



University of Kerala

Discipline	PHYSICS				
Course Code	UK3DSCPHY202				
Course Title	SOLID STATE PHYSICS & SPECTROSCOPY				
Type of Course	DSC				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	1. Students should know the atom model 2. Students should be aware of different types of materials				
Course Summary	This course aims to provide the basic concepts of solid state physics and spectroscopy and make the students aware of some of the applications of spectroscopy.				

BOOKS FOR STUDY:

1. Physics for scientists and engineers with Modern Physics, 7th Edition, Serway & Jewett,
2. University Physics Vol.3, OpenStax
3. Modern Physics: R.Murugesan, S.Chand & Co.

BOOKS FOR REFERENCE:

1. Fundamentals of Molecular Spectroscopy: Banwell, TMH
2. Molecular Spectroscopy: G.Aruldas, PHI, 2004

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Solid State Physics (Book 3)		9	
	1	Types of molecular bonds- ionic bond, covalent bond, metallic bond, molecular bond, Hydrogen bond, Van der waal bond	2	1
	2	Crystal structure-crystal lattice and translation vectors	2	1
	3	Unit cell-symmetry operations point groups and space groups	2	1
	4	Types of lattices-lattice directions and planes, interplaner spacing-simple crystal structures	3	1
II	Band Theory of Solids (Book 2, Sec. 9.5)		9	
	5	Energy bands- Valence band , Conduction band, Energy Gap	1	2
	6	Classification of solids as conductors, semiconductors and insulators based on band theory	2	2
	7	Semiconductors and doping, break down mechanism	2	2
	8	Semiconductor devices- Junction diode, zener diode, light emitting and light absorbing diodes, Transistors, integrated circuits.	4	2
III	Spectroscopy (Book 2 & 3)		9	
	9	Atomic spectra, selection rule, Hydrogen spectrum	1	3
	10	X-ray spectrum, Moseley's law	2	3
	11	Optical spectra- spectral terms and notations, selection rules	1	3
	12	Molecular spectra- origin and nature of molecular spectra	1	3
	13	Rotational spectra of diatomic molecules-rotational energy levels	2	3
	14	Diatomic vibrational spectra-vibrational energy levels	2	3
IV	Spectroscopic Techniques (Book 3)		9	
	15	EM Spectrum- UV, Visible, IR, Radio and microwave regions	1	4

	16	Principle of various spectrometers used in specific regions of EM spectrum	2	4
	17	Absorption spectroscopy, Emission spectroscopy	2	4
	18	Block diagram of absorption spectrometer	2	4
	19	Mass spectroscopy-qualitative ideas of ESR & NMR spectrometers.	2	4
	Laser (Book 3)		9	
V*	20	Interaction of light with matter, absorption, spontaneous emission, stimulated emission	2	5
	21	Principle of laser, population inversion, metastable states, pumping, light amplification,	2	5
	22	Types of Laser- Ruby laser, He-Ne laser, Semiconductor laser	4	5
	23	Application- Holography	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	LED characteristics: To (i) study the variations in resistance with varying current	6
2	Photo diode characteristics: To study the output characteristics of a photo diode	6
3	Half wave rectifier-Measurement of ripple factor with and without filter capacitor	6
4	Full wave rectifier- Measurement of ripple factor with and without filter capacitor	6
5	LED circuit design	6
6	Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different RL and (ii) for different input voltage with same RL.	6
7	Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for RL 100 to 5000).	6
Part B* – At least One Experiment to be performed		
8	To determine the Planck's constant using LEDs of at least 4 different colours	6

9	Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.	6
10	Transistor characteristics-CE-To draw the input and output characteristic curves of a transistor in the CE configuration	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe various molecular bonds and crystal structures	U	1
CO-2	Identify different types of solids and get basic knowledge about semiconductors and semiconductor devices	U	1
CO-3	Identify the basic concepts of atomic and molecular spectra.	U	1,2
CO-4	Differentiate various spectroscopic techniques and its applications	U, Ap	1
CO-5	Describe the fundamental knowledge about lasers	U	1
CO-6	Inculcate experimental skills and to interpret experimental data through laboratory experiments	U, Ap	1,7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: SOLID STATE PHYSICS & SPECTROSCOPY

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe various molecular bonds and crystal structures	PO-1,3 PSO-1	U	F, C	L	-
CO-2	Identify different types of solids and get basic knowledge about semiconductors and	PO-1,3 PSO-1	U	F, C	L	-

	semiconductor devices					
CO-3	Identify the basic concepts of atomic and molecular spectra.	PO-1,3 PSO-1, 2	U	F, C	L	-
CO-4	Differentiate various spectroscopic techniques and its applications	PO-1,3 PSO-1	U, Ap	F, C	L	-
CO-5	Describe the fundamental knowledge about lasers	PO-1,3 PSO-1	U	F, C	L	-
CO-6	Inculcate experimental skills and to interpret experimental data through laboratory experiments	PO-1,2 PSO-1, 7	U, Ap	F, C, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	-	-	-	-	-	2	-	1	-	-	-	2	-	-
CO-2	2	-	-	-	-	-	2	-	1	-	-	-	2	-	-
CO-3	2	1	-	-	-	-	2	-	1	-	-	-	2	-	-
CO-4	2	-	-	-	-	-	2	-	1	-	-	-	2	-	-
CO-5	2	-	-	-	-	-	2	-	1	-	-	-	2	-	-
CO-6	2	-	-	-	-	2	2	1	-	-	-		2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	✓	-	✓
CO-2	✓	✓	-	✓
CO-3	✓	-	-	✓
CO-4	✓		-	✓
CO-5	✓	✓	-	
CO-6	-	-	-	✓