# DEPARTMENT OF PHYSICS

# SYLLABUS

# BACHELOR OF TECHNOLOGY ( 1ST YEAR)

# [2012-13]

# SIKKIM MANIPAL UNIVERSITY

**DEPARTMENT OF PHYSICS**

PH1103 (4L + 1T hrs/week)

ENGINEERING PHYSICS

**Max Marks: 100**

No. of questions to be set: 4 from UNIT – I and 4 from UNIT – II of 20 marks each.
No. of questions to be answered: Any 5 questions selecting at least two questions from each UNIT.

**Objectives:**

1. The course focuses at developing the basic background in physics that will be required by an engineering student to pursue his B.Tech. course. The fundamental concepts and applications of the laws of physics through real life applications are embodied in the course. (PEO1, PEO2, PEO4, PEO6)
2. The course gives a thorough idea about oscillations, mechanical waves and wave optics required in different branches of engineering. (PEO1, PEO3, PEO4)
3. An introduction to the quantum mechanics is given so that the students can understand its application in their advanced courses in higher semesters. (PEO1, PEO2, PEO3)
4. The physics of band theory of solid is introduced which forms the backbone of electronics. (PEO1,PEO2, PEO3)
5. Overall the course aims for use of an integrated system where mathematical and scientific skills such as measuring, predicting, formulating explanations, drawing conclusions, and solving problems that are used in technology and its development. Scientific information will be made with real life examples and laboratory experiments where possible.(PEO1, PEO2, PEO4, PEO5, PEO6)

**Prerequisites**: Student should have the basic knowledge of the laws of physics in different areas of physics like waves, geometrical optics, atomic physics, states of matter and basic laws of heat and thermodynamics. They should have also done a course in mathematics involving calculus, simple differential equations, algebra, elementary number theory and trigonometry.

**Learning Outcomes**: After the completion of the complete syllabus, the student will be capable of the following:

1. Use Science Process and Thinking Skills. (PO1, PO2)
2. Observe objects for patterns and record both qualitative and quantitative information.(PO3)
3. When given a problem, plan and conduct experiments on the topic.(Po2, PO3)
4. Plan procedures to control independent variable.(PO3, PO4, PO10)
5. Analyze data and construct reasonable conclusions.(PO3,PO8))
6. Communicate Effectively Using Science Language and Reasoning.(PO7)
7. Provide relevant data to support their inferences and conclusions. (PO8)
8. Use mathematical reasoning to communicate information.(PO1, PO4)
9. To correlate the laws of physics for explaining facts and figures.(PO1, PO2)
10. Development of any devices, appliances, instruments can be done only when the laws of the force governing their actions are understood properly.( PO1, PO2, PO3, PO4)

## UNIT-I

**Oscillations:** Overview of vibrations with emphasis on damped and forced oscillators, resonance, coupled oscillations, normal mode. **[4hrs.']**

**Wave:** Longitudinal and transverse waves, wave equation, plane waves, phase velocity, superposition, group velocity. **[4 hrs]**

**Optics:** Interference of light waves, Young's experiment, Thin film interference, Newton's ring, Diffraction of light – Fresnel and Fraunhofer class, Fraunhofer diffraction for single slit (derivation) and double slits, N-slits and plane transmission grating (qualitative discussions). Rayleigh criterion, Polarization, Double refraction, Plane, Circularly and elliptically polarized light. **[14 hrs]**

## UNIT- II

**Quantum Mechanics:** Inadequacy of classical mechanics, Black body radiation, Rayleigh Jeans' law, Wien's displacement law, Planck's radiation law, Planck's quantum hypothesis, Photoelectric effect, Wave particle duality, de Broglie waves, Matter waves (Davisson-Germer experiment), Group velocity and phase velocity, wave packets and Heisenberg's uncertainty principle, wave function and its physical significance, Schrodinger's equation, Schrodinger's 1-D time independent equations, Potential well, potential barrier and quantum tunneling. **[14 hrs]**

**Band Theory of Solids:** Concept of free electron theory, quantum theory of free electrons, Fermi energy, Effect of temperature in Fermi-Dirac distribution, Bloch theorem, Concept of energy levels and bands, Distinction between Insulator, Semi conductors and Conductors in terms of energy band, p-n junction. **[4 hrs]**
Lecture(s) on recent trends in Physics in engineering perspective (Non-credit).

**Text Books:**


1. Physics by Resnick, Halliday and Krane, Vol 1&2; 5th Edn, John Wiley and Sons Inc.
2. Optics by N. Subrahmanyam, and Brij Lal., S. Chand and Company, New Delhi.
3. Physics for Scientists and Engineers with Modern Physics, by Serway and Jewatt, Volume 2; 6th Edn., Thomson
4. Concept of Modern Physics by Arthur Beiser, 6th Edn., Tata Mc Graw Hill.


**Reference:**


1. Berkley Physics Course by Kittel, Knight, Ruderman, Helmholz and Moyer , Vol. 1 ; Tata Mc Graw Hill.
2. Berkley Physics Course by Crawford, Vol 3; Tata Mc Graw Hill.
3. Berkley Physics Course by Wichmann, Vol 4; Tata Mc Graw Hill.
4. Engineering Physics, by H. K. Malik and A. K. Singh, 1st Edn., Tata Mc Graw Hill.
5. Engineering Physics, by Dattu R Joshi, 1st Edn., Tata McGraw Hill.

## DEPARTMENT OF PHYSICS

**PH1162**

ENGINEERING PHYSICS LAB

**Max Marks: 100**

There will be **ONE** laboratory class of 3 hours duration per week. There are **13 weeks** expected in a semester.

**Note:** Minimum of **FIVE** experiments to be completed from each **UNIT.**

**Objectives:**

1. The objective of the lab being **learning**, the course has been designed such that the students are able to apply the scientific method to experiments in the laboratory and verify the theoretical ideas and concepts covered in lecture by completing a host of experiments.(PEO1, PEO2, PEO6)
2. It will also enable the students to apply analytical techniques, statistical analysis and graphical analysis to the experiments. (PEO2, PEO3, PEO6)
3. In this laboratory, the course emphasis is on the understanding of basic principles of oscillations, resonance characteristic properties for semiconductor diode, zener diode, different instruments used in a field of optics, electronics etc. .(PEO1, PEO2, PEO3, PEO6)

**Prerequisites:** The students should have completed a course of Physics at Higher Secondary level and thereby has an understanding of the basic principles of oscillations and waves and a preliminary knowledge of semiconductor physics.

### UNIT-I

1. To study the normal modes of Coupled Oscillator.
2. To study the motion of Damped harmonic oscillator and determine its damping constant.
3. To study forced oscillation and resonance.
4. Determine the moment of inertia of a body by means of a torsion pendulum.
5. To find the velocity of sound in the given liquid using Ultrasonic Interferometer.
6. To draw (A) Histogram and Normal distribution error curve, and (B) to compute arithmetic mean; standard deviation and probable error of the measured lengths of the side of a rectangular metallic block.
7. To determine the value of Plank's constant and verify inverse square law.
8. To determine the ripple factor of a half-wave and a full-wave rectifier with and without filter.
9. To determine the radius of curvature of the given Plano-convex lens by Newton's Ring method.

### UNIT-II

1. To determine (a) the grating element, number of lines per unit length (1cm/1inch) in the given grating by normal incidence method and (b) the wavelength of the lines in the mercury spectrum.
2. To determine the diameter of the given thin wire using an air wedge.
3. To determine the intensity of diffraction pattern at single and double slits.
4. To draw the I-V characteristic curve of a semiconductor diode (Ge or Si) and determine its knee voltage, and forward dynamic resistance.
5. To draw the I-V characteristic curve of a zener diode and determine its break down voltage, forward knee voltage, and zener resistance.
6. To determine Hall-coefficient of the given semiconductor and its charge carrier density.

7. To study the energy band gap and diffusion potential of a PN junction.
8. To determine the angle of polarisation for a glass plate using Brewster's law.
9. To verify Malus' law.

**References:**


1. Physics (5th edition) Volume 1 & 2: Resnick, Halliday and Krane, John Wiley & Sons.
2. The Theory of Errors in Physical Measurements: J. C. Pal, New Central Book Agency (P) Ltd.
3. Practical Physics: C.L. Arora, S. Chand & Co.
4. Fundamentals of Optics, 4th Ed., F.A. Jenkins and H.E. White, McGraw-Hill BookCo., 1981.
5. Optics, A Ghatak, Tata-McGraw Hill, New Delhi, 1992
6. Vibration and Waves, A.P. French, Arnold-Heinemann, New Delhi, 1972.