

	PSC QUIZ 2 dt 11-09-2023	
	Name: _____ Roll No. _____	
Q1	Following free electron model, sketch the $E-k$ diagram for a metal in reduced zone scheme.	
Q2	Derive a relation relating the effective mass and curvature in $E-k$ diagram	
Q3	Explain briefly the velocity saturation effect in Si.	
Q4	Sketch the electron concentration vs $1/T$ plot for a n-doped semiconductor.	
Q5	Obtain the Einstein relation relating mobility and diffusion coefficient.	

Q6	Plot the DOS vs Energy for 3D and 2D materials in the same figure.	
Q7	Calculate the energy, in terms of kT and E_F , at which the difference between the Boltzmann approximation and the Fermi-Dirac function is 5 percent of the Fermi function.	
Q8	Calculate the position of the Fermi energy level in n-type silicon at $T = 300$ K with respect to the intrinsic Fermi energy level. The doping concentrations are $N_d = 2 \times 10^{17} \text{ cm}^{-3}$ and $N_a = 3 \times 10^{16} \text{ cm}^{-3}$.	
Q9	Estimate the intrinsic carrier density for Si when the temperature is doubled from room temperature (300K) to 600 K.	
Q10	The electron density in a Si sample decreases linearly from 10^{16} to 10^{15} cm^{-3} over a distance of 10 cm. The area of the sample is 6 cm^2 and diffusion constant is $15 \text{ cm}^2/\text{s}$. Determine the diffusion current of electron.	