RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, Nov. / Dec. 2024

Semester II

PH3204 - PHYSICS OF SEMICONDUCTORS AND DEVICES

(Regulation2023)

Time:3hrs Max.Marks: 100

CO1	Understand the basics of electronic states and energy band structure formation
CO2	Recognize the importance of carrier concentration and doping in semiconductors
CO3	Understand the operation and characteristics of PN junction and BJTs
CO4	Comprehend the characteristics of the field effect transistors
CO5	Realize the physics of special semiconductor devices

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	What are the benefits of quantum free electron theory?	2	CO1	L2
2	Give a brief note on the concept of holes in semiconductors.	2	CO1	L2
3	How does the Fermi level vary with temperature in an intrinsic semiconductor	2	CO2	L4
4	What is a quantum well? Give an example.	2	CO2	L1
5	What happens to the depletion layer when the P-N junction diode is reverse biased?	2	CO3	L3
6	How does the band-gap vary in a heterojunction?	2	CO3	L4
7	Define pinch-off voltage.	2	CO4	L1
8	What is an avalanche breakdown?	2	CO4	L2
9	Sketch the schematic diagram of an opto-coupler.	2	CO5	L4
10	What is a varactor diode?	2	CO5	L3

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a) (i)	Describe the nature of energy levels in solid state crystals.	10	CO1	L2
(ii)	How does the electric potential vary in a crystal?	3	CO1	L5
	OR			
11 (b) (i)	Derive the expression for electron effective mass.	10	CO1	L2
(ii)	How does electron effective mass affect the electrical conductivity?	3	CO1	L5
12 (a)	Derive the expression for density of electrons in an intrinsic semiconductor	13	CO2	L3
	OR			

12 (b)	What are degenerate and non-degenerate semiconductors? Explain with neat diagrams. How is the band-gap engineered in a semiconductor?	13	CO2	L3
13 (a)	Describe the construction and working of a common emitter bipolar transistor	13	CO3	L4
	OR			
13 (b)	Discuss about the equivalent circuits with suitable examples.	13	CO3	L4
14 (a)	Describe the construction and working of a Field Effect Transistor (FET) with suitable diagrams.	13	CO4	L3
	OR			
14 (b)	Describe the construction and I-V relationship of a Metal-Oxide Semiconductor FET (MOSFET).	13	CO4	L3
15 (a)	Explain the construction and working of (i) Silicon-Controlled Rectifier (SCR) and (ii) Insulated-Gate Bipolar Transistor (IGBT).	13	CO5	L5
	OR			
15 (b)	Describe the fabrication and applications of (i) Tunnel diode and (ii) Laser diode.	13	CO5	L5

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Derive the expression for carrier concentration in n-type and p-type semiconductors	15	CO2	L3