

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS-2022

B.Tech-VIII Semester (CS/Civil/BT)

COURSE CODE (CREDITS): 21B1WEC732

MAX. MARKS: 35

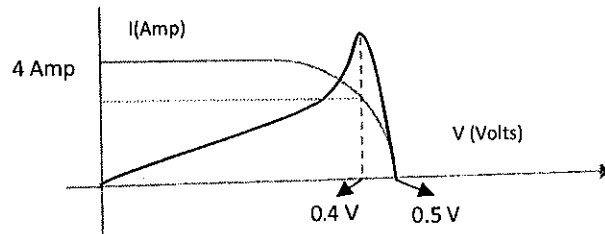
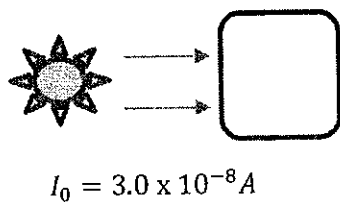
COURSE NAME: Renewable Energy Systems

COURSE INSTRUCTOR: Pankaj Kumar

MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

- Q1. Compare merits, demerits and deployment area of Lead acid, Sodium Sulphur and redox flow batteries. [4]
 Q2. What is the principle of Li-Ion battery? Mention its safety, charging procedure and application areas. [4]
 Q3. What is spectral sensitivity. Explain its characteristics. If external efficiency is 85% than calculate spectral sensitivity for radiation of 800 nm. [4]
 Q4. Calculate the expression of maximum power point and Fill Factor for a solar cell. A typical PV Cell characteristic is given below in Fig.1, find the FF of Solar cell. I_0 is the reverse saturation current. [2+1+3]



- Q5. Draw the diamond structure of Si. Find its atomic concentration if lattice constant of Si is 5.43 \AA . Also calculate its intrinsic carrier concentration at room temperature (27°C). $N_c = 2.8 \times 10^{19} / \text{cc}$, $N_v = 1.04 \times 10^{19} / \text{cc}$. Impurities Boron 2×10^{16} and phosphorous 5×10^{16} are added to it. Find charge carrier concentration. Draw the fermi level with reference to conduction or valance band. what is the type of semiconductor? [1+1+1+2]
 Q6. Consider a GaAs pn junction solar cell with the following parameters: $N_a = 10^{17} \text{ cm}^{-3}$, $N_d = 2 \times 10^{16} \text{ cm}^{-3}$, $D_n = 190 \text{ cm}^2/\text{s}$, $D_p = 10 \text{ cm}^2/\text{s}$, $\tau_{n0} = 10^{-7} \text{ s}$, and $\tau_{p0} = 10^{-8} \text{ s}$. Assume a photocurrent density of $J_L = 20 \text{ mA}/\text{cm}^2$ is generated in the solar cell. (a) Calculate the open-circuit voltage and (b) determine the ratio of open-circuit voltage to built-in potential barrier. N_i for GaAs is $1.8 \times 10^6 / \text{cc}$. [2+2]
 Q7. What is Betz's Limit. If wind is blowing at 4 m/s at height at 20m. A wind turbine with 50 m diameter is installed at 120 m. Density of air is $1.2 \text{ kg}/\text{m}^3$ and friction coefficient is 0.3. What is the power that wind turbine is generating? [2+2]
 Q8. Explain Solar Flat plate collector. How its efficiency is calculated. How glazing improves the efficiency. [2+1+1]