Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
BS12	Applied Physics I	L	T	P	L	T	P	Total
		3	-	-	3	-	-	3
		Examination Scheme						
		ISE			MSE		ESE	
		10			30		100 (60% weightage)	

COURSE OBJECTIVE:

To provide the knowledge and methodology necessary for solving problems in the field of engineering

Pre-requisite Course Codes		HSC level physics
After successful completion of the course, student will be able to		
Course Outcomes	C01	Illustrate the knowledge of crystallography and identify crystal structure using X-ray diffraction
	C02	Comprehend the Physics of semiconductors and apply the same to electronic devices
	C03	Identify various engineering materials based on their electrical and magnetic properties
	C04	Apply the knowledge of superconductivity for various potential applications
	C05	Describe the working of transducer to produce ultrasonic waves and its various applications

Module No.	Module Name	Unit no.	Topics	Ref.	Hrs.
1	Crystallography	1.1	Space lattice, Unit Cell and its characteristics, Bravais lattices, Cubic crystal system; HCP structure, Special cubic crystal structures:- Diamond structure, ZnS structure, NaCl structure, $BaTiO_3$ structure	1,2, 4	06
		1.2	Miller indices of crystallographic planes & directions; interplanar distance; introduction to X-rays, X-ray diffraction and Bragg's law; Determination of crystal structure	1,2, 4	05
		1.3	Ligancy and Critical radius ratio; Point defects	1,2, 4	02
2	Semiconductors	2.1	Band formation in solids and classification of solids on band theory; drift, mobility and	1,2, 4	03

			conductivity in conductors; Fermi-Dirac distribution function and Fermi level in a conductor, insulator		
		2.2	intrinsic and extrinsic semiconductors; intrinsic conductivity and extrinsic conductivity; Law of mass action, charge neutrality condition; intrinsic carrier concentration, electron and hole concentration; Extrinsic carrier concentration as a function of temperature; Effect of impurity concentration and temperature on the Fermi Level; Hall Effect and its applications. Drift and Diffusion current density	1,2, 4	04
		2.3	Formation of a P-N junction, depletion region and barrier potential; Energy band structure of P-N Junction (unbiased, forward-bias, reverse-bias); concept of carrier current densities in p-n junction in equilibrium, forward bias and reverse bias; Breakdown mechanism - zener effect and avalanche	1,2, 4	03
		2.4	P-N junction devices: LED, zener diode, photoconductors, photovoltaic solar cells and Bipolar Junction Transistors	1,2, 4	03
3	Dielectric and Magnetic materials	3.1	Dielectric constant, polarization, relative permittivity, dielectric susceptibility, Relation between three electric vectors D, E and P, Effect of dielectric on capacitance; Polarizability; Clausius-Mossotti equation, Types of polarization; Ferroelectric materials, Applications of dielectric materials - Requirement of good insulating material, some important insulating material	2,3, 4	04
		3.2	Origin of magnetization using Atomic Theory; classification of magnetic materials; Origin of ferromagnetism, domain theory and Hysteresis loss; Soft & hard magnetic materials and their applications	1,2, 3,4	03
4	Superconductivity	4.0	Introduction, Meissner Effect; Type I and Type II superconductors; BCS Theory (concept of Cooper pair), Josephson junction; Applications of superconductors- SQUID, MAGLEV	4	03
5	Ultrasonics	5.0	Ultrasonic Waves; Methods of production of ultrasonic waves - Piezoelectric Oscillator & Magnetostriction Oscillator; low and high frequency applications	4	03
				Total	39

References:

[1] Kittel Charles and Paul McEuen,"Introduction To Solid State Physics", New Delhi,8th ed, John Wiley & Sons, 2015.
[2] Pillai S,"Solid State Physics", 7th ed, New age international, 2015.
[3] Dekker A J, "Electric Engineering Materials", PHI,1970.
[4] Bhattacharya D K and Tandon, "Engineering Physics", 1st ed, New Delhi, Oxford Press, 2015.