# 22PY101 APPLIED PHYSICS

Hours Per Week :

L	Т	Р	С
2	0	2	3

**PREREQUISITE KNOWLEDGE:** Basics of atomic structure and electronic transitions, Bonding in solids, and concept of waves.

## COURSE DESCRIPTION AND OBJECTIVES:

The purpose of this course is to present the principles and concepts of Light and Sound waves. It enunciates the concurrent understanding of Lasers and Optical Fibers. It emphasizes on the principles and applications of Nano materials as relevant to an Engineer.

# MODULE-1

8L+0T+8P = 16 Hours

# UNIT-1

#### PHYSICAL OPTICS

**Interference:** Introduction-Superposition principle -Types of superposition of waves – Division of wave front, Division of amplitude, Newton rings- Experiment – Diameter of Newton rings (bright & dark), Determination of wavelength – Determination of Refractive Index.

**Diffraction:** Introduction- Interference versus Diffraction – Types of diffraction, Fraunhofer diffraction at single and double slit (qualitative), Plane transmission diffraction grating (Qualitative) – Determination of wavelength.

**Polarization:** Polarized and unpolarized light, Production of polarized light, Nicol prism, Quarter and half wave plates, Optical activity - Laurent's half shade polarimeter.

UNIT-2

# 8L+0T+8P = 16 Hours

#### LASERS AND FIBRE OPTICS

**LASERS:** Characteristics of laser light – spontaneous and stimulated emission, Population Inversion – Pumping Processes –He-Ne laser, Semiconductor laser and applications of lasers, Holography – construction – reconstruction and applications.

**Fiber Optics:** Principle of optical fibre – acceptance angle, numerical aperture, Types of fibres– Step Index fiber – Gradded Index fiber - Fibre optic sensor-Biosensors.

#### PRACTICES:

- Newtons rings: Determination of wavelength of a given light source.
- Diffraction grating: Determination of wavelength Normal Incidence method.
- Polarimeter: Determination of Optical rotation of an optically active solution.
- Laser: Determination of wavelength of a given LASER source using plane diffraction grating.

#### **MODULE-2**

#### UNIT-1

#### 8L+0T+8P = 16 Hours

#### CRYSTAL PHYSICS

**Crystal Physics:** Introduction-Fundamental terms of crystal physics, Lattice parameters and Crystal systems, packing factor for SC, BCC and FCC –Miller indices – Rules to find Miller Indices – Important features of Miller Indices – Distance of separation between successive (h k l) planes (Qualitative), XRD and Bragg's law.



https://www.google.com

#### 8L+0T+8P = 16 Hours

#### SKILLS:

- ✓ Apply the dynamics of Light to realize the various potential applications in Engineering.
- Evaluate the concepts of Lasers and Optical Fibers to realize versatile applications in Science, Engineering and Technology.
- ✓ Analyze the Crystal Structures and orientation of planes.
- ✓ Appraise the importance of Ultrasonics in medicine.
- ✓ Demonstrate the synthesis and characterization of Nano materials in view of their applications.

## UNIT-2

## **ELEMENTS OF NANOMATERIALS**

**Elements of Nano Materials:** Introduction- Principles of Nano materials, Synthesis of Nanomaterials: top- down and bottom- up approaches – Ballmilling – Sol-gel, Applications of nanomaterials, Characterization of nanomaterials by electron microscopy (SEM-Construction – Working – Applications), TEM- (Construction – Working – Applications), AFM – Construction – Working – Applications.

#### PRACTICES:

- Band gap: Determination of Energy bandgap of a semiconductor.
- Optical fibre: Determination of a Numerical Aperture of an Optical Fibre.
- LED: Study of V-I characteristics of LED.
- Ultrasonic interferometer: Determination of Ultrasonic wave velocity in liquid medium.

# COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of Physical Optics in the perspective of Engineering applications.	Apply	1	1, 3, 5, 6, 7
2	Analyse the wavelengths of Laser for applications in medicine and to foster the knowledge on Optical Fibers to realize Fiber Optic Sensors.	Analyze	1	1, 3, 5, 6, 7
3	Recognise the importance of Crystal Physics relevant to Bio-Physical systems.	Apply	2	1, 2, 4, 5, 6, 7, 9
4	Evaluate Ultrasonic waves to apply them in medical diagnostics.	Evaluate	2	1, 2, 4, 5, 6, 7, 9
5	Connect the dimensions of Nano particles to consolidate the Physical and Chemical aspects of Nano materials.	Analyze	2	1, 3, 5, 6, 9, 11, 12

## **TEXT BOOKS:**

- 1. S.O.Pillai, "Solid State Physics", New age International publishers, 8th edition, 2018.
- 2. M.R. Srinivasan, "Engineering Physics", New Age International Publishers, 1st edition 2008.

## **REFERENCE BOOKS:**

- 1. M.N. Avadhanulu, P.G. Kshirsagar and T.V.S. Aruen Murthy, "A Text Book of Engineering Physics", 11th edition, S. Chand & Company Ltd., 2019.
- 2. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", 1st edition, Pearson India Education Services Pvt. Ltd., 2018.
- 3. D. Halliday, R. Resnick and J. Walker "Fundamentals of Physics", 6th edition, John Wiley and Sons, 2020.
- 4. T. Pradeep, "A Text Book of Nanoscience and Nanotechnology", 1st edition, Tata Mc-Graw Hill, 2018.