

SUBJECT TITLE : APPLIED SCIENCE
SUBJECT CODE :
PERIODS/WEEK : 6 (Physics 3 + Chemistry 3)
PERIODS/SEMESTER : 108 (54 + 54)
CREDITS : 6

Rationale:

Knowledge of Applied Science is essential to develop scientific temper, basic understanding of concepts and principles of science so as to give a good foundation for further study of engineering courses and also to help in developing continued learning skills. The course is intended to achieve the same.

PART – A : PHYSICS

TIME SCHEDULE

Module	Topic	Periods
I	Units and Dimensions Dynamics Circular Motion	24
II	Rotational Dynamics Satellites Elasticity	24
	Total	48

OBJECTIVES

On Completion of the module, the student will be able to

MODULE-1

1.1 Units And Dimensions

- 1.1.0 Understand the concept of units and measurements with a basic knowledge about dimensions
- 1.1.1 Define Unit of a physical quantity.
- 1.1.2 Explain the principle of measurement.
- 1.1.3 Identify fundamental and derived units.
- 1.1.4 Define dimension of a physical quantity.
- 1.1.5 Derive dimensional formula for physical quantities.

1.2 Dynamics

- 1.2.0 Apply the dynamics of a particle in practical situations.
- 1.2.1 Identify vector and scalar quantities.
- 1.2.2 Derive the expression $S_n = u + a(n - \frac{1}{2})$
- 1.2.3 Solve Problems related to gravity with equations of motion.
- 1.2.4 Derive the expressions for time of flight, horizontal range and maximum height for a projectile.
- 1.2.5 Solve the problems based on the above expression

- 1.2.6 State the Newton's laws of motion
- 1.2.7 Define the terms:
- 1.2.8 1. Force 2. Inertia 3. Momentum 4. Impulse
- 1.2.9 Derive the relation $F = ma$
- 1.2.10 State Law of conservation of momentum and prove it in the case of two bodies making a collision.
- 1.2.11 Explain the principle behind recoil of gun and derive an expression for recoil velocity.
- 1.2.12 Solve Problems related to Laws of motion.
- 1.2.13 Identify the causes of friction

1.3 Circular Motion

- 1.3.0 Understand the concept of circular motion
- 1.3.1 Define angular displacement and angular velocity .
- 1.3.2 Derive relation between linear velocity and angular velocity.
- 1.3.3 Mention the expression for centripetal acceleration and force.
- 1.3.4 Apply the principle of centripetal force in the case of banking of roads and rails.
- 1.3.5 Solve problems related to centripetal force.

MODULE-II

2.1 Rotational Dynamics

- 2.1.0 Understand the dynamics of a rotating body.
- 2.1.1 Define Moment of Inertia of a rigid body
- 2.1.2 Define Radius of gyration
- 2.1.3 State theorems of parallel and perpendicular axes.
- 2.1.4 Define Torque
- 2.1.5 Mention relation between torque and angular momentum.
- 2.1.6 Mention the expression for kinetic energy of rotation.
- 2.1.7 Derive an expression for moment of inertia of a uniform circular disc about an axis passing through its centre and perpendicular to its plane.
- 2.1.8 Derive expression for kinetic energy of a disc rotating on horizontal plane. Solve problems using the above expressions.

2.2 Satellites

- 2.2.0 Understand the idea of satellites.
- 2.2.1 State Newton's Law of Gravitation.
- 2.2.2 Derive expression for Orbital velocity and Period of satellite.
- 2.2.3 Explain Geostationary satellite.

2.3 Elasticity

- 2.3.0 Comprehend the concept of elasticity
- 2.3.1 Define Stress, Strain and Elastic limit.
- 2.3.2 State Hooke's law.
- 2.3.3 Derive expression for Young's modulus, rigidity modulus and bulk modulus.
- 2.3.4 Understand the term elastic fatigue.
- 2.3.5 Solve Problems related to modulus of elasticity.

CONTENT DETAILS

MODULE – I

1.1 Units and dimensions

Units – fundamental and derived units-Systems of units – SI System and its advantages - Dimensions, dimensional formula , dimensional equations ,applications and limitations – Derivation of expression of period of a simple pendulum using dimension.

1.2 Dynamics

Equation of motion (re-capitulation only) - Derivation of $S_n = u + a(n - \frac{1}{2})$ Acceleration due to gravity – equation of motion under gravity. Numerical problems.

Projectile motion – Derivation of expressions for Time of flight, Horizontal range and Maximum height. Problems. Linear Momentum, Newton's laws of motion – Definition of force and inertia – Derivation of $F = ma$. Unit of force- Impulse -Law of conservation of momentum (Derivation). Recoil of gun. Friction-causes of friction-advantages and disadvantages of friction. Numerical Problems.

1.3 Circular motion

Uniform circular motion – definitions for angular displacement , angular velocity and angular acceleration- Relation between linear velocity and angular velocity (derivation)- Centripetal acceleration and centripetal force-Banking of roads and rails (qualitative). centrifugal force – Numerical problems.

MODULE- II

2.1 Rotational Dynamics

Centre of mass and centre of gravity-Moment of inertia of a rigid body – Radius of gyration- Theorems of Parallel and Perpendicular axes (only statement) – Angular momentum - Torque – Relation between Torque and angular momentum (no derivation) Expression for K.E. of rotation (no derivation). Moment of Inertia of a uniform circular disc about an axis passing through its centre and perpendicular to its plane (derivation) – K.E. of disc rolling on a horizontal plane. Numerical problems.

2.2 Satellites

Newton's Law of Gravitation- Expression for acceleration due to gravity-Satellites-Artificial Satellites - Orbital velocity and Period of satellite (derivation).Geostationary satellites.

2.3 Elasticity

Elastic and plastic bodies – Stress – Strain – Elastic limit - Hooke's law – Young's Modulus , Rigidity modulus and Bulk modulus –Elastic fatigue. Numerical problems.

Reference Books:-

1. Physics – Resnick and Halliday
2. Mechanics – D.S.Mathur
3. Mechanics – Narayana Kurup
4. Modern Physics - Murukesan

PART – B: CHEMISTRY

TIME SCHEDULE

Module	Topic	Periods
I	Basic concepts in Chemistry Acids, Bases & Redox Reactions Volumetric Analysis and pH Test	24
II	Water and its treatment Introduction to Nano-Chemistry Test	24
	Total	48

OBJECTIVES

MODULE- I

Formulae and Equations

- 1.1.1 Review the fundamental ideas in chemistry
- 1.1.2 Explain the terms atom, molecule, valency, radical, molecular formula
- 1.1.3 Compute molecular weight from molecular formula
- 1.1.4 Do the calculations based on simple stoichiometric equations – weight(s) of product(s)/reactant(s) (chemical equation should be given)

Acids,bases & Redox reactions

- 1.2.1 Recollect the idea of acids & bases .
- 1.2.2 Illustrate Arrhenius' & Lewis concept of acids and bases.
- 1.2.3 Distinguish between strong and weak acids and bases.
- 1.2.4 Explain neutralization with an example.
- 1.2.5 Illustrate the calculation of equivalent weights of common acids and bases.
- 1.2.6 Explain the electronic concept of oxidation & reduction .
- 1.2.7 Illustrate redox reactions taking the reactions in Daniel Cell as example

Volumetric Analysis & PH

- 1.3.1 Understand the term volumetric analysis
- 1.3.2 Describe the terms titration, end point , indicator & standard solution
- 1.3.3 Identify the indicators phenolphthalein/methyl orange to be used in a given acid-base titration, know the respective pH ranges
- 1.3.4 Understand the strength of solutions in terms of normality and molarity
- 1.3.5 Understand the calculation of normality and molarity of solutions
- 1.3.6 Understand the principle of volumetric analysis
- 1.3.7 Solve simple problems based on the relation $V_1N_1=V_2N_2$
- 1.3.8 Understand the ionic product of water
- 1.3.9 State pH – understand its expression
- 1.3.10 Describe what is pH scale
- 1.3.11 Solve simple problems based on pH
- 13.12 Define buffer solutions
- 1.3.13 Describe what is acid buffer & basic buffer – one example each

MODULE II

Water and its treatment

- 2.1.1 Understand hard & soft water- definition and its causes.
- 2.1.2 Distinguish between hard water & soft water
- 2.1.3 Mention the types of hardness

- 2.1.4 Explain methods of removal of hardness – one each (temp. – boiling, permanent – ion exchange)
- 2.1.5 Explain disadvantages of using hard water – wastage of soap in laundry, formation of boiler scales
- 2.1.6 Understand the basic idea of Potable water- its characteristics and treatment

Introduction to Nano-Chemistry

- 2.2.1 Understand the basic concept of nanosize and nanomaterials
- 2.2.2 Explain the application of nanomaterials in medicine and catalysis
- 2.2.3 Understand the idea of carbon nanotubes
- 2.2.4 Mention the basic idea of the synthesis of carbon nanotubes
- 2.2.5 List some important properties of carbon nanotubes
- 2.2.6 Mention some important application of carbon nanotubes.

CONTENT DETAILS

MODULE I

1.1 Formulae & Equations

Matter, Elements, Atoms, Molecules, Valency, Symbols, Radicals, Molecular formula, Atomic weight, Molecular weight, Balancing Chemical equations problems based on given chemical equations. (weight concept only).

Acids-bases and Redox reactions

Acids-Bases – (Arrhenius, & Lewis Concepts only) – Concepts of strong and weak acids & bases – Neutralization with example. Equivalent weight of acid & bases (Calculation of equivalent weight of common acids and bases -Oxidation & Reduction (electronic concept only) - Redox reaction (Eg: - Daniel Cell Reaction).

Volumetric Analysis & PH

Volumetric analysis: Quantitative analysis – Titration, End Point, Indicators, Choice of indicators in acidimetry & alkalimetry, Strength of solutions, standard solutions, Units of measurement of strength (Normality & Molarity), Calculation of normality & molarity, principle of volumetric analysis, Simple problems based on $V_1N_1 = V_2N_2$.

Ionic product of water, PH (Definition and expression) PH Scale – Calculation of PH Buffer solution (Types & examples)

MODULE II

2.1 Water & its treatment

Hard & soft water, Types of Hardness. Reason for Hardness. One method to remove Temporary hardness (Boiling) – Removal of permanent hardness (Ion-exchange method) – disadvantages of using hard water a) Wastage of Soap in laundry, (b) Boiler Scale formation, Potable Water, Characteristics and its treatment. (Screening, Sedimentation, Coagulation, Filtration, Sterilization(using chlorine or bleaching powder, UV, Ozone)

2.2 Introduction to Nanochemistry

Introduction to nano size and nanomaterials, applications of nanomaterials in medicine and catalysis. Carbon nanotubes, Basic idea of synthesis of carbon nanotubes, important properties of nanotubes and application of carbon nanotubes.

REFERENCES:-

- 1 Sony. P.L. A text book of Inorganic chemistry S. Chand & Company.
- 2 Puri & Sharma A text book of Inorganic Chemistry S. Chand & Company
- 3 N. Krishnamurthy, P. Vallinayakam & D. Madhavan Engineering Chemistry PHI Learning Pvt. Limited.
- 4 Putti R. Vijayasathy Engineering Chemistry PHI Learning Pvt. Ltd.