

## Details of Course:

Course Title	Course Structure			Pre-requisites
	L	T	P	
Physics	03	00	02	NiL

**Course Objective:** The main objective of the course is using physics to solve scientific or engineering problems, thereby bridging the gap between physical science and technology. This course is aimed to offer broad areas of physics which are required as an essential background to engineering students.

## Course Outcomes (COs):

CO1	To explain special theory of relativity and apply its concepts in various fields of physics and engineering.
CO2	Apply concepts in interference, diffraction, and polarization to solve relevant numerical problems and to relate to relevant engineering applications.
CO3	To demonstrate the basic understanding of laser and optical fibre for gaining advanced knowledge in the field of optical communication and opto-electronics.
CO4	To demonstrate core theories of quantum mechanics and its impact on society.
CO5	Demonstrate principles of semiconductor physics. Apply gained knowledge of physics to general real-world situations.

S.No	Content	Contact Hours
Unit 1	<b>Relativity:</b> Review of concepts of frames of reference, Michelson-Morley Experiment and its implications, Einstein's Special theory of relativity and its postulates, Lorentz transformation equations, law of addition of velocities, Concept of simultaneity, Length contraction, Time dilation, Mass variation with velocity, Concepts of energy and momentum, Mass energy relation.	8
Unit 2	<b>Physical Optics:</b> Interference: Methods of formation of coherent sources, Parallel thin films, Wedge shaped film, Newton's rings. Diffraction: Fraunhofer diffraction, Single slit, Double slit and N-slit/grating. Polarization: Phenomenon of double refraction, Nicol Prism, Production and analysis of plane, circularly and elliptically polarized light, Optical activity, Specific rotation.	10
	<b>Lasers and Optical Fibres:</b>	8

<b>Unit 3</b>	Introduction to laser and its properties, Working principle of lasers, Spontaneous and stimulated emission, Einstein's coefficients, Ruby and He-Ne lasers. Classification of optical fibres, Core-cladding refractive index difference, Numerical aperture and pulse dispersion, V- number.	
<b>Unit 4</b>	<b>Quantum Physics:</b> Compton effect, Wave Particle Duality, de-Broglie relation, Davison and Germer Experiment, Postulates of Quantum Mechanics and introduction to wave function, Physical Significance of wave function- Probability density and normalization, Schrödinger wave Equation, Operators, Expectation values and eigen value equation, Particle in a Box, Concept of tunnelling.	<b>10</b>
<b>Unit 5</b>	<b>Semiconductor Physics:</b> Origin of bands, Intrinsic and extrinsic semiconductors, Concept of Fermi level, Carrier concentration in intrinsic and extrinsic semiconductors, Drift and diffusion current, Einstein Relation, Hall effect.	<b>6</b>

S.No	Name of Text Books/Authors	Year of Publication/Reprint
1.	Concept of Modern Physics by Arthur Beiser	Mcgraw-Hill , 6 <sup>th</sup> Edition, 2009,
2.	Optics, by A. Ghatak	McGraw-Hill, 7 <sup>th</sup> Edition, 2020
3.	Fundamentals of Optics by Jenkins and White	McGraw-Hill, 4 <sup>th</sup> Edition, 2017
4.	Solid state electronic devices by Streetman and Banerjee	Pearson, 7 <sup>th</sup> Edition, 2015
5.	Semiconductors physics & Devices by D. A. Neaman	McGraw-Hill, 4 <sup>th</sup> Edition, 2015
6.	Optics, by Brijlal and Subramaniyam	S Chand, 23 <sup>rd</sup> Revised Edition, 2006
<b>Reference books:</b> Fundamentals of Physics by Halliday, Walker and Resnick, John Wiley & Sons, Inc., 12th Edition, 2021		

## **List of Experiments (Physics), Common to All.**

1. To determine the compressibility of a given liquid by ultrasonic diffraction method.
2. To determine the specific rotation of sugar solution using Laurent's half shade polarimeter.
3. To determine the wavelength of green and violet lines of mercury light using plane diffraction grating.
4. To determine the wavelength of sodium light by Newton's rings.
5. To find the numerical aperture of a given optical fibre.
6. To compare the wavelength of a laser source measured by diffraction pattern from a single slit and a plane diffraction grating.
7. To study Hall Effect and to determine Hall coefficient  $R_H$  and hence find the density of charge carriers in a semiconductor at room temperature by Hall effect measurement.
8. To determine the Planck's constant by photoelectric effect/light emitting diode (LED).
9. To determine the energy band gap ( $E_g$ ) of a semiconductor by Four-Probe method.
10. To determine the ratio of charge to mass (e/m) for an electron.

## **Additional Experiments for Fast Learners**

1. To determine the mass susceptibility of anhydrous manganese chloride ( $MnCl_2 \cdot H_2O$ ) by Quinck's tube.
2. To determine the dispersive power of the material of a prism using a spectrometer.