

PROGRAMME NAME/S: COMMON TO ALL ENGINEERING PROGRAMS**SEMESTER : FIRST****COURSE TITLE : APPLIED PHYSICS I****COURSE CODE :****I. RATIONALE:**

Applied Physics includes the study of dynamic and diverse topics all related to things that go on in the world around us. Aim of learning this is to give an understanding of this world both by observations and by prediction of the way in which objects will behave. Study of physics in first year is essential for engineering diploma students because it provides the fundamental principles that lie behind engineering and helps students in developing technical skills that are useful in upcoming semesters. There is requirement of offering learners sufficient conceptual background of Physics which would ultimately make them proficient to meet the challenges of engineering problems in upcoming time. Concrete utilization of physical principles and analysis in various fields of engineering and technology are given prominence in this course.

II. INDUSTRY/EMPLOYER EXPECTED OUTCOME:

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of following industry identified outcome expected from this course. Apply principles of physics to solve broad based relevant engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS):

Students will be able to achieve & demonstrate the following COs on completion of course based learning:

CO1- Understand basic mathematical tools, identities and functions required for Physics Problems

CO2- Use basic instruments to measure the physical quantities in various engineering problems.

CO3- Apply basics of mechanics to solve given engineering problems.

CO4- Understand how one material differs from another.

CO5- Apply basic principles of thermometry to solve engineering problems.

CO6- Apply principles of waves and oscillations to solve engineering problems.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT FOR APPLIED PHYSICS-I

Sr. No.	Theory Learning Outcomes (TLOs) aligned to COs.	Learning content mapped with Theory Learning Outcomes (TLOs) and COs.	Suggested Learning Pedagogies.	No Of Lecture	CO
1	TLO1.1: Solve problems based on algebraic identities $(x+y)^2, (x-y)^2, x^2 - y^2$ TLO1.2: Expansion of $(1+x)^n, (1-x)^n$ TLO1.3: Apply Pythagoras theorem and	UNIT – I Basic Mathematics for Physics 1.1 Introduction about algebraic Identities $(x+y)^2, (x-y)^2, x^2 - y^2$ 1.2 Introduction about Binomial	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	04	CO1

	trigonometric ratios to explain relation between Hypotenuse, Base and perpendicular of right angle. TLO1.4: Solve basic integration and differentiations of single functions. TLO1.5: Explain and Draw Line graph.	theorem $(1+x)^n, (1-x)^n$ 1.3 Trigonometry: introduction about Pythagoras theorem and basic trigonometric ratios 1.4 Basic introduction about integration and differentiation 1.5 Line graph representation			
2	TLO2.1: Explain physical quantities and its types with examples. TLO2.2: Apply dimensional analysis to check correctness of equation and conversion of units in different systems. TLO2.3: Estimate the errors in the measurement for the given problem. TLO2.4: Explain the procedure of measurement of a given object by using vernier calipers, screw gauge and spherometer TLO2.5: Differentiate between scalar and vector quantities with examples.	UNIT - II Units and Measurements 2.1 Physical quantities: Fundamental and derived quantities and their units, Systems of units: CGS, MKS and SI. 2.1 Dimensions, dimensional formula, Applications of dimensional analysis; principle of homogeneity of dimensions: correctness of physical equations, conversion of units in different systems of units. 2.1 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures. 2.1 Applications of Vernier calipers, Screwgauge, Spherometer 2.1 Vector analysis: Scalar and Vector quantities, Resolution and composition of vectors, Addition of vectors, Vector Multiplication.	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	06	CO2
3	TLO3.1: Explain force, Momentum, Impulse, friction. TLO3.2: Relate linear and angular velocity, linear and angular acceleration, Torque and Angular momentum. TLO3.3: Calculate work, power and energy for given problems.	UNIT - III Basics of Mechanics 3.1 Force: Newton's laws of force with examples, Linear motion, Linear momentum and it's conservation, impulse, Law of parallelogram of forces. Friction: Types of friction, applications of friction, Lubricants (only general idea), applications of lubricants. 3.2 Circular motion: Angular	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	12	CO3

	TLO3.4: Explain work-energy theorem.	displacement, angular velocity and angular acceleration, Relation between linear and angular velocity, linear and angular acceleration, Centripetal force (only concept and formula) and centrifugal force with application such as banking of roads, bending of cyclists. Rotational Motion: Torque, relationship between Torque and Angular momentum, Center of mass, Moment of Inertia, radius of gyration, Theorems of parallel and perpendicular axes (statements only). Application of rotational motion in transport vehicles, trains and aeroplane turbine/engine. 3.3 Work: definition and its SI units, Work done in moving an object. Power: definition and its SI units, calculation of power with numerical problem, Energy: Definition and its SI units: Kinetic energy and Potential energy with examples and their derivation. 3.4 Work -Energy Theorem, Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another with its application.			
4	TLO4.1: Explain Hooke's law and stress-strain diagram. TLO4.2: Define pressure and explain engineering applications of compressibility of fluids. TLO4.3: How temperature and impurity affects surface tension of any liquid. TLO4.4: Define Stoke's law and obtain formula for terminal velocity.	UNIT - IV Some Properties of Matter 4.1 Elasticity: definition of stress and strain, different types of modulus of elasticity, stress – strain diagram, Hooke's law. Engineering applications of Elasticity. 4.2 Pressure: definition of Pressure, its units, atmospheric pressure, Fortin's barometer, gauge pressure, absolute pressure. Pascal's law (concept only).	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	08	CO4

		Bernoulli's Theorem (concept and examples only). Compressibility of fluids and its engineering applications. 4.3 Surface tension: concept, its units, applications of surface tension, effect of temperature and impurity on surface tension. 4.4 Viscosity: Viscosity and coefficient of viscosity: Stoke's Law and terminal velocity, effect of temperature on viscosity.			
5	TLO5.1: Differentiate between heat and temperature and conversion between different scales of temperatures. TLO5.2: calculate coefficient of linear, surface and cubical expansions and obtain relation amongst them. TLO5.3: Explain modes of transfer of heat.	UNIT - V Basic Thermodynamics 5.1 Difference between heat and temperature, Principles of measurement of temperature and different scales of temperature and their relationship. 5.2 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them. 5.3 Modes of transfer of heat (Conduction, convection and radiation with examples), Coefficient of thermal conductivity, Engineering Application of conduction, convection and radiations	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	10	CO5
6	TLO6.1: Obtain expression for displacement, velocity, acceleration, time period, frequency and Energy in simple harmonic motion. TLO6.2: Explain transverse waves and longitudinal waves. TLO6.3: Explain the role of acoustics in improve communication and listening in auditorium and class rooms.	UNIT - VI Waves and oscillations 6.1 S.H.M.: Definition, expression for displacement, velocity, acceleration, time period, frequency and Energy in S.H.M. Time period of Simple pendulum. S.H.M. waves. 6.2 Transverse waves and longitudinal waves, Sound waves, frequency of sound, wavelength of sound, amplitude of sound, speed of sound. 6.3 Acoustics of buildings –	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	08	CO6

	TLO6.4: Explain applications of ultrasonic Waves, ultrasonic cleaning, and ultrasonic soldering.	reverberation, reverberation time, echo, coefficient of absorption of sound, methods to control reverberation time and their applications. 6.4 Ultrasonic – Ultrasonic waves, their engineering and medical applications.			
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V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES FOR APPLIED PHYSICS-I:

Sr. No.	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment/Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Determine least count of measuring equipment.	To find the Least count of given different measuring equipment (eg. voltmeter, ammeter, stop watch, vernier calipers etc).	3	CO1
2	LLO 2.1 Use Micrometer Screw gauge to: Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement.	To find the diameter of wire using a screw gauge.	2	CO2
3	LLO 3.1 Use vernier caliper to: Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 3.2 Estimate the errors in measurement.	To find volume of solid cylinder and hollow cylinder using a vernier caliper.	2	CO2
4	LLO 4.1 Use spherometer to: Measure radius of curvature of given object. LLO 4.2 Estimate the errors in measurement.	To determine the radius of curvature using a Spherometer.	2	CO2
5	LLO 5.1 Verify law of parallelogram law of forces.	To verify parallelogram law of forces.	2	CO3
6	LLO 6.1 Determine the coefficient of friction on horizontal plane.	To determine the coefficient of friction on horizontal plane.	2	CO3
7	LLO 7.1 Determine force Constant of spring using Hooke's Law.	To determine force Constant of spring using Hooke's Law.	2	CO4
8	LLO 8.1 Determine Young's Modulus by Searle's apparatus.	To determine the Young's Modulus by Searle's apparatus.	2	CO4
9	LLO 9.1 By Stoke's method determine viscosity of given liquid	To determine the viscosity of given liquid by Stoke's method	2	CO4
10	LLO 10.1 Use Fortin's barometer to find atmospheric pressure.	Determine the atmospheric pressure at a place using Fortin's barometer.	2	CO4
11	LLO 11.1 Determine Coefficient of	Determination of Coefficient of	2	CO5

	thermal conductivity using Searle's apparatus.	thermal conductivity using Searle's apparatus.		
12	LLO 12.1 Determine thermal conductivity of bad Conductor by Lee's disc method.	Determine the thermal conductivity of a nonmetallic solid (bad Conductor) by Lee's disc method.	2	CO5
13	LLO 13.1 Find the time period of a simple pendulum. LLO 13.2 Determine the length of second's pendulum.	To find the time period of a simple pendulum and determine the length of second's pendulum.	3	CO5
14	LLO 14.1 Determine frequency of A.C. mains or of an electric vibrator by Melde's experiment.	Determine the frequency of A.C. mains or of an electric vibrator by Melde's experiment.	2	CO6
15	LLO 15.2 Study relation between frequency and length of a given wire under constant tension.	Study the relation between frequency and length of a given wire under constant tension using sonometer.	2	CO6
Note: Out of above suggestive LLOs - Minimum 70% of the above listed lab experiments are to be performed. Judicious mix of LLOs is to be performed to achieve desired outcomes.				

VI. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING):

MICRO PROJECT:

- Prepare prototype vernier caliper of desired least count using card sheet.
- Collect information by library survey regarding engineering material used in various industries.
- Prepare model to show conservation of linear momentum.
- Prepare model to show Conservation of angular momentum.
- Prepare Charts on given topics.
- Prepare Charts for practical.
- Prepare model to demonstrate expansion of solids, liquids and gases.
- Prepare model to demonstrate Hook's law.
- Prepare model to demonstrate Bernoulli's Theorem.
- Prepare model to demonstrate Surface tension.
- Prepare model to demonstrate Viscosity.
- Prepare model on how to control friction.

ASSIGNMENTS:

- Prepare a chart to summarize basic Integration and differentiation formulas.
- Prepare a chart to summarize units and measurements.
- Write Work-energy theorem.
- Calculate power for given problems.
- Determine the rigidity modulus of the suspension wire using torsion pendulum. (Virtual Lab)

- Determine g , the acceleration of gravity at a particular location. (Virtual Lab)
- Convert the units of a given physical quantity from one system of units to another.
- Measure room temperature of hot baths / bodies by using mercury thermometer and convert it into different scales.
- Find Viscosity of Liquid. (Virtual Lab)

VII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED:

Sr. No.	Equipment/Instrument/Tools Name with Broad Specifications	Relevant LLO Number
1	Screw Gauge: Range :0-25 mm, Resolution: 0.01mm	1,2,8
2	Vernier Calipers: Range: 0-150mm, Resolution: 0.1mm	1,3
3	Spherometer: Least Count 0.01mm	1,4
4	Stop Watch: Mechanical	1,13
5	Ammeter: (0-3A)	1
6	Voltmeter: (0-3V)	1
7	Solid Cylinder and Hollow Cylinder	3
8	Watch Glass	4
9	Gravesand's Apparatus /Parallelogram Apparatus with three slotted weight and two pulleys, stand type portable.	5
10	Mirror Strip	5
11	Coefficient of Friction apparatus complete setup with weight box.	6
12	Metallic bob	2,3,13
13	Hooke's law apparatus.	7
14	Searle's Apparatus with slotted weight and wire	8
15	Viscosity Apparatus for Stokes's Method.	9
16	Fortin's barometer	10
17	Searle's apparatus for thermal conductivity	11
18	Lee's disc with stand.	12
19	Melde's electric vibrator.	14
20	Sonometer	15
21	Sensitive Thermometer	14,15
22	Steam Boiler	14,15

VIII. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table):

Sr. No.	Unit	Unit Title	AlignedCOs	Learning Hours (L+T)	Weightage%
1	I	Basic of Mathematics for Physics	CO1	04	9
2	II	Units and Measurements	CO2	06	13
3	III	Basics of Mechanics	CO3	12	25
4	IV	Some properties of matter	CO4	08	16
5	V	Basic Thermodynamics	CO5	10	21
6	VI	Waves and Oscillations	CO6	08	16
Grand Total				48	100

IX. SUGGESTED COS - POS MATRIX FORM:

Applied Physics - I							
Course Outcome s(COs)	Programme Outcomes (POs)						
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning
CO1	3	3	2	1	1	1	1
CO2	3	1	2	3	1	1	1
CO3	3	2	2	1	1		1
CO4	3	2	2	2	1	1	1
CO5	3	1	2	2	1		1
CO6	3	1	1	1	1	1	1
Legends: - High:03, Medium:02, Low:01							

X. SUGGESTED LEARNING MATERIALS / BOOKS:

Sr. No.	Author	Title	Publisher with ISBN Number
1	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part I - Class XI	National Council of Education Research and Training, ISBN: 8174505083
2	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part II - Class XI	National Council of Education Research and Training, ISBN: 8174505660
3	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, ISBN: 8174506314
4	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, ISBN: 8174506713
5	David Halliday, Robert Resnik and Jearl Walker	Fundamentals of Physics	John Wiley & sons, Hoboken, 2014 ISBN: 812650823X
6	B. N. Ivanov	Fundamentals of Physics	CBS
7	Yakov Perelman	Physics at every step	Prodinova, ISBN: 2917260564
8	H. C. Verma	Concepts of physics	Bharti Bhawan, ISBN: 8177091875

XI. LEARNING WEBSITES & PORTALS:

S.N.	Link / Portal	Description
1	www.sciencejoywagon.com/physicszone	Electricity, Magnetism and Semiconductors, basic of fiber optics
2	https://phet.colorado.edu	Electricity, Magnetism and Semiconductors, Thermometry and basic of fiber optics
3	www.physicsclassroom.com	Concepts of basic physics
4	EDUPOINT	Concepts of basic physics

5	NPTEL	Concepts of basic physics
6	SWAYAM	Concepts of basic physics
7	Vlab (Virtual Lab)	To perform practical virtually.