge, Force on Conductor; Force and Torque on rectangular coil, Moving coil galvanometer; Hall effect; Magnetic field of a moving charge; Biot and Savart law and its application to (i) a circular coil (ii)a long straight conductor (iii) a long solenoid; Ampere's law and its application to (i)a long straight conductor (ii) a straight solenoid (iii) a toroidal solenoid; Forces between two parallel conductors carrying current-definition of ampere. (14 hrs)
2. Magnetic properties of materials-Elements of earth magnetism and their variation; Dip and Dip circle; Flux density in magnetic material; Relative permeability; Susceptibility; Hysteresis, Dia,-Para- and Ferro-magnetic materials. (5 hrs)
3. Electromagnetic Induction-Faraday's laws; Induced electric fields; Lenz's law, Motional electromotive force; AC generators; eddy currents; Self inductance and Mutual inductance; Energy stored in an inductor; Transformer. (8 hrs)
4. Alternating Currents- Peak and RMS Value of AC current and Voltages, AC through resistor, capacitor and inductor; Phasor diagram, Series circuits containing combination of resistor, capacitor and inductor; Series Resonance, Quality factor; Power in AC circuits: Power factor; choke coil. (8 hrs)

Unit-3 Modern Physics **55 teaching hours**

1. Electrons and Photons-Electrons: Milikan's oil drop experiment, Gaseous discharge at various pressure; Cathode rays, Motion of electron beam in electric and magnetic fields; Thomson's experiment to determine specific charge of electrons.
   Photons: Quantum nature of radiation; Einstein's photoelectric equation; Stopping potential; Measurement of Plank's constant, Milikan's experiment (10 hrs)
2. Solids and Semiconductor devices- Structure of solids; Energy bands in solids (qualitative ideas only); Difference between metals, insulators and semi-conductors using band theory; Intrinsic and extrinsic semi-conductors; P-N Junction; Semiconductor diode: Characteristics in forward and reversse bias; Full wave rectification; Filter circuit; Zener diode; Transistor: Common emitter characteristics, Logic gates; NOT, OR, AND, NAND and NOR. , Nanotechnology(introductory idea) (11 hrs)
3. Quantization of energy-Bohr's theory of hydrogen atom; Spectral series; Excitation and ionization potentials; Energy level; Emission and absorption spectra, De Broglie Theory; Duality; Uncertainly principle.

Lasers: He- Ne laser, Nature and production, properties and uses.
X-rays: Nature and production; uses: X-rays, X-rays diffraction, Bragg's law. (9 hrs)

4. Nuclear physics- Nucleus: Discovery of nucleus; Nuclear density; Mass number; Atomic number; Atomic mass; Isotopes; Einstein's mass-energy relation, Mass Defect; Binding energy; Fission and fusion. (6 hrs)
5. Radioactivity- Alpha-particles; Beta-particles, Gamma rays; Laws of radioactive disintegration; Half-life and decay constant; Geiger-Muller Tube; Radio carbon dating; Medical use of nuclear radiation; Health hazards and safety precautions. (7 hrs)
6. Nuclear energy and other sources of energy- Sources of energy; Conservation and degradation of energy; Transformation of energy.
   Nuclear energy: Energy released from fission and fusion; Thermal and Hydroelectric power; Wind energy; Biofuels; Solar energy; Solar constant; Solar devices; Global energy consumption pattern and demands; Energy use in Nepal.
   Fuels and pollution: Global Warming; Acid rain. (9 hrs)
7. Particle physics and cosmology- particles and antiparticles, Quarks and Leptons, baryons, mesons.
   Universe- Hubble law; Big Bang; Critical density; Dark matter, (3 hrs)

Practical

A student will perform at least 24 experiments from the given list:

Introduction

General instruction: Students are expected to learn general ideas of errors, order of accuracy and graphical analysis. Students are also expected to learn the physical principles and theory of experiments on magnetism not covered in the theory curriculum.

List of experiments

A. Wave and Optics

1. Determination of the wavelength of sodium light by measuring the diameter of Newton's rings.
2. Determination of the wavelength of a given monochromatic source of light by passing a plane diffraction grating.
3. Determination of the refractive index of a given transparent medium and calculation of the speed of the light in the medium.
4. Uses of laser beams:
   i Determination of the wavelength of He-Ne laser light
   ii Determination of the diameter of a given hair
5. Uses of Sonometer:
   i Determination of the frequency of a given tuning fork
   ii Comparison of frequencies of two tuning forks
6. Determination of the frequency of A.C. Mains.
7. Use of Resonance tube:
   i Determination of velocity of sound in air at NTP
   ii Comparison of frequencies of two tuning forks
8. Determination of the end correction of the resonance tube apparatus.

B. Electricity

9. Verification of Ohm's Law
10. Use of P.O. Box:
    - i Determination of the resistivity of the material of a given wire
    - ii Verification of the laws of series and parallel resistances
11. Use of meter bridge:
    - i Comparison of resistances of two given wires
    - ii Determination of the resistivity of the material of a given wire
    - iii Verification of the laws of series and parallel resistances
12. Determination of high resistance by substitution method.
13. Determination of the capacitance of the capacitor by charging and discharging a capacitor.
14. Use of potentiometer:
    - i Comparison of emf's of two cells
    - ii Comparison of resistances of two given wires
    - iii Determination of the internal resistance of a cell
15. Conversion of given galvanometer into an ammeter and a voltmeter of desired range.
16. Calibration of a given ammeter and voltmeter.
17. Determination of the half-life of a circuit containing a pure capacitor in series with a resistance in a D. C. circuit.
18. Uses of a series LCR circuit:
    - i Determination of the resonant frequency of a series LCR circuit
    - ii Determination of the quality factor of a series LCR circuit

C. Magnetism

19. Determination of the pole strength and magnetic moment of a bar magnet by locating the neutral points keeping:
    - i North pole pointing towards the geographical south
    - ii North pole pointing towards the geographical north
20. Use of deflection magnetometer:
    - i Determination of the pole strength and magnetic moment of a bar magnet
    - ii Comparison of the magnetic moments of two bar magnets
21. Use of oscillation magnetometer:
    - i Determination of the pole strength and magnetic moment of a bar magnet
    - ii Comparison of the magnetic moments of two bar magnets
22. Use of dip circle:
    Determination of the angle of dip in the laboratory

D. Modern Physics

23. Study the characteristics of a junction diode.
24. Study the characteristics of a transistor.
25. Study the characteristics of a Zener diode.
26. Determination of Planck's constant using a photocell

List of Activities

1. To assemble a household circuit comprising three bulbs, three switches, a fuse and a power source. Measure current and voltage across each component and then interpret the data.
2. Use of multimeter to (a) identify base of transistor and terminal of IC (b) Check whether a given electronic component (e.g. diode, transistor, and IC) is in working order.
3. To study the relation between frequency and length of a given wire under constant tension using sonometer.
4. Study of AND, OR, and NOT gates.
5. To identify the difference between e.m.f. and p.d. of a cell.

Note: The above are only the specimens of activities. In order to arouse creativity, the students must be encouraged to take up new activities (other than mentioned above) in consultation with the teacher concerned.

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4. Teaching strategies:

- Lecturing
- Group interaction
- Problem solving
- Demonstration
- Evaluation

5. Instructional materials

OHP, LCD, demonstration kits, writing boards etc.

6. Evaluation Scheme

Unit	Teaching Hours	LAQ	SAQ	NP	Mark Distribution			Total
					LAQ	SAQ	NP	
Electricity and Magnetism	55	3/4	4/5	2/3	4 x 3	2 x 4	4 x 2	**28**
Modern Physics	55	3/4	4/5	2/3	4 x 3	2 x 4	4 x 2	**28**
Waves and Sound	21	1/2	1/2	1/1	4 x 1	2 x 1	4	**10**
Physical Optics	19	1/2	1/2	1/1	4 x 1	2 x 1	3	**9**
Total	**150**	**8/12**	**10/14**	**6/8**	**32**	**20**	**23**	**75**

Note:
LAQ: Long answer Questions
SAQ: Short answer Questions
NP: Numerical Problems

a. In the table numerator denotes the number of questions to be attempted and denominator denotes the number of questions asked. For example, 3/4 means 3 questions are to be answered out of 4 questions.
b. There will be three groups A, B and C. Group A contains short-answer questions (SAQ), group B long-answer questions (LAQ) and group C numerical problems (NP).
c. Each of SAQs carries 2 marks, each of LAQs carries 4 marks and each of numerical problems carries 4 marks except in Physical Optics for which it carries only 3 marks.
d. Short answer questions should cover the entire course as far as possible. These questions should be of conceptual type.

Practical

Every student will perform at least 20 experiments and 4 activities during the academic year.

7. **Evaluation Scheme for Practical examination:**

One experiment	12 Marks
One activity	03 Marks
Practical record of experiments and activities	5 marks
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Total	**25 Marks**

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HSEB

Model Question for Grade-XII, 2065

Subject:PHYSICS **Time:** 3 hours **Full Marks:** 75 **Pass Marks:** 27

(All answers of numerical problems should be expressed in S.I. system)

Group –A

Q. 1. Attempt any **FOUR** questions (2 x 4 = 8)

(a) Two wires, one of copper and other of iron, have he same diameter and carry the same current. In which wire will the drift velocity of electrons be more?
(b) Differentiate between a fuse wire and a heating wire.
(c) Why are the pole-pieces of magnets cut into cylindrical form in a galvanometer?
(d) Hall voltage is much more measurable in semiconductor than in metals. Why?
(e) Explain why two parallel wires carrying current in the opposite direction repel each other?
(f) 220V a.c. is more dangerous than 220V d.c., why?

Q. 2. Attempt any **FOUR** questions (2 x 4 = 8)

(a) If the discharge tube is filled up with various gases in turn, will the discharge in all gases take place at the same electrode potential?
(b) A photon and an electron have got the same de-Broglie wavelength. Explain which has greater total energy.
(c) How is NOT gate realised?
(d) It is said that a very powerful crane is required to lift a nuclear mass of microscopic size. Commen on this.
(e) Commen on the statement "A nucleus contains no electrons and yet can eject them."
(f) What are the effects of pollution on living organisms?

Q. 3. Attempt any **ONE** question (1 x 2 = 2)

(a) How can bats fly around without colliding with objects that come in their way?
(b) Longitudinal waves cannot be polarized. Why?

Q. 4. Attempt any **ONE** question (1 x 2 = 2)

(a) Differentiate between wave-front and wavelet?
(b) What is the difference between Fresnel and Fraunhofer diffraction?

Group – B

Q. 5. Attempt any **THREE** question (4 x 3 = 12)

(a) State Biot and Savart law and use it to obtain an expression for the magnetic field at the centre of the circular coil.
(b) What are the catagories in which magnetic materials are classified? Explain their differences.
(c) State Faraday's laws of electrolysis. How will you verify Faraday's second law experimentally?
(d) Show that Lenz's law is an example of conservation of energy.

Q. 6. Attempt any **THREE** question (4 x 3 = 12)

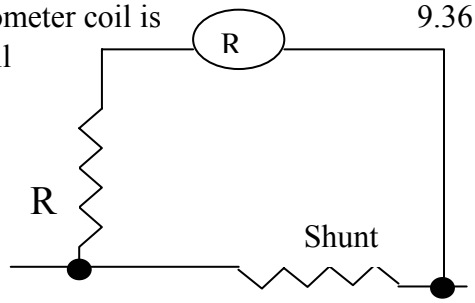
(a) Show, in Bohr's model, that radii of electronic orbits increase an n^2, where n is the quantum number of the orbit.
(b) Define decay constant of a radioactive element. How is it related to half-life?
(c) Discuss a zener diode and its use as voltage stabilizer.
(d) Describe a theory which accounts for the origin and evolution of the universe.

Q. 7. Attempt any **ONE** question (4 x 1 = 4)
(a) Show that both harmonics, odd and even, can be produced in an organ pipe open at both ends.
(b) What is Doppler's effect? Obtain an expression for the apparent pitch when a source moves towards a stationary observer.

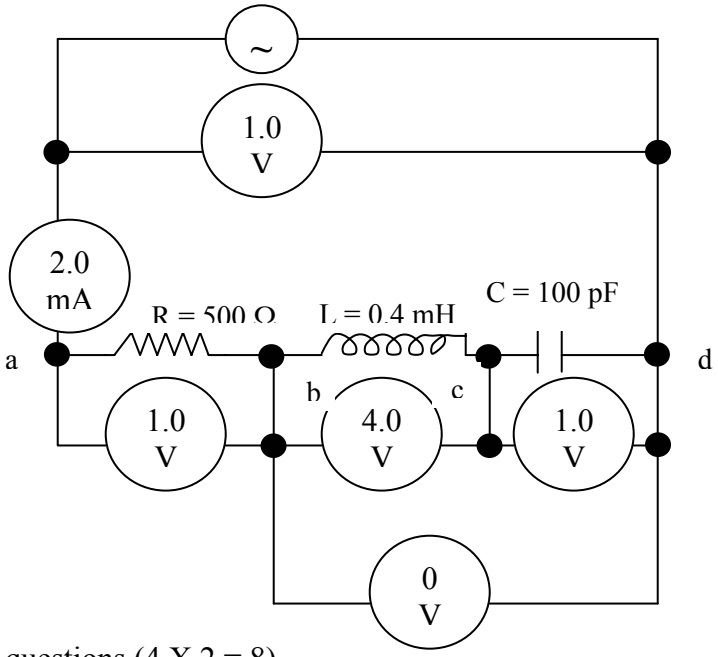
Q. 8. Attempt any **ONE** question (4 x 1 = 4)
(a) Show that in Young's double slits experiment widths of dark and bright fringes are equal.
(b) Describe Focault's method of determining the speed of light.

Group – C

Q. 9. Attempt any **TWO** questions (4 x 2 = 8)
(a) The resistance of the coil of a pivoted-coil galvanometer coil is 9.36 Ω and a current of 0.0224 A causes it to deflect full scale. We want to convert this galvanometer to an ammeter reading 20.0 A full-scale. The only shunt available has a resistance of 0.025 Ω. What resistance R must be connected in series with the coil?



(b) A standard cell of 1.0185 V, when used in a one meter long slide wire potentiometer balances at 60 cm. Calculate the percentage error in a voltmeter which balances at 65 cm when reading is 1.1 volt.
(c) The series circuit in figure is a similar to arrangements that are sometimes used in radio tuning circuits. The circuit is connected to the terminals of an a.c. source with a constnant r.m.s. terminal voltage of 1.9 V and a variable frequency. Find (i) the resonance frequency (ii) the inductive reactance and the impenance at the resonance frequency (iii) the r.m.s. current at the resonance and (iv) the r.m.s. voltage across each circuit element at resonance.



Q. 10. Attempt any **TWO** questions (4 X 2 = 8)

(a) A city requires 10^8 watts of electrical power on the average. If this is to be supplied by a nuclear reactor of efficiency 20% using $^{235}_{92}U$ as the fuel. Calculate the amount of fuel required for one day's operation. (Given: energy released per fission of $^{235}_{92}U$ = 200 MeV).

(b) A clean nickel surface of workfunction 5.1 eV is exposed to light of wavelength 235 nm. What is the maximum speed of the photoelectrons emitted from their surface?

(c) An electron moving with a speed of 10^7 m/s is passed into a magnetic field of intensity 0.1 T normally. What is the radius of the path of the electron inside the field? If the strength of the magnetic field is doubled, what is the new radius of the path? (e/m = 1.8 x 10^{11} C.kg^{-1})

Q. 11. What is the difference between the speed of longitudinal waves in air at 27^{o}C and their speed at -13^{o}C? What is the speed at 0^{o}C? (4)

Q. 12. Light traveling in water strikes a glass plate at an angle of incidence of 53^o, part of the beam is refracted and part is reflected. If the refracted and reflected portions make an angle of 90^o with each other, what is the index of refraction of glass? (3)

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