



ABES Engineering College, Ghaziabad

Department of Applied Sciences & Humanities

Session: 2025-26

Year/ Semester: I/1st

Branch/Section: CSE11-20 / CSEDS / ECE

Course Code: 25AS101

Course Name: Applied Physics

Assignment: 03

Date of Assignment:

Date of Submission:

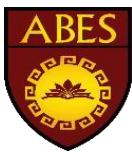
MM:10 marks

Q. No.	Questions	CO	KL	Marks
1	Classify solid materials on the basis of energy band gap.	CO3	K2	1
2	Where is the Fermi level positioned in an intrinsic semiconductor, N--type & P-type semiconductor, and how does it vary with temperature?	CO3	K2	1
3	How does mobility & conductivity of semiconductor materials vary with temperature?	CO3	K1	1
4	Define depletion region and built-in – potential in a PN junction	CO3	K1	1
5	What are the methods used for the generation of electron-hole pairs in semiconductors?	CO3	K2	1
6	Which recombination process is used in semiconductors like silicon?	CO3	K2	1
7	Why do LEDs emit different colours of light?	CO3	K2	1
8	How does sunlight intensity affect the current produced by a solar cell?	CO3	K2	1
9	Differentiate between dark current and photocurrent of Photodiode.	CO3	K1	1
10	Define Fermi Level.	CO3	K1	1

CO Course Outcomes mapped with respective question

KL Bloom's knowledge Level (K1, K2, K3, K4, K5, K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6>Create



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Tutorial /Practice sheet : 03

Q. No.	Question	CO	KL	
1	Find the value of F(E) for $E-E_F = 0.01\text{eV}$ at 200 K. (Ans: $F(E) = 0.36$)	CO3	K3	
2	Calculate the probability that a state in conduction band is occupied by an electron and calculate the thermal equilibrium electron concentration in silicon at $T = 300\text{K}$. Assume the Fermi energy is 0.25eV below conduction band. The value of N_c for silicon at $T = 300\text{ K}$ is $N_c = 2.8 \times 10^{19} \text{ cm}^{-3}$. (Ans: $F(E_C) = 6.43 \times 10^{-5}$, $n=1.8 \times 10^{15} \text{ cm}^{-3}$).	CO3	K3	
3	In an N-type semiconductor the Fermi level lies 0.3eV below the conduction band at 300K. If the temperature is increased to 330 K, find the new position of the Fermi level. (Ans: 0.33eV)	CO3	K3	
4	In a p-type semiconductor at $T=300\text{K}$, the Fermi level lies 0.4eV above the valence band. If the concentration of the acceptor atoms is doubled, find the new position of the Fermi level. (Ans: 0.3923 eV)	CO3	K3	
5	If the drift velocity of holes under a field gradient 100V/m is 5 m/sec . What is the mobility ?(Ans: $\mu = 0.05 \text{ m}^2/\text{V}\cdot\text{sec}$)	CO3	K3	
6	A Semi-conductor wafer is 0.5mm thick a potential of 100 mV is applied across thickness. What is the electron drift velocity if the mobility is $0.2 \text{ m}^2/\text{V}\cdot\text{sec}$.(Ans: $v_d = 40 \text{ m/sec}$)	CO3	K3	
7.	The resistivity of intrinsic semiconductor at 300K is $0.47\Omega\cdot\text{m}$. If the electron and hole mobilities are 0.38 and $0.18\text{m}^2/\text{V}\cdot\text{sec}$, calculate the intrinsic carrier density at 300K. (Ans: $n_i = 2.38 \times 10^{19} \text{ m}^{-3}$)	CO3	K3	
8.	An intrinsic semiconductor material P has an energy gap of 0.36 eV while another material Q has an energy gap of 0.72 eV. Compare the intrinsic carrier densities in these materials at 300K. .(Ans: $n_i(P)/n_i(Q) = 1049$)	CO3	K3	
9.	Find the resistance at 300K of an intrinsic Ge rod which is 1cm long, 1 cm wide and 1 cm thick. The intrinsic carrier density at 300K is $2.5 \times 10^{19} \text{ m}^{-3}$ and the mobilities of electron and hole are 0.39 and $0.19 \text{ m}^2/\text{V}\cdot\text{sec}$ respectively. (Ans: $R = 43.1 \Omega$)	CO3	K3	
10.	Determine the number density of donor atoms which have to be added to an intrinsic semiconductor to produce an n-type semiconductor of conductivity $5 \Omega^{-1} \cdot \text{cm}^{-1}$. Given $\mu_e = 3850 \text{ cm}^2/\text{V}\cdot\text{sec}$.(Ans: $N_d = 0.81 \times 10^{16} \text{ cm}^{-3}$)	CO3	K3	



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11.	A solar cell of size $10 \text{ cm} \times 10 \text{ cm}$ produces a voltage of 0.5 V and a current of 2.5 A under sunlight with an insolation of 800 W/m^2 . What is the efficiency of the solar cell? (Ans: $\eta = 15.6\%$)	CO3	K3	
12.	A rectangular solar module measuring $1.5 \text{ m} \times 2.0 \text{ m}$ receives solar radiation of 550 W/m^2 . If the efficiency of the module is 12% , what is its power output? .(Ans: $P_{out}= 198 \text{ W}$)	CO3	K3	
13.	A solar cell with an area of 25 cm^2 produces a short circuit current of 0.9 A and an open circuit voltage of 0.55 V . Calculate the maximum power the cell can generate. .(Ans: $P_{max}= 0.495 \text{ W}$)	CO3	K3	
14.	An LED is made from GaAsP semiconductor with an energy gap of 1.875 eV . Calculate the wavelength of emitted light. .(Ans: $\lambda= 660 \text{ nm}$)	CO3	K3	
15.	A solar cell has following characteristics:- $V_{OC} = 0.6 \text{ V}$, $I_{SC} = 3 \text{ A}$, $V_{MP} = 0.5 \text{ V}$, $I_{MP} = 2.5 \text{ A}$. Calculate the fill factor of solar cell. (Ans:-FF= 0.694 or 69%)	CO3	K3	

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