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 $E-E_F$ = 0.01eV 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 =300K . Assume the Fermi energy is 0.25eV below conduction band. The value of N_c for silicon at T = 300 K is $N_c = 2.8 \times 10^{19}$ cm^{-3}. **(Ans: F(E_C) = 6.43 X 10^{-5}, n=1.8 x 10^{15} 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=300K, 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:μ = 0.05 m^2/V-sec)**	CO3	K3	
6	A Semi-conductor wafer is 0.5mm thick a potential of 100 mV is applied at across thickness. What is the electron drift velocity if the mobility is 0.2 m^2/V-sec.(**Ans: v_d = 40 m/ sec)**	CO3	K3	
7.	The resistivity of intrinsic semiconductor at 300K is 0.47Ω-m. If the electron and hole mobilities are 0.38 and 0.18m^2/ V-sec, calculate the intrinsic carrier density at 300K. (**Ans: n_i = 2.38 x 10^{19} 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 2.5×10^{19} m^{-3} and the mobilities of electron and hole are 0.39 and 0.19 m^2/ V-sec respectively. (**Ans: R = 43.1 Ω)**	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 $Ω^{-1}$. cm^{-1}. Given $μ_e$ = 3850 cm^2/ V-sec.(**Ans: N_d = 0.81 x 10^{16} cm^{-3})**	CO3	K3	

11.	A solar cell of size 10 cm × 10 cm produces a voltage of 0.5 V and a current of 2.5 A under sunlight with an insolation of 800 W/m². What is the efficiency of the solar cell? (**Ans: η = 15.6%)**	CO3	K3	
12.	A rectangular solar module measuring 1.5 m × 2.0 m receives solar radiation of 550 W/m². If the efficiency of the module is 12%, what is its power output? .(**Ans: Pout= 198 W)**	CO3	K3	
13.	A solar cell with an area of 25 cm² 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: Pmax= 0.495 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: λ= 660 nm)**	CO3	K3	
15.	A solar cell has following characteristics:- V_{OC} = 0.6 V, I_{SC} = 3A , V_{MP} = 0.5V ,I_{MP} = 2.5 A. Calculate the fill factor of solar cell**. (Ans:-FF= 0.694 or 69%)**	CO3	K3	

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