NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	**B.Tech. First Year**
Course Code:	**XXXX**
Course Title:	Physics
Course Type:	Introductory
Year of Introduction:	2022-23

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):
At the end of the course, the student will be able to –

1. Understand the fundamental principles of Physics behind the current technological advancements (BL2)
2. Apply the concepts of Physics for solving engineering problems (BL3)
3. Analyse the existing technological limitations with the help of modern Physics concepts (BL4)
4. Measure various characteristics of physical quantities and establish the proof of concepts (BL4)

Syllabus: **Total Teaching Hours: 30**

Unit	Syllabus	Teaching Hours
Unit 0	**Importance of Applied Physics in Engineering** Significance of Applied Physics in Engineering, Challenges, requirements, and applications of Physics in engineering.	**01**
Unit I	**Lasers and Holography** Introduction, Basics of Interaction of radiation with matter, Condition for light Amplification, Population inversion and metastable state, pumping, the principle pumping scheme: Three and Four-level scheme, Construction and working of the optical resonator, Ruby Laser, Applications of the laser beam, Holography.	**04**
Unit II	**Introduction to Fiber Optics** Introduction of fiber-optic system, Principle and construction of fiber cable, Acceptance angle and numerical aperture, Types of Optical fiber: Based on material & based on the mode of propagation, Index profile, Fiber optic communication link, Losses in optical fiber communication, Advantages of fiber optic system.	**04**

Unit III	**Introductory Quantum Mechanics** Introduction to Quantum Physics, Compton effect, Wave function, Probability density, Normalization of the wave function, Expectation values, Quantum Mechanical Operators, Schrodinger Equations- Time-dependent and independent forms, Particle in a three-dimensional box.	**04**
Unit IV	**Semiconductor Physics** Molecular Orbital theory- bonding, antibonding, and non-bonding orbitals, Formation of energy bandgap in semiconductors, Classification of bandgap- direct and indirect, optical and electronic, Fermi Dirac distribution function, Fermi Energy and Energy band structure of various semiconductors, Variation of Fermi energy level with carrier concentration and temperature.	**04**
Unit V	**Fundamentals of Nanomaterials** Introduction – Nanoscale; Nanomaterials: Methods for the synthesis of nanomaterials, Properties of nanomaterials – Electrical, Magnetic, Optical, Mechanical, Characterization techniques – X-ray Diffraction (XRD) - Single Crystal, Powder, and Laue techniques, Scanning Electron Microscopy, Tunnelling Electron Microscopy, Nanostructures; Carbon nanotubes Characteristics and applications, Nanotechnology and environment.	**05**
Unit VI	**Acoustics and Ultrasonics** Introduction, Defection due to the reflection of sound, Sabine's empirical formula, Reverberation theory, Eyring's equation, Acoustical defects and their remedies, Acoustic materials, Ultrasonic waves, Piezoelectric method, Properties and application of ultrasonic waves.	**04**
Unit VII	**Physics of Industry Instruments** CO_2 laser, Semiconductor diode laser, Fiber optic sensors, Nuclear accelerator – LINAC, Cyclotron, Detectors - GM Counter, Scintillation Detector, Vacuum pumps - rotary pump, diffusion pump, Ion pump, Measurement of vacuum with different gauges.	**04**

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings:

1. M. N. Avadhnulu and P. Kshirsagar, A Text Book of Engineering Physics, S Chand.
2. T. Pradeep, Nano: The Essentials, New Central Book Agency.
3. B. L. Theraja, Physics for Engineers, S Chand Publication.
4. K. Thyagarajan and Ajoy Ghatak, Lasers: Fundamentals and Applications, Springer.
5. Nouredine Zettili, Quantum Mechanics: Concepts and Applications, Wiley.
6. G. Aruldhas, Engineering Physics, PHI.
7. Sulbha Kulkarni, Nanotechnology: Principles and Practices, Springer.

L= Lecture, T= Tutorial, P= Practical, C= Credit

List of Practical

Sr. No.	Title
1.	To analyse fundamental units and dimensions (prerequisite)
2.	To estimate the solar energy in terms of solar power and V-I characteristics, the power load characteristics of the solar cell
3.	To evaluate the charge-to-mass ratio for electrons by applying a perpendicular magnetic field on the electron beam in CRT
4.	To measure the electromotive force by dynamic magnetic field and verification of Faraday's law
5.	To measure the energy efficiency of a power transformer.
6.	To measure the resistivity of semiconductors by four-point probe method at different temperatures.
7.	Determination of forbidden energy band gap in a semiconductor using a junction diode
8.	To measure the wavelength of light from a sodium vapour lamp and find the thickness of thin film using Newton's rings method
9.	To determine the velocity of ultrasonic waves in liquid and its compressibility using an ultrasonic interferometer
10.	To determine the refractive index of a liquid by lens method
11.	Resistivity measurement by Hall Effect for semiconductor sample
12.	To determine the value of Planck's constant by the reverse photoelectric method
13.	To study characteristics of Geiger – Muller Tube
14	Virtual Laboratory Experiment on Resistivity measurement by Hall Effect for metal samples
15	To measure the wavelength of light from various light sources and find the thickness of thin film using Newton's rings method (Virtual Laboratory)