

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**  
**COURSE CURRICULUM**

Course Title: Engineering Physics (Group-1)  
(Code: 3300004)

<b>Diploma Programmes in which this course is offered</b>	<b>Semester in which offered</b>
Automobile Engineering, Ceramic Engineering, Civil Engineering, Environment Engineering, Fabrication Technology, Mechanical Engineering, Mechatronics Engineering, Metallurgy Engineering, Mining Engineering, Plastic Engineering, Transportation Engineering	<b>First Semester</b>
Chemical Engineering, Textile Manufacturing Technology, Textile Processing Technology	<b>Second Semester</b>

## 1. RATIONALE

As Physics is the mother of all engineering disciplines, students must have some basic knowledge on physics to understand their core engineering subjects more comfortably. Accordingly, in reviewing the syllabus, emphasis has been given on the principles, laws, working formulae and basic ideas of physics to help them study the core subjects. Complicated derivations have been avoided because applications of the laws and principles of physics are more important for engineering students.

As Physics is considered as basic science its principles, laws, hypothesis, concepts, ideas are playing important role in reinforcing the knowledge of technology. Deep thought is given while selecting topics in physics. They are different for various branches of engineering. This will provide sound background for self-development in future to cope up with new innovations. Topics are relevant to particular program and students will be motivated to learn and can enjoy the course of Physics as if it is one of the subjects of their own stream.

Engineering, being the science of measurement and design, has been offspring of Physics that plays the primary role in all professional disciplines of engineering. The different streams of Physics like Optics, Acoustics, Dynamics, Semiconductor Physics, Surface Physics, Nuclear physics, Energy Studies, Materials Science, etc provide Fundamental Facts, Principles, Laws, and Proper Sequence of Events to streamline Engineering knowledge.

**Note:-** Teachers should give 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.

Laboratory experiments have been set up keeping consistency with the theory so that the students can understand the applications of the laws and principles of physics.

## 2. LIST OF COMPETENCIES

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.....

### i. Apply principles and concepts of Physics for solving various Engineering Problems

## 3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

## 4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit – I</b>	1.1 Explain Physical Quantities and their units. 1.2 Measure given dimensions by using appropriate instruments accurately. 1.3 Calculate error in the measurement 1.4 Solve numerical based on above outcomes	<b><u>SI Units &amp; Measurements</u></b> 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)
<b>Unit– II</b>	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 motion 2.5 State law of conservation of momentum 2.6 Solve numerical problems based on above topics	<b><u>Force and Motion:</u></b> 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 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)
<b>Unit– III</b>	3.1 Comprehend the concept of elasticity and Define Stress, Strain and Elastic limit.	<b><u>General properties of matter</u></b> <b>3.1 Elasticity</b> Deforming force, restoring force, elastic and plastic

Unit	Major Learning Outcomes	Topics and Sub-topics
	3.2 State Hooke's law. 3.3 Explain the term elastic fatigue. 3.4 Distinguish between Streamline and Turbulent flow 3.5 Define coefficient of viscosity. 3.6 Apply the principle of viscosity in solving problems. 3.7 State significance of Reynold's number 3.8 Explain terminal velocity. 3.9 Mention Stoke's formula. 3.10 Explain the effect of temperature on viscosity 3.11 Comprehend the phenomenon of surface tension and its applications. 3.12 Define surface tension. 3.13 Explain angle of contact and capillarity. 3.14 Solve problems related to surface tension.	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. <b>3.2 Surface Tension.</b> 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 <b>3.3 Viscosity</b> Fluid friction, viscous force, Definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of 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)
<b>Unit- IV</b>	4.1 Distinguish between Heat and Temperature. 4.2 Explain modes of Transmission of heat and their applications. 4.3 Define heat capacity and specific heat of substances. 4.4 Explain temperature 4.5 List various temperature scales and convert among temperatures	<b>Heat Transfer</b> 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)
<b>Unit- V</b>	5.1 Comprehend the concept of wave motion 5.2 Distinguish between transverse and longitudinal waves. 5.3 Define period, frequency, amplitude and wavelength 5.4 Explain principle of superposition of waves 5.5 Define resonance 5.6 Explain resonance. 5.7 State Formula for velocity of sound in air 5.8 Comprehend the Importance of Reverberation 5.9 State Sabine's formula and Factors affecting Reverberation time 5.10 Explain ultrasonic waves. Mention applications of	<b>Waves and Sound</b> 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 <b>Ultrasonic Waves</b> Definition, Properties of ultrasonic waves Uses of ultrasonic waves. <b>Acoustics Of Building</b> Importance of Reverberation, Reverberation time, 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	Major Learning Outcomes	Topics and Sub-topics
	ultrasonic waves	
<b>Unit– VI</b>	6.1 State Properties Of Light 6.2 Define various phenomena of light 6.3 State Snell’s law of refraction. 6.4 Explain importance and list applications of nanotechnology in engineering field	<b><u>Light and Nanotechnology</u></b> 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  Introduction to Nanotechnology (Numericals on above topics)
<b>Unit – VII</b>	7.1 Define radio activity 7.2 Distinguish between Natural & Artificial radioactivity 7.3 State relation between Half Life, Average Life & Decay Constant. 7.4 Describe properties of Alpha, Beta and Gamma rays.	<b><u>Radioactivity</u></b> <b>7.1 Radioactivity</b> Definition, Natural & Artificial radioactivity, Units and Laws of Radioactivity, Half Life, Average Life & Decay Constant. <b>7.2 Radioactive Rays</b> Properties and uses of alpha particles, beta particles and gamma rays (Numericals on Above topics)

## 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	SI Units & Measurements	05	03	02	05	10
2.	Force and Motion	05	02	02	04	08
3.	General Properties of Matter	10	04	06	08	18
4.	Heat Transfer	04	02	02	02	06
5.	Waves and sound	07	04	04	04	12
6.	Light and Nanotechnology	07	03	03	04	10
7.	Radioactivity	04	02	02	02	06
	<b>Total</b>	<b>42</b>	<b>20</b>	<b>21</b>	<b>29</b>	<b>70</b>

### Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom’s taxonomy)

## 6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

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.

S. No.	Unit No.	Experiment /Practical Exercises
1	1	Linear Measurement by Vernier calipers
2	1	Linear Measurement by Micrometer screw
3	3	Measurement of Surface tension
4	3	Measurement of Viscosity
5	3	Measurement of Young's Modulus
6	3	To determine Force constant with the help of periodic time of oscillations of spring
7	3	Measurement of specific gravity
8	6	To calculate refractive index of material of prism using spectrometer device.
9	4	Joule's mechanical equivalent of heat
10	4	Measurement of co-efficient of thermal conductivity
11	5	To study the relation between the length of a stretched string and the tension in it with the help of a sonometer.
12	6	To calculate SA/V ratio of simple objects to understand nanotechnology

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

□ Hours distribution for Physics Experiments :

Sr. No.	Description	Hours
1	An introduction to Physics laboratory and its experiments (for the set of first four experiments)	02
2	Set of first four experiments	08
3	An introduction to experiments (for the set of next four experiments)	02
4	Set of next four experiments	08
5	Mini project	06
6	Viva and Submission	02

## 7. SUGGESTED LIST OF PROPOSED 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 prepare models of Vernier calipers, micrometer screw gauge and travelling microscope

And many more 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

And many more Course/topic based seminars:

1. Seminar by student on any relevant topic

## 8. SUGGESTED LEARNING RESOURCES

### A. List of Books

Sr No.	Author	Title of Books	Publication
1	Sears And Zemansky	University Physics	Pearson Publication
2	Paul G Hewitt	Conceptual Physics	Pearson Publication
3	Halliday & Resnick	Physics	Wiley India
4	G Vijayakumari	Engineering Physics, 4e	Vikas-Gtu Students' Series
5	Arvind Kumar & Shrish Barve	How And Why In Basic Mechanics	Universities Press
6	Ncert	Physics Part 1 And 2	Ncert
7	Giancoli	Physics For Scientists And Engineers	
8	H C Verma	Concepts Of Physics	
9	Gomber & Gogia	Fundamentals Of Physics	Pradeep Publications, Jalandhar

### 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](http://www.physicsclassroom.com)
2. [www.physics.org](http://www.physics.org)
3. [www.fearofphysics.com](http://www.fearofphysics.com)
4. [www.sciencejoywagon.com/physicszone](http://www.sciencejoywagon.com/physicszone)
5. [www.science.howstuffworks.com](http://www.science.howstuffworks.com)

## 9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- Dr. S. B. Chhag**, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Rajkot
- Ku. B. K. Faldu**, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Ahmedabad
- Shri D. V. Mehta**, Lecturer in Physics, Science Deptt, RCTI, Ahmedabad
- Shri S. B. Singhania**, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Ahmedabad
- Dr. U. N. Trivedi**, Lecturer in Physics, Science Deptt, RCTI, Ahmedabad

### Coordinator and Faculty Members From NITTTR Bhopal

- Dr. P. K. Purohit**, Professor, Department of Applied Science, NITTTR, Bhopal

