

Satyug Darshan Institute of Engineering & Technology, Faridabad

Department of Applied Science & Humanities

Academic year 2025-26

Programme: B.Tech(CSE/CE)	Year & Semester: I & I/II
Course Name: Physics(Semiconductor Physics)	Course Code: PHU-149-V
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Unit I

Short answer questions

Q.N.	Question	KL
1	Draw E-k diagram for a semiconductor using Kronig Penney model.	3
2	What is the change in the shape of E-k curve when potential barrier strength is zero?	4
3	What is the effective mass and rest mass?	1
4	Define occupation probability?	1
5	Distinguish Direct and indirect bandgap semiconductors.	4
6	What is Fermi level and Fermi energy?	1
7	Give two examples of each direct and indirect bandgap semiconductors.	1

Long answer questions

Q.N.	Question	KL
1	What is the effect of periodic potential on the energy of electrons in a metal? Explain it on the basis of the Kronig-Penney model and explain the formation of energy bands.	4
2	Draw the Fermi function at three temperatures lower, moderate and high.	3
3	Define effective mass. Prove that it is dependent on energy and wave vector.	4
4	Differentiate between metals, semiconductors and insulators using band theory.	4
5	Calculate density of states in three dimensions and obtain the formula for Fermi energy.	4

Unit II

Short answer questions

Q.N.	Question	KL
1	How many junctions are there in PN Junction?	1
2	Explain diffusion in carrier transport.	2
3	What do you mean by knee voltage when the PN junction diode is forward biased?	2
4	Which type of semiconductor is suitable for optoelectronic devices?	1
5	What do you understand by optoelectronic devices? give two examples.	2
6	Define Intrinsic and Extrinsic semiconductor.	1
7	Distinguish Ohmic and Schottky contacts.	4

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Long answer questions

Q.N.	Question	KL
1	What do you mean by intrinsic semiconductor? Obtain an expression for the intrinsic carrier concentration in an intrinsic semiconductor. under what conditions will fermi level be in the middle of the forbidden gap?	4
2	Derive an expression for carrier concentration in extrinsic semiconductors. What would be the position of Fermi level? Explain.	4
3	Compare a Schottky diode to a PN diode. In which applications do Schottky diodes perform better than PN diodes?	5
4	Define the terms drift velocity and diffusion velocity. When the p-n junction is forward biased, which one is dominant and why?	4
5	Draw an energy band diagram of a metal semiconductor junction and level the important quantities such as Fermi level, band bending, etc.	3

Unit III

Short answer questions

Q.N.	Question	KL
1	Define Spontaneous and Stimulated emission.	1
2	Define the term Meta stable state.	1
3	Define Photovoltaic effect and write its applications.	2
4	Write three uses of Solar cells.	1
5	Explain the effect of impurity on photoconductivity.	2
6	What is optical gain in metal semiconductor junction?	1
7	What is Fermi's Golden rule?	1

Long answer questions

Q.N.	Question	KL
1	What is radiative and non-radiative transition? Explain in brief the optical joint density of states.	4
2	What are transition rates? Explain Fermi's golden rule?	3
3	Explain photovoltaic effect. With required diagrams discuss construction and working of solar cell.	4
4	Write the assumptions of the Drude model and calculate the equation of conductivity using this model.	4
5	What is optical gain and optical loss in semiconductors?	2

Unit IV

Short answer questions

Q.N.	Question	KL
1	Define Hall mobility and Hall coefficient.	1
2	What is the Vander Pauw method for resistivity?	1
3	What is the basic principle of UV visible spectroscopy?	1

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4	How to calculate band gap in uv-vis spectroscopy	3
5	What is the use of UV-visible spectra in semiconductors?	2
6	What parameters can be extracted from diode I-V characteristic?	2

Long answer questions

Q.N.	Question	KL
1	Explain four probe methods. Derive an equation to calculate resistivity of a thin semiconductor.	4
2	Explain Vander Pauw measurements for carrier density, resistivity and Hall mobility.	4
3	Explain hot point probe measurement with suitable diagrams.	3
4	Discuss UV-VIS method for band gap measurement of semiconductors.	4
5	Write a short note on DLTS techniques.	2

Unit V

Short answer questions

Q.N.	Question	KL
1	Explain 0-D structure giving examples.	2
2	Explain the Quantum wells, wires, and dots.	2
3	Explain the structure of buckyballs.	2
4	What is the use of quantum dots?	2
5	Give one practical example each of quantum wells, wires, and dots.	1
6	Differentiate between hetero-junction and homo-junction.	4

Long answer questions

Q.N.	Question	KL
1	What do you mean by low dimensional structure? Classify different types of low dimensional structure.	2
2	What do you mean by density of state? Give its physical significance. Compare the density of state function for zero, one and two dimensional systems.	3
3	Write any two techniques of synthesis and characterization of quantum dots.	2
4	What is a Heterojunction solar cell? Explain Heterojunctions and associated band-diagrams.	3
5	Write a note on n - n Heterojunction.	4



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