LESSON PLAN

17PHY12/22 ENGINEERING PHYSICS

Course objectives:

The objective of this course is to make the students learn and understand basic concepts and principles of physics to analyze practical engineering problems and apply its solutions effectively and meaningfully. To understand building up of models, design issues, practical oriented skills and problem solving challenges are the great tasks of the course. Knowledge about shock waves and practical applications is the prime motto to introduce new technology at the initial stage of Engineering.

(Provided by Visvesvaraya Technological University)

Subject Code: **17PHY 12 / 17PHY 22**

Total no. of Hours: 50 Number of Sessions/week: 04

Name of Faculty: **Dr. Gajanan V. Honnavar** **Credits: 04**

Dr. Muhammad Faisal

Dr. Mohana Lakshmi

Ms. Sneha L

Session No.	Module / Ref. Text	Topic to be covered (in detail)	% of portion covered		Course Outcomes covered
			Chapter wise	Cumulative	
1.	Module – 1 Modern Physics and Quantum Mechanics Refer T1, T2, R4, & R5	Introduction to CBCS. Introduction to Engineering Physics course and the plan ahead.	20	20	CO1
2.		Modern Physics. Black body radiation spectrum.			
3.		Assumptions of quantum theory of radiation, Planck's law			
4.		Wein's law and Rayleigh Jeans' law from Planck's law for shorter and longer wavelength limits.			
5.		Compton Effect. Wave Particle dualism, de-Broglie hypothesis.			
6.		Matter waves and their characteristic properties. Superposition of waves. Definition of Phase velocity and group velocity.			
7.		Relation between phase velocity and group velocity. Relation between group velocity and particle velocity.			
8.		Numerical Examples on Modern Physics chapter.			
9.		Heisenberg's uncertainty principle and its application (Non-existence of electron in the nucleus).			
10.		Wave function. Properties and physical significance of wave function.			
11.		Probability density and Normalization of wave function.			
12.		Setting up of one dimensional time independent Schrodinger wave equation. Eigen values and Eigen functions.			
13.		Application of Schrodinger wave equation for a particle in a potential well of infinite depth and for free particle.			
14.		Numerical Examples on Quantum mechanics.			

15.	Module – 3 Lasers and Optical Fibers Refer T1, T2, R4, R5 & R7	Einstein's coefficients (expression for energy density).	20	40	CO3
16.		Requisites of a Laser system. Condition for laser action			
17.		Principle, Construction and working of CO2 laser and semiconductor Laser.			
18.		Principle, Construction and working of semiconductor Laser.			
19.		Applications of Laser – Laser welding, cutting and drilling.			
20.		Measurement of atmospheric pollutants and Holography.			
21.		Principle of Recording and reconstruction of images, applications of Holography.			
22.		Propagation mechanism in optical fibers. Angle of acceptance. Numerical aperture.			
23.		Expression for Numerical aperture.			
24.		Types of optical fibers and modes of propagation.			
25.		Attenuation, Block diagram discussion of point to point communication, applications.			
26.		Numerical examples of Lasers			
27.		Numerical examples on Optical Fibers			
28.	Module – 2 Electrical Properties of Materials Refer T1, T2, R4, R5 & R7	Free–electron concept (Drift velocity, Thermal velocity, Mean collision time, Mean free path, relaxation time)	20	60	CO4
29.		Failure of classical free electron theory. Quantum free electron theory, Assumptions			
30.		Fermi factor, density of states (qualitative only).			
31.		Fermi–Dirac Statistics.			
32.		Expression for electrical conductivity based on quantum free electron theory, Merits of quantum free electron theory.			
33.		Conductivity of Semi conducting materials.			
34.		Concentration of electrons and holes in intrinsic semiconductors, law of mass			

		action.			
35.		Temperature dependence of resistivity in metals and superconducting materials. Effect of magnetic field (Meissner effect).			
36.		Type-I and Type-II superconductors.			
37.		Temperature dependence of critical field. BCS theory (qualitative).			
38.		High temperature superconductors. Applications of superconductors –. Maglev vehicles.			
39.		Numerical examples.			
40.		Numerical examples.			
41.		Numerical examples.			
42.	Module – 4 Crystal Structure Refer T1, T2, R1, & R4	Space lattice, Bravais lattice–Unit cell, primitive cell. Lattice parameters.	20	80	CO2
43.		Crystal systems. Direction and planes in a crystal.			
44.		Miller indices. Expression for inter – planar spacing.			
45.		Co-ordination number (SC, FCC, & BCC).			
46.		Atomic Packing Factor (SC, FCC, & BCC).			
47.		Bragg's law, Determination of crystal structure using Bragg's X–ray diffractometer			
48.		Polymorphism and Allotropy			
49.		Crystal Structure of Diamond.			
50.		Atomic packing factor of Diamond.			
51.		Qualitative discussion of Perovskites.			

52.		Numerical examples on Crystal structure.			
53.		Numerical examples on Crystal structure.			
54.		Numerical examples on Crystal structure.			
55.	Module – 5 Shock waves and Science of Nano- Materials Refer T1, T2, R2, & R5	Definition of Mach number, distinctions between- acoustic, ultrasonic, subsonic and supersonic waves.	20	100	CO5
56.		Description of a shock wave and its applications. Basics of conservation of mass, momentum and energy.			
57.		Normal shock equations (Rankine-Hugonit equations).			
58.		Normal shock equations (Rankine-Hugonit equations).			
59.		Methods of creating shock waves in the laboratory using a shock tube.			
60.		Description of hand operated Reddy shock tube and its characteristics.			
61.		Introduction to Nano Science.			
62.		Density of states in 1D, 2D and 3D structures. Density of states in 1D, 2D and 3D structures.			
63.		Synthesis: Top-down and Bottom–up approach, Ball Milling and Sol–Gel methods.			
64.		CNT – Properties, synthesis by Arc discharge			
65.		Pyrolysis method of synthesis of CNTs, Applications.			
66.		Scanning Electron microscope: Principle, working and applications.			
67.		Numerical examples.			

Literature:

Book Type	Code	Publication information
Text	T1	Wiley precise Text, "Engineering Physics". Wiley India Private Ltd., New Delhi. Book series – 2014
Text	T2	Dr.M.N. Avadhanulu, Dr.P.G.Kshirsagar, "Text Book of Engineering Physics", S Chand Publishing, New Delhi – 2012.
Supplementary	S	Class Notes (will be provided in soft copy before each topic)
Reference	R1	S.O.Pillai, "Solid State Physics", New Age International. Sixth Edition
Reference	R2	Chintoo S.Kumar , K.Takayana and K.P.J.Reddy,"Shock waves made simple", Willey India Pvt. Ltd. New Delhi,2014
Reference	R3	A. Marikani, "Engineering Physics", PHI Learning Private Limited, Delhi – 2013
Reference	R4	Prof. S. P. Basavaraju, "Engineering Physics", Subhas Stores, Bangalore – 2
Reference	R5	V. Rajendran, "Engineering Physics", Tata Mc.Graw Hill Company Ltd., New Delhi - 2012
Reference	R6	S.Mani Naidu,"Engineering Physics", Pearson India Limited – 2014.

Course Outcomes:

On Completion of this course, students are able to:
CO1: Gain Knowledge about Modern physics and quantum mechanics and demonstrate the application of the concept to various examples (electron microscope, energy quantization)
CO2: Understand and apply the concepts of electrical conductivity in metals, semiconductors and superconductors.
CO3: Use the knowledge gained by the study of basics of Lasers and Optical fibers in understanding the applications of lasers in industry and in meteorology; the application of optical fibers in communications systems.
CO4: Understand basics of Crystal structure and use the acquired skills to explain the common crystals (diamond, perovskite).
CO5: Learn about shock waves and their uses. Understand the basic physics behind nano systems.