Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

ELECTRONICS AND COMMUNICATION ENGINEERING

IV & VI SEMESTER

PH5202 Semiconductor Physics and Devices

(Regulation 2019)

Time:3 hrs Max. Marks: 100

CO1	Ability to recall the basics of electronics states and understand the energy band structure formation
CO2	Ability to understand the importance of carrier concentration and doping in semiconductors
CO3	Ability to demonstrate the Physics of transport & charge carriers
CO4	Ability to understand the importance of optical properties of materials
CO5	Ability to apply the physics of derives and importance of quantum structures

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)

(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	Define Reciprocal Lattice of a crystal.	2	1	L1
2	Bismuth has a=b=c=4.74 AU and angles α=β=λ=60°. What is the crystal structure?	2	1	L4
3	What is significance of "acceptor energy level just lies above the valence band "for a p-type semiconductor.	2	2	L3
4	Draw the Fermi distribution curve at 0K and at any temperature T K	2	2	L2
5	Comment of the effect of temperature on carrier transport of conductors, Intrinsic and Extrinsic semiconductors.	2	3	L3
6	What is meant by the term electron-hole pair?	2	3	L2
7	Distinguish between Radiative and non-radiative transitions	2	4	L2
8	Give the significance of Kramers-Kronig relations.	2	4	L3
9	What is meant by depletion region in PN diode.	2	5	L2
10	What are photonic crystals? Mention its classification.	2	5	L1

PART- B (5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Define effective mass of an electron, and derive an expression for the effective mass along with E-K curve. Explain the concept of hole.	13	1	L3
	OR			
11 (b)	Derive the expression for dynamics of electrons in a periodic potential and also explain the Kronig-Penny model of free electrons.	13	1	L3
12 (a)	Derive the expression for carrier concentration (electrons and holes) in intrinsic semiconductors	13	2	L3
	OR			
12 (b)	Derive the expression for carrier concentration in n-type	13	2	L3

13 (a)	Explain in details about Avalanche and Zener breakdown	**13**	3	L1
	OR			
13 (b)	Explain in detail about scattering phenomena in semiconductors	**13**	3	L1
14 (a)	With the help of energy band diagrams, analyze the possible transitions giving rise to photo generation, Auger recombination and Shockley- Read- Hall processes.	**13**	4	L4
	OR			
14 (b)	Analyze the dynamic carrier transport within a semiconductor and thereby establish the continuity equations.	**13**	4	L4
15 (a)	Discuss in details the various steps involved in the fabrication of a semiconductor devices.	**13**	5	L2
	OR			
15 (b)	Describe the principle and working of a photo detector (PIN or Avalanche) with suitable diagram and also obtain the efficiency for the same.	**13**	5	L2

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16. (a)	In a semiconductor the energy level is lying 0.012eV below fermi level. What is the probability of this level not being occupied by an electron at 27 degree Celsius.	**5**	2	
(b)	Energy required to remove an electron from a metal is 2.3 eV. Does the metal exhibit photoelectric effect from a light having wavelength 2800 angstrom.	**5**	4	L5
(c)	Evaluate the number of photons from green light of mercury (with wavelength = 4961 angstrom) requires to do one joule of work.	**5**	4