SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)

Applied Science (Physics)

Semester/Year		I/II	Program		B.Tech
Subject Category	BS	Subject Code:	PH BS....	Subject Name:	**Applied Physics**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work		L	T	P	
60	20	10	10	30	20	150	3	0	1	4

Prerequisites:

Intermediate Physics (Theory and Lab)

Course Objective:

This course is designed to impart fundamental knowledge about some areas of physics which are to the core of emerging technologies. It is planned to provide knowledge about Quantum mechanics, Lasers , Fiber Optics, Hologhphy, Superconductor, Nano materials, Dielectric and piezoelectric materials. Laboratory sessions are also designed which are blended with experiments on the fundamental and advanced areas of physics.

Course Outcomes:

After completion of the course, students will be able

CO1	To understand basic quantum physics and apply it to the behaviour of a system at the microscopic level and solve the problems.
CO2	To understand process of lasers and explain the requirements, properties, classification of various lasers. They will also develop an understanding of optical fibers and and holography and can explin the characteristics, various losses, dispersion in optical fibers and procsees of construction and reprocuction of holograms.
CO3	To understand the basic concepts and theory of semiconductor for devices application.
CO4	To understand and know the principle of superconductors and nanomaterils. The sdunednt will be able to explain types of superconductors, their properties and applications, nano technology and its applications.
CO5	To understand the characteristic of Dielectrics and Piezoelectric materials in terms of their applications .
CO6	To perform experiments related to the course contents.

UNITs	Descriptions	Hrs.	COs
I	**Quantum mechanics:** Planckôs quantum hypothesis, Wave-particle duality of radiation, de-Broglie matter waves, Davisson and Germerôs electron diffraction experiment, Compton effect, Phase and group velocity, Heisenberg uncertainty principle and its applications, wave function and its significance, Eigen value and Eigen function, Schrödinger wave equations, particle in one dimensional potential box.	8	01
II	**Lasers:** Properties of lasers, the basic process of lasers, Population-inversion, classification of lasers, working of He-Ne, Ruby, Nd: YAG and CO_2 lasers, Applications of Lasers in Communication, Medical and Industry. **Optical fibers:** Light guidance through optical fibres, the qualitative idea of critical and acceptance angle, types of fibers, numerical aperture, V- Number, intermodal & material	8	02

	dispersions in fiber. **Holography:** Basic principle of holography, Construction and reconstruction of Image on hologram and applications of holography.		
III	**Basic of semiconductors**: Density of energy states, Energy-band formations, direct and indirect band gap, Effective mass, Fermi energy levels. Mobility and carrier concentrations (intrinsic). Radiative and non-radiative recombination mechanisms in semiconductors . **Semiconductor Devices**: Properties of PN junction and I-V diode equation, Photovoltaic cell, LED Materials for fabrication, LED Structures and Characteristics; Injection Laser Diode (ILD) - Laser action in semiconductors , structures and efficiency.	8	03
IV	**Superconductors**: Free electrons theory of metals, Temperature dependence of resistivity in superconducting Metals , Effect of magnetic field (Meissner effect) , Temperature dependence of critical field, Type I and Type II superconductors, BCS theory (Qualitative), High-temperature superconductors and Applications of superconductors. **Nanomaterials**: Basic principle of nanoscience and technology, structure, properties ad uses of Fullerene and Carbon nanotubes, Applications of nanotechnology.	8	04
V	**Dielectrics Materials**: Polar and Non-Polar Dielectrics, Dipole moment and Polarization, Dielectric constant& Polarization, Gauss law in Dielectric, the relation between electric field vector E, Pand D. **Piezoelectric materials**- Ferroelectric materials , Piezoelectric effect, direct and converse parameter definitions, Piezoceramics, Piezopolymers, Piezoelectric materials as sensor and transducers.	8	05
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. To determine the width of a single slit from the study of Fraunhoffer diffraction pattern using a He-Ne Laser.
2. To determine the frequency of A.C. mains using an electrical - vibrator.
3. Determination of Planck's constant.
4. To determine the frequency of A.C. mains using a sonometer.
5. To study the nature of polarization of light using the half-wave plate.
6. To find the numerical aperture of the given fibre.
7. To determine the refractive indices μ_0 and μ_e of Quartz prism for ordinary and extraordinary rays using the spectrometer.
8. To determine the wavelength of monochromatic source of light by Fresnelôs biprism.
9. To study the V-I characteristics of semiconductor diode
10. To study V-I Characteristics of LED
11. To study the V-I characteristics of tunnel diode
12. To determine the radius of curvature of a given plano-convex lens by Newtonôs rings method.
13. To determine the absorption coefficient of a glass plate by ñLUMMER- BRODHUMò photometer.
14. To determine the resolving power of a telescope.
15. To determine the wavelength of light emitted by mercury vapour lamp using a diffraction grating.

Text Book-

- Concepts of Modern Physics, Arthur Beiser, Tata McGraw-Hill,6th edition,2009.
- Optics, A.Ghatak, McGraw Hill, 2012.
- Engineering Physics , Hitendra K Malik& A.K. Singh, Mc Graw Hill Education Private Limited
- Elements of Modern Physics, S.H. Patil
- Kiruthiga Sivaprastha, Modern Physics, S. Chand
- A Textbook of Engineering Physics, Gaur and Gupta, Dhanpat Rai Publishers, New Delhi,8th edition,.2011.
  Electrical Engineering Materials by A.J. Dekker, PHI publication

Reference Books-

- Lasers and non-linear optics, B.B.Laud, New Age international,3rd edition,2011
- Solid State Physics, S.O.Pillai , New Age International Ltd, publishers
- Electromagnetic Theory for Telecommunications, C.S.Liu and V.K.Tripathi, Foundation Books, New Delhi,2007
- Quantum Mechanics by L.I. Schiff, Mc Graw Hill Co.
- A Textbook of Quantum Mechanics by Piravonu Mathews, K. Venkatesan (Tata McGraw Hill)
- Cady, W. G., Piezoelectricity, Dover Publication
- Piezoelectric Materials & Devices: Application in Engineering And Medical Sciences By M.S. Vijiya .CRC Press.
- Electrical Engineering Materials Physics Properties by SP A Seth, Dhanpat Rai Publications.

Modes of Evaluation and Rubric

Assignments, Quiz, Tests & exams

Criteria	Excellent (3 points)	Good (2 points)	Fair(1 point)
Quiz	> 80%	60-80%	40-60%
Test & exam	>75%	60 -75%	< 60%
Assignment	Assignment is coherently organized and the logic / solution to all the problems provided. Writing is clear and concise and persuasive.	Assignment is generally well organized and logic / solution to maximum of the problems provided barring few inaccuracies.	Assignment is poorly organized and difficult to follow. Does not flow logically from one part to another with lots of mistakes

List/Links of e-learning resource

- https://nptel.ac.in/courses/122107035/#
- https://nptel.ac.in/course.html
- http://www.tndte.gov.in/site/wp-content/uploads/2016/08/Engineering-physics.pdf
- https://physicstoday.scitation.org
- Barbastathis, G. and Sheppard C., Optics, https://ocw.mit.edu/courses/mechanical-engineering/2-71-optics-spring-2009/

Recommendation by Board of studies on	14.06.2022
Approval by Academic council on	
Compiled and designed by	Jetendra Parashar
Subject handled by department	Applied Science (Physics)