GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

APPLIED PHYSICS
(Code: 3310101)

Diploma Programme in which this course is offered	Semester in which offered
Aeronautical Engineering	First

1. RATIONALE.

The Applied Physics program is to prepare students for careers in engineering where physics principles can be applied to the advancement of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering.

2. COMPETENCY.

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies…….

- Select proper measuring instrument on the basis of range, least count & precision required for measurement.
- Analyze properties of material & their use for the selection of material mostly applicable for engineering users..
- Identify good & bad conductors of heat and proper temperature scale for temperature measurement
- Identify, analyze, discriminate and interpret logical sequence of field problems with the study of physics.
- Analyze variation of sound intensity with respect to distance.
- Follow the principles used in the physical properties, its measurement and selections.

3. COURSE OUTCOMES.

1. The student will demonstrate the ability to think in core concept of their engineering application by studying various topics involved in branch specific applications.
2. The student will demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in physics.
3. In courses involving laboratory, the student will demonstrate the ability to collect and analyze data and to prepare coherent reports of his or her findings.
4. In a design module project , the student will demonstrate the ability to perform a literature search, to make use of appropriate computational or laboratory skills, and to make an effective written or oral presentation of the results of the project.

4. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
03	00	02	05	70	30	30	20	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment

5. COURSE DETAILS.

Unit	Major Learning Topics and Sub-topics	Outcomes (in cognitive domain)
Unit – I Units & Measurements	1.1 Explain Physical Quantities and their units. 1.2Measure given dimensions by using appropriate instruments accurately. 1.3Calculate error in the measurement 1.4Solve numerical based on above outcomes	1.1 Need of measurement and unit in engineering and science, definition of unit , requirements of standard unit, systems of units-CGS,MKS and SI, fundamental and derived quantities and their units 1.2 Least count and range of instrument, least count of vernier caliper, micrometer screw gauge 1.3 Definition of accuracy, precision and error, estimation of errors -absolute error, relative error and percentage error, rules and identification of significant figures. (Numerical on above topics)
Unit– II Force and Motion:	2.1 List Newton's laws of motion 2.2 Differentiate among various forces in nature 2.3 Define inertia, momentum and impulse of force 2.4 State Newton's laws of	Recapitulation of equations of motion, Newton's Ist law of motion, Force, basic forces in motion, gravitational force, electrostatic force, electromagnetic force, nuclear force, Inertia, types of inertia (inertia of rest, inertia of motion, inertia of direction), Momentum, Newton's IInd law of

Unit	Major Learning Topics and Sub-topics	Outcomes (in cognitive domain)
	motion 2.5 State law of conservation of momentum 2.6 Solve numerical problems based on above topics	motion, measurement of force using second law, simple problems on F = ma and equations of motion, Impulse of force, Impulse as the product of force and time, impulse as the difference of momentum, examples of impulse, simple problems on impulse, Newtons IIIrd law of motion and its examples. Law of conservation of momentum, Statement, simple problems (Numerical on above topics)
Unit–III General properties of matter	3.1Comprehend the concept of elasticity and Define Stress, Strain and Elastic limit. 3.2State Hooke's law. 3.3Explain the term elastic fatigue. 3.4Distinguish between Streamline and Turbulent flow 3.5Define coefficient of viscosity. 3.6Apply the principle of viscosity in solving problems. 3.7State significance of Reynold's number 3.8Explain terminal velocity. 3.9Mention Stoke's formula. 3.10Explain the effect of temperature on viscosity 3.11Comprehend the phenomenon of surface tension and its applications. 3.12Define surface tension. 3.13Explain angle of	3.1 Elasticity Deforming force, restoring force, elastic and plastic body, stress and strain with their types. elastic limit, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity and relation between them (no derivation), stress strain diagram. behavior of wire under continuously increasing load, yield point, ultimate stress, breaking stress, factor of safety. 3.2 Surface Tension. Molecular force, cohesive and adhesive force, Molecular range, sphere of influence, Laplace's molecular theory, Definition of surface tension and its S.I. unit, angle of contact, capillary action with examples, shape of meniscus for water and mercury, relation between surface tension , capillary rise and radius of capillary (no derivation),effect of impurity and temperature on surface tension 3.3 Viscosity Fluid friction, viscous force, Definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of

Unit	Major Learning Topics and Sub-topics	Outcomes (in cognitive domain)
	contact and capillarity. 3.14 Solve problems related to surface tension.	viscosity and its S.I. unit, streamline and turbulent flow with examples, critical velocity, Reynolds's number and its significance, free fall of spherical body through viscous medium (no derivation), up thrust force, terminal velocity, Stokes law (statement and formula). (Numericals on Above topics)
Unit– IV Heat Transfer	4.1Distinguish between Heat and Temperature. 4.2Explain modes of Transmission of heat and their applications. 4.3Define heat capacity and specific heat of substances. 4.4Explain temperature 4.5List various temperature scales and convert among temperatures	4.1 Three modes of transmission of heat - conduction, convection and radiation, good and bad conductor of heat with examples, law of thermal conductivity, coefficient of thermal conductivity and its S.I. unit. 4.2 Heat capacity and specific heat of materials 4.3 Celsius, Fahrenheit and Kelvin temperature scales and their conversion formulae (Numericals on above topics)
Unit– V Waves and Sound	5.1 Comprehend the concept of wave motion 5.2 Distinguish between transverse and longitudinal waves. 5.3Define period, frequency, amplitude and wavelength 5.4Explain principle of superposition of waves 5.5Define resonance	Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength, longitudinal and transverse wave, principle of superposition of waves, definition of resonance with examples, Formula for velocity of sound in air and various factors affecting it Ultrasonic Waves Definition, Properties of ultrasonic waves Uses of ultrasonic waves. Acoustics Of Building Importance of Reverberation, Reverberation time,

Unit	Major Learning Topics and Sub-topics	Outcomes (in cognitive domain)
	5.6Explain resonance. 5.7State Formula for velocity of sound in air 5.8Comprehend the Importance of Reverberation 5.9State Sabine's formula and Factors affecting Reverberation time 5.10Explain ultrasonic waves. Mention applications of ultra sonic waves	Optimum time of Reverberation, Coefficient of absorption of Sound, Sabine's formula for Reverberation time, Factors affecting Reverberation time and acoustics of building. (Numericals on above topics)
Unit– VI **Modern Physics**	6.1 State Properties Of Light 6.2 Define various phenomena of light 6.3 State Snell's law of refraction. State Properties of laser *Explain spontaneous and stimulated emission, population inversion and optical pumping *Explain construction and working of Nd:YAG laser *State applications of lasers. * Explain principle & working of optical fibres	Light : Properties Of Light, Electromagnetic spectrum, Reflection, refraction, snell's law, diffraction, polarization, interference of light, constructive and destructive interference (Only definitions),physical significance of refractive index, dispersion of light. (Numericals on above topics) LASER : Introduction, Characteristics of laser radiation, Spontaneous and stimulated emission, Working of LASER with basic idea about Population, Inversion, Pumping mechanism, Optical Resonators Nd: YAG LASER, Applications of LASER: Medical, Industrial, Communication and other FIBER OPTICS : Introduction of Optical Fiber, Advantages of Optical Fiber, Total Internal Reflection, Numerical Aperture and Acceptance angle, Modes of Propagation, Types of Optical Fiber, Applications of optical fiber
Unit– VII **Nanophysics**	Define nanotechnology and explain importance and list applications of nanotechnology in	Nanoscale, Surface to volume ratio, Surface effects on Nanomaterials, Nanomaterials and Nanotechnology, Unusal properties of Nanomaterials, Disadvantages of Nanomaterials, Carbon Nanotubes: Introduction, Structure, Synthesis, Properties and applications Applications

Unit	Major Learning Topics and Sub-topics	Outcomes (in cognitive domain)
	engineering field	of Nanomaterials

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY).

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	UNITS & MEASUREMENT	05	03	02	05	10
	FORCE AND MOTION	05	02	02	04	08
	GENERAL PROPERTIES OF MATTER	10	04	06	08	18
	HEAT TRANSFER	04	02	02	02	06
	WAVES AND SOUND	07	04	04	04	12
	MODERN PHYSICS	07	03	03	04	10
	NANO PHYSICS	04	02	02	02	06
TOTAL		42	20	21	29	70

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy).

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

General Notes:

a. If midsem test is part of continuous evaluation, unit numbers I and II are to be considered.
b. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.
c. In examination, example of same chapter is to be asked in place of example.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

1. Linear Measurement by Vernier Callipers
2. Precision measurement by Micrometer Screw Gauge
3. Measurement of Viscosity
4. Measurement of Young's Modulus
5. Measurement of Surface tension
6. To determine Force constant with the help of periodic time of oscillations of spring

7. Measurement of specific gravity
8. To calculate refractive index of material of prism using spectrometer device.
9. Joule's mechanical equivalent of heat
10. Measurement of co-efficient of thermal conductivity
11. To study the relation between the length of a stretched string and the tension in it with the help of a sonometer.
12. To calculate SA/V ratio of simple objects to understand nanotechnology

Minimum 8 experiments/practical exercises should be performed from the above list

8. SUGGESTED LIST OF STUDENT ACTIVITIES.

Following is the list of proposed student activities like:

Laboratory based mini projects :
1. To calculate acoustics of given class room
2. To measure diameter and calculate resistance of given set of conductors

Teacher guided self learning activities :
1. To prepare a chart of applications of nanotechnology in engineering field
2. To prepare models to explain different concepts

Course/topic based seminars :
1. Seminar by student on any relevant topic

9. SUGGESTED LEARNING RESOURCES

A. List of Books

1. Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd.
2. Fundamentals of Physics: by D. Halliday, R Resnick and J. Walker, Asian Books Pvt. Ltd.
3. Fundamentals Of Physics By: Gomber & Gogia Pradeep Publications, Jalandhar
4. Engineering Physics, G Vijayakumari Vikas-Gtu Students' Series
5. H C Verma Concepts Of Physics
6. Ncert Physics Part 1 And 2 Ncert

B. List of Major Equipment/ Instrument

1. Redwood's Viscometer
2. Digital Vernier Calipers And . Digital Micrometer Screw Guage
3. Digital Travelling Microscope
4. Joule's Calorimeter
5. Searle's Thermal Conductivity Apparatus
6. Visible Light Spectrometer

C. List of Software/Learning Websites

1. www.physicsclassroom.com
2. www.physics.org
3. www.fearofphysics.com
4. www.sciencejoywagon.com/physicszone
5. www.science.howstuffworks.com