Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (EE)/SEM-1/MEE-105C/2009-10

2009

ENERGY SYSTEM

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. a) What is meant by renewable energy sources ?

   b) What do you understand by energy chain ? What do you understand by greenhouse effect and what are its consequences ? How is it caused ?

   c) Explain the importance of non-conventional energy sources in the present context. What do you understand by green power ? 3 + 6 + 5

2. a) What is fuel cell ? What is the difference between a fuel cell and battery ?

   b) Described the principle of working of H_2–O_2 fuel cell, give also its limitation.

c) Calculate the following for a hydrogen-oxygen fuel cell :

i) The voltage output of fuel cell

ii) Cell efficiency

iii) The electrical work output per mole of H_2O produced

iv) The heat transfer to the surrounding.

The following reactions are to be taken place :

At the anode $H_2 \rightarrow 2H^+ + 2e^-$

At the cathode, $2e^- + \frac{1}{2} O^2 + H_2O = 2OH^-$

The cell is operated at 25° C, Take the following data :

$\Delta H°$ 298 K = $- 286 \times 10^{-3}$ kJ/kg mole

$\Delta G°$ 298 K = $- 2373{\cdot}3 \times 10^3$ kJ/kg mole

and $n = 2$ 4 + 5 + 5

3. a) What are the factors affecting the performance of Biomass digester ?

b) Described in difference step of biomass fuel (non-petroleum) production from biomass.

c) Calculate the efficiency of fuel cell. 5 + 5 + 4

4. a) What are the major advantages and disadvantages of MHD generating system ?

   b) Derive the expression for max power generation per unit volume of generator.

   c) A deep ocean wave of 2 m peak to peak appears at *h* period of 8 s. Find the wavelength, phase velocity and power associate with the wave. At this power rate, what is the average annual wave energy in MWh ? 3 + 6 + 5

5. a) Prove the power in wave is directly proportional to the square of amplitude & to the period of wave.

   b) A hydro-electric station has a reservoir of the area 3·6 square kilometre and capacity 5×10^6 m^3. The effective head is 300 metre. The panstock, turbine and generator efficiency are respectively 70%, 80% and 85%.

      i) Calculate the total electrical energy that can be generated from power station.

      ii) If *n* load of 1500 kW has been supplied for 3 hours, find the fall in reservoir level. 7 + 7

6. a) Derive the expression for power & efficiency for a thermonic generator.

   b) What is the basic difference between thermo-electric and thermonic-conversion system ? Explain the working principle of thermo-electric generator.

   c) Explain in brief captive power plant. 5 + 6 + 3

7. a) Describe energy management system and its importance.

   b) Give the comparison of stem power plant, hydro power plant, diesel power plant and nuclear power plant on the basic of operating cost, initial cost, efficiency, maintenance cost and availability of source of power.

7 + 7