Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ME)/SEM-8/ME-806/2010

2010

NON-CONVENTIONAL ENERGY SOURCES

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) For small wind turbine system suitable batteries are

      a) lead-acid battery

      b) alkaline battery

      c) normal acid battery

      d) dry cell.

   ii) Main criterion for selecting the site for a wind firm is

      a) high wind velocity

      b) very low wind velocity

      c) high velocity area with forests, etc.

      d) adequate and uniform avarage wind velocity.

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iii) Types of geothermal fluids used as input to power plants
   a) hot brine b) cold water
   c) sea water d) vapour.

iv) Savonius rotor is used in
   a) wave energy system
   b) hydropower system
   c) tidal power system
   d) thermal power system.

v) Kaplan turbine is a
   a) impulse turbine b) mixed flow turbine
   c) axial flow turbine d) none of these.

vi) Pelton terbine is used for
   a) high head b) low head
   c) medium head d) none of these.

vii) Solar water heating system requires
   a) smaller storage volume
   b) larger storage volume
   c) no storage volume
   d) moving water.

viii) Fuel with highest caloric value is
   a) Diesel b) Petrol
   c) Coal d) Hydrogen.

ix) The energy content of biomass fuel depends upon
   a) carbon content b) moisture content
   c) ash content d) all of these.

x) Tidal energy is the result of interaction of the gravitational pull of
   a) earth b) moon
   c) sea waves d) none of these.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Discuss solar water heating system with antifreeze with a neat sketch.
3. What are the main types of tidal power generation systems ? Discuss in brief about linked basin scheme.
4. Draw a neat sketch of a solar pond used to drive a vapour cycle turbine.
5. Write a short note on environmental implications of use of geothermal energy.
6. Draw a neat sketch of a biogas plant and label the parts.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) For wave energy generation, show that potential energy density per unit area is $\frac{1}{4} g\rho a^2$, symbols have their usual meanings. 7

   b) What are the advantages and disadvantages of wave energy ? 8

8. a) What do you mean by PV-cell ? 3

   b) With a schematic diagram, discuss a solar-thermal electrical power plant. 12

9. a) What is magma ? 2

   b) What is the limitation of a geothermal power plant ? 8

   c) What are the main criteria in selecting the site of a wind farm ? 5

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10. a) Prove that in case of a horizontal axis wind turbine, maximum power can be obtained when exit velocity = $\frac{1}{3}$ wind velocity and $P_{max} = \frac{8}{27g} \rho a v^3$, symbols have their own meanings. 8

b) What is OTEC ? Describe a closed cycle OTEC plant with the help of flow diaggram. 7

11. a) Explain bio-mass gassification process. 7

b) Calculate the efficiency of a closed cycle OTEC system using ammonia as the working fluid and installed at a location where the warm and cold sea water streams are at temperatures of 29°C and 8°C respectively. Make an allowance of about 5°C for the temperature difference required in the evaporator and condenser for transfering heat and assume that the ammonia is evaporating at 24°C and condensing at 13°C. Take the isentropic efficencies of the turbine and pump to be 90 and 80 per cent respectively.

The relevant properties of ammonia are as follows : 8

t (°C)	P (bar)	V_f (m^3/kg)	h_f (kJ/kg)	h_g (kJ/kg)	S_f (kJ/kgK)	S_g (kJ/kgK)
13	6·813	$1·612 \times 10^{-3}$	241·5	1456·2	0·929	5·175
24	9·725	$1·655 \times 10^{-3}$	293·7	1464·6	1·107	5·048

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