

Major Test
India Institute of Technology Delhi
Centre for Energy studies

IInd Semester 2009-2010

ESL- 730

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Direct Energy Conversion.

Section A

Max Marks: 12

Attempt all questions

- 1 a) Find the wavelength of radiation whose photons have energy equal to the band gap of GaAs. Calculate wavelength of light capable of forming an electron hole pair in Si. Band gap of Si is 1.11 eV, $h = 6.625 \times 10^{-34}$ J-sec, $c = 3 \times 10^8$ m/s. (1+1)
- b) Draw typical current, voltage and power characteristic of solar cell and typical current-voltage characteristics of Si cell showing the effect of illumination level and load resistance. (1+1)
- c) Explain in brief the following.
- i) What is plasma wavelength? Only on the bases of reflection transmission spectra. (1)
- ii) What is Ohmic contact? (1)
- 2 a) A photovoltaic cell has an open circuit voltage of 0.6V and a short circuit current of 250 A/m^2 at a cell temperature of 40°C . The maximum voltage is 0.519 Volt. Calculate current density that maximizes the power of the cell. What would be the corresponding power per unit cell area?
 $k = 1.38 \times 10^{-23} \text{ J/K}$. (1+1+1+1)
- b) Draw the schematic for a fuel cell employing hydrogen as a fuel. (1)
- c) Derive the following relations for fuel cell

$$T \left(\frac{\partial E}{\partial T} \right)_p = \frac{\Delta H}{nF} + E \quad (1)$$