MINOR TEST II ESL 360 DIRECT ENERGY CONVERSION METHODS

Time: 1 hour **TOTAL MARKS: 20**

NOTE: Answer all questions. ***Write part A & B in separate answer sheets***

I Card

Part A

(1) In a solar cell, mobile electron generation depends on what parameters? (2)

(2) What are avoidable and unavoidable recombination processes in semiconductor devices? Write down the recombination rates of all the processes (3)

(3) A beam of photons of 500 nm wavelength is falling on a piece of indirect band gap semiconductor. The absorption coefficient of the 500 nm photons in the semiconductor is 10^4 cm^{-1}. What is the maximum distance the photons would be able to travel in the semiconductor before getting absorbed? (1)

(4) What is the specific difference, which you learn from the direct energy conversion process compared to conventional energy conversion? (1)

The following statements are true or false, justify with the comments, Marks will be given only with justification (3)

(5) The energy exchange processes from the Sun to solar thermal as well as photovoltaic devices are same.

(6) Solar cell is a simple DC battery.

Part B

1. Consider a basic thermoelectric engine (comprising of materials A and B) kept in mutual contact, along with the heat source and sink reservoirs, by copper strips. The heat source reservoir (at temperature T_1) and heat sink (at temperature T_2) temperatures are such that T_1-T_2 being negligibly small. From basic principles, derive the efficiency and the condition at which the thermoelectric engine operates at maximum efficiency. **[6]**

2. Give the definition of Figure of Merit in a Thermoelectric Generator, clearly explaining what each term implies. **[2]**

3. Find the current that will make the junction heat transfer to be zero for a thermocouple with Seebeck coefficient (α_s) of 220 microvolts/°K and the temperature of the ambient junction being 300°K along with a junction resistance of 0.1 ohm. What will the corresponding junction heat transfer be at the hot junction with a temperature of 780 °K. [2]