**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**Course Curriculum**

**ENGINEERING PHYSICS**
**( Code: 3326307)**

| Diploma Programme in which this course is offered | Semester in which offered |
|---|---|
| Agriculture Engineering | 2nd |

## 1. RATIONALE.

The Engineering 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 |
| 02 | 00 | 01 | 03 | 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 | Outcomes (in cognitive domain) | Major Learning Topics and Sub-topics |
|---|---|---|
| **Unit – I Magnetic Materials** | 1.1 Distinguish between dia, para and ferromagnetic material<br>1.2 Understand Langevin theory of dia and para magnetism.<br>1.3 ExplainAdiabatic demagnetization.<br>1.4 Understand Weiss molecular field theory & Ferro magnetism<br>1.5 State Curie – Weiss law | 1.1 Dia, Para and Ferromagnetism classification.<br>1.2 Langevin theory of dia and para magnetism.<br>1.3 Adiabatic demagnetization.<br>1.4 Weiss molecular field theory & Ferro magnetism<br>1.5 Curie – Weiss law |
| **Unit– II Quantum Physics Schrodinger wave Eqquation** | 2.1 Understand Concept of wave particle and wave function<br>2.2 Explain Schrodinger wave equations<br>2.3 Understand Zeeman effect, stark effect, paschan effect<br>2.4 Explain Raman spectroscopy | 2.1 Wave particle duality<br>2.2 de-Broglie concept<br>2.3 Uncertainty principle<br>2.4 Wave function<br>2.5 Time dependent Schrodinger wave equation<br>2.6 Time independent Schrodinger wave equation<br>2.7 Qualitative explanation of Zeeman effect<br>2.8 Stark effect and Paschan back effect<br>2.9 Raman spectroscopy |
| **Unit–III Semiconductor Physics** | 3.1 Define types of materials based on energy bands<br>3.2 State Boch's function statement<br>3.3 Explain Bloch's electron and effective mass<br>3.4 Distinguish between intrinsic and extrinsic semiconductor<br>3.5 State Law of mass action | 3 .1 Bands in solids<br>3.2 Statement of Bloch's function, Velocity of Bloch's electron & effective mass<br>3.3 Distinction between metals, insulators and semiconductors.<br>3.4 Intrinsic and extrinsic semiconductor<br>3.5 Law of mass action<br>3.6 Determination of energy gap in semiconductors.<br>3.7 Donors and acceptor levels. |
| **Unit– IV Superconductivity** | 4.1 Define Superconductivity<br>4.2 Explain Effect of critical magnetic field<br>4.3 Sate Types of superconductors<br>4.3 Explain Josephson's effect<br>4.4 Define Squids and i | 4.1 Superconductivity<br>4.2 Critical magnetic field<br>4.3 Meissiner effect<br>4.4 Isotope effect<br>4.5 Type – I and Type - I Superconductors<br>4.6 Josephson's effect DC & AC<br>4.7 Squids<br>4.8 Introduction to high $T_c$ |

| Unit | Outcomes (in cognitive domain) | Major Learning Topics and Sub-topics |
|---|---|---|
| | ntroduction to high $T_c$ | |
| **Unit– V Laser, Holography and Fiber Optics** | 5.1 Explain spontaneous and stimulated emission, population inversion<br>5.2 Explain Einstein coefficients<br>5.3 Explain Construction and working of He-Ne and Ruby lasers.<br>5.4 Explain Ammonia and Ruby masers<br>5.5 Explain holography<br>5.6.Explain construction and working of optical fibers<br>5.7 State Types of optical fibers<br>5.8 State Input and output characteristics of optical fiber<br>5.9 State fiber optics applications. | 5.1 Spontaneous and Stimulated emission<br>5.2 Einstein A and B coefficients<br>5.3 Population inversion<br>5.4 He – Ne and Ruby Lasers.<br>5.5 Ammonia and Ruby masers.<br>5.6 Holography<br>5.7 Optical fiber – Physical structure and basic theory<br>5.8 Optical fiber mode types<br>5.9 Input and output characteristics of optical fiber and applications. |
| **Unit– VI Luminescence** | 6.1 State Luminescence law<br>6.2 Define Luminous flux<br>6.3 Define Luminous Intensity<br>6.4 Explain Candle power and brightness. | 6.1 Illumination laws of illumination<br>6.2 Luminous flux<br>6.3 Luminous Intensity<br>6.4 Candle Power<br>6.5 Brightness |

**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 |
| 1 | **Magnetic Materials** | 4 | 2 | 4 | 4 | 10 |
| 2 | **Quantum Physics & Schrodinger** | 10 | 4 | 6 | 6 | 16 |

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| | **wave Equation** | | | | | |
| 3 | **Semiconductor Physics** | 5 | 2 | 4 | 4 | 10 |
| 4 | **Superconductivity** | 4 | 4 | 6 | 5 | 15 |
| 5 | **Laser, Holography and Fiber Optics** | 5 | 6 | 4 | 5 | 15 |
| 6 | **Luminescence** | 1 | 4 | - | - | 4 |
| TOTAL | | 29 | 22 | 24 | 24 | 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:

1. If mid sem test is part of continuous evaluation, unit numbers I and II are to be considered.
2. 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.
3. In examination, example of same chapter is to be asked in place of example.

## 6. 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. To find the frequency of A.C. supply using an electrical vibrator.
2. To find the low resistance using Carey Foster bridge without calibrating the bridge wire.
3. To determine dielectric constant of material using De Sauty's bridge.
4. To determine the value of specific charge (e/m) for electrons by helical method.
5. To study the induced e.m.f. as a function of velocity of the magnet.
6. To obtain hysteresis curve (B –H curve) on a C.R.O. and to determine related magnetic quantities.
7. To study the variation of magnetic field with distance along the axis of a current carrying circular coil and to determine the radius of the coil.
8. To determine the energy band gap in a semiconductor using a PN junction diode.
9. To determine the slit width from Fraunhofer diffraction pattern using laser beam.
10. Determination of ultrasonic wave velocity in a liquid medium.
11. To find the numerical aperture of optical fiber.
12. To set up the fiber optic analog and digital link.
13. To study the phase relationships in L.R. circuit.
14. To study LCR circuit
15. To study the variations of thermo e.m.f. of a copper-constant thermocouple with temperature.
16. To find the wave length of light by prism.

## 8 SUGGESTED LEARNING RESOURCES

### A. List of Books

1. Engineering Physics by Uma Mukherji
2. Solid State Physics by A.J.Dekker
3. Physics for Engineers by S.P.Taneja
4. Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar
5. Fundamentals of Physics by Resnick and Halliday, Asian Books Pvt. Ltd., New Delhi
6. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi.

## B. List of Major Equipment/ Instrument

1. Carey Foster bridge
2. De Sauty's bridge
3. Cathode Ray Oscilloscope (C.R.O)
4. PN junction diode

## C. List of Software/Learning Websites

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