SYLLABUS

1.3 APPLIEDPHYSICS

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RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

Note:Teachersshouldgive examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

LEARNINGOUTCOMES

Afterundergoingthis subject, thestudents willbe able to:

- Identifyphysicalquantities,parameters and select their units for use in engineering solutions.
- Units anddimensions of different physical quantities.
- Represent physical quantities as scalarand vectors.
- Basic laws of motions,
- Analyseanddesignbankingofroadsandapplyconservationof to explain recoilof gunetc.
- Definework, energyandpower and theirunits.Solve problems about work and power
- Statethe principle of conservation of energy.
- Identifyforms ofenergy,conversion from one form to another.
- Compare and contrast the physical properties associated with linear motion and rotational motion and give examples of conservation of angularmomentum.
- Describe thesurface tensionphenomenonanditsunits,applications, effectsof temperature on surfacetension.
- Describetheviscosityofliquids.
- Definestressand strain, modulus of elasticity.
- StateHooke's law.
- Measuretemperature in various processes on different scales (Celsius,Kelvin, Fahrenheitetc.)
- Distinguish betweenconduction, convection and radiation.
- Useequipmentlike,Vernier calliper, screwgauge, spherometer.

- Differentiate between Transverse and Longitudinal, Periodic and Simple Harmonic

Motion.

- Explain the terms: frequency, amplitude, wavelength, wave velocity, frequency and relation between them.
- Explain various Engineering and Industrial applications of Ultrasonics.
- Applyacoustics principles to various types of buildings toget best sound effect.
- Explain the laws of reflection and refraction oflight.
- Explain total internal reflection as applied to optical fibers.
- Definecapacitanceand its unit and solvesimple problems usingC=Q/V
- Explain the role of free electrons in insulators, conductors andsemiconductors.
- Application of semiconductors as diode, rectifiers, concept of transistors
- Explain electric current as flow of charge, theconcept of resistance, heating effect of current.
- State and applyOhm's law.
- Calculate the equivalent resistanceof avarietyofresistor combinations.
- Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Applythe useof optical fibrein Medical fieldandoptical fibreCommunication.
- Concept of nanomaterials

LIST OFPRACTICALS (To perform minimum fourteen experiments)

1. To find diameter ofsolidcylinder using a Vernier calliper
2. Tofindinternaldiameteranddepthofabeakerusinga Vernier calliperandhencefind its volume.
3. To find the diameter ofwireusingscrewgauge.
4. To find thickness of paper usingscrewgauge.
5. To determinethe thickness of glass strip usingaspherometer
6. To determine radius of curvature of a given spherical surface by a spherometer.
7. To verifyparallelogram law of forces
8. To determinetheatmosphericpressure ataplaceusingFortin’s Barometer
9. To determine forceconstant of springusingHooke’s law
10. Measuring room temperature with the help of thermometer and its conversion in different scale.
11. To find thetime period of asimple pendulum
12. To determine and verifythetime period ofCantilever
13. To verify Ohm’s laws byplottingagraph betweenvoltageand current.
14. To verifylaws of resistances in seriescombination.
15. To verifylaws of resistancein parallel combination.
16. To find resistanceofgalvanometer byhalf deflection method
17. To verifylaws of reflection oflight usingmirror.
18. To verifylaws of refraction using glass slab.
19. To find the focal length of a concave lens, using a convex lens
20. To studycolourcodingscheme ofresistance.

INSTRUCTIONAL STATREGY

Teachermayusevariousteachingaidslikemodels,charts,graphsandexperimentalkitsetc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

MEANSOFASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype
- Actual laboratoryand practical work, exercises and viva-voce

RECOMMENDED BOOKS

1. Text Book ofPhysics forClass XI(Part-I, Part-II); N.C.E.R.T., Delhi
2. AppliedPhysics,Vol.IandVol.IIbyDr.HHLal;TataMcGraw Hill, Delhi
3. Applied Physics - I& II by AS Vasudeva; Modern Publishers, Jalandhar.
4. Applied Physics - I& II by R A Banwait; Eagle Prakashan, Jalandhar.
5. A text book of OPTICS by N Subrahmanyam, Brij Lal and Avadhanulu; S Chand Publishing, New Delhi.
6. Nanotechnology: Importance and Applications by M H Fulekar; IK International Publishing House (P) Ltd., New Delhi.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
8. Practical Physics, byC.L. Arora, SChandPublication

Websites forReference:

http://swayam.gov.in

DISTRIBUTION OF SYLLABUS AND MARKS FOR ASSESSMENTS

Section A (20%)

1. Units and Dimensions (10 periods)

1.1 Definition of Physics, Physical quantities (Fundamental and derived),
1.2 Units: fundamental and derived units,
1.3 Systems of units: CGS, FPS, MKS, SI
1.4 Definition of Dimensions;
1.5 Dimensionalformulae and SI unitsof physical quantities (distance, displacement, area, volume, velocity, acceleration, momentum,force, impulse,work,power, energy, pressure, surfacetension, stress, strain)
1.6 Principleof homogeneityof dimensions
1.7 Dimensional equations, Applications of dimensional equations; checking of correctness of equation, Conversion of system of unit (force, work)

2. Force and Motion (10 periods)

2.1 Scalar and vector quantities–(Definition and examples),
2.2 AdditionofVectors,Triangle&Parallelogram Law (Statementonly),
2.3 Scalar and Vector Product (statement and formulaonly)
2.4 Definition of Distance, displacement, speed, velocity, acceleration
2.5 Force and its units, concept of Resolution of force
2.6 Newton's Law of motion (Statement and examples),
2.7 Linear Momentum, conservation of momentum (Statement only), Impulse
2.8 **Circularmotion**:definitionofangulardisplacement,angularvelocity,angular acceleration, frequency, timeperiod; Relation between linear and angular velocity.
2.9 Centripetal and centrifugal forces(definition and formulaonly)
2.10 ApplicationofcentripetalforceinBankingofroads (derivationforangle ofbanking)

Section B (20%)

3. Work, Power andEnergy (08 periods)

3.1. Work (Definition, Symbol, Formula and SI units)
3.2. Energy (Definition and its SI units), Examples of transformation of energy.
3.3. KineticEnergy (Formula, examplesand itsderivation)

3.4. PotentialEnergy (Formula, examplesand itsderivation)
3.5. Law ofconservationofmechanical energy for freely falling bodies (With Derivation)
3.6. Power (definition, formula and units)
3.7. Simple Numerical problems based on formula of Power

4 Rotational Motion (04 periods)

4.1 Rotationalmotion with examples
4.2 Definition oftorque andangular momentumand their examples
4.3 Conservation of angularmomentum(quantitative) and its examples
4.4 Momentofinertiaanditsphysicalsignificance, radiusofgyration(definition, derivation and formula).

5. Properties ofMatter (8periods)

5.1 Definition of Elasticity, Deforming force, Restoring force, example of Elastic and plastic body,
5.2 Definition of Stress and strain with their types,
5.3 Hooke's law, Modulus of Elasticity (Young's, Bulk modulus and shear)
5.4 Pressure (definition, formula, unit), Pascals Law
5.5 Surface tension: definition, its units, applications of surface tension, effect of temperature on Surface tension
5.6 Viscosity: definition, units, effect of temperature on viscosity
5.7 Fluid motion, stream line and turbulent flow.

Section C (60%)

6. Heat and Temperature (06 periods)

6.1 Definition of heatand temperature (on the basis of kinetic theory),
6.2 Difference between heat and temperature
6.3 Principles of measurement oftemperature.
6.4 Modes of transfer of heat (Conduction, convection and radiation with examples).
6.5 Properties ofheat radiation
6.6 Different scales of temperatureand theirrelationship

7. Wave motion and its applications (10 periods)

7.1 Wave motion, transverse and longitudinal wave motion with examples, Terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wave length .

7.2 Simple Harmonic Motion (SHM): definition, examples
7.3 Cantilever (definition, formula of time period (without derivation).
7.4 Free, forced and resonant vibrations with examples
7.5 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time.
7.6 Ultrasonics: Introduction and their engineering applications (cold welding, drilling, SONAR)

8. Optics (05 periods)

8.1. Reflection and refraction with laws, refractive index, lens formula (no derivation), power of lens (related numerical problems).
8.2. Total internal reflection and its applications, Critical angle and conditions for total internal reflection
8.3. Microscope, Telescope (definition)
8.4. Uses of microscope and telescope.

9. Electrostatics (09 Periods)

9.1. Electric charge, unit of charge, conservation of charge.
9.2. Coulombs law of electrostatics,
9.3. Electric field, Electric lines of force (definition and properties), Electric field intensity due to a point charge.
9.4. Definition of Electric flux, Gauss law (Statement and derivation)
9.5. Capacitor and Capacitance (with formula and units), Series and parallel combination of capacitors (simple numerical problems)

10. Current Electricity (08 Periods)

10.1 Electric Current and its Unit, Direct and alternating current,
10.2 Resistance, Specific Resistance and Conductance (definition and units)
10.3 Series and Parallel combination of Resistances.
10.4 Ohm's law (statement and formula),
10.5 Heating effect of current, electric power and its units
10.6 Kirchhoff's laws (statement and formula)

11 Electromagnetism (04 periods)

11.1. Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with examples.
11.2. Magnetic field, magnetic intensity, magnetic lines of force, magnetic flux and their units

11.3. Electromagnetic induction (definition)

12. Semiconductor physics (09 periods)

12.1. Definition of Energy level, Energy bands,

12.2. Types of materials (insulator, semiconductor, conductor) with examples,

12.3. Intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics

12.4. Diode as rectifier – half wave and full wave rectifier (centre tap only)

12.5. Semiconductor transistor; pnp and npn (Introduction only), symbol.

13. Modern Physics (09 periods)

13.1. Lasers: full form, principle, spontaneous emission, stimulated emission, population inversion, engineering and medical applications of lasers.

13.2. Fibre optics: Introduction to optical fibers (definition, parts), applications of optical fibers in different fields.

13.3. Introduction to nanotechnology (definition of nanomaterials with examples) and its applications.