ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2008

NON-CONVENTIONAL ENERGY SOURCES

SEMESTER - 7

Time : 3 Hours] [Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Biogas is produced by a particular type of bacterial digestion. The digestion process is called

a) Normal digestion b) Aerobic digestion

c) Anaerobic digestion d) None of these. ☐

ii) The greenhouse gas is

a) carbon dioxide b) methane

c) nitrous oxide d) all of these. ☐

iii) Maximum efficiency of a solar cell is around 20% when the cell is fabricated from

a) amorphous Si b) monocrystalline Si

c) polycrystalline Si d) none of these. ☐

iv) Dolphin mechanism is a method of extracting

a) solar energy b) wind energy

c) ocean wave energy d) geothermal energy. ☐

v) Geothermal energy field is available mainly in which of the following areas ?

a) Hilly b) Volcanic

c) Offshore d) Desert. ☐

vi) The energy radiated by the sun on a bright day is

a) 2·5 kW/m^2 b) 1·0 kW/m^2

c) 500 W/m^2 d) 200 W/m^2 ☐

vii) On an average the temperature of the earth increases per km as one moves inward by

a) 60°C b) 10°C

c) 150°C d) 30°C. ☐

viii) Bio-diesel can be mixed with which of the following ?

a) Petrol b) Diesel

c) Kerosene d) All of these. ☐

ix) Fill factor of a good silicon solar cell is

a) less than 0·5 b) 0·5 to 0·7

c) 0·7 to 1·0 d) 1·0 to 2·0. ☐

x) Lignin content of biomass

a) delays chemical reaction b) quickens chemical reaction

c) has no effect d) none of these. ☐

xi) Produces gas consists of

a) only CH_4 b) CH_4 and CO_2

c) CO, H_2 and N_2 d) none of these. ☐

xii) An illuminated solar cell is

a) constant current device

b) constant voltage device

c) constant power output device

d) none of these. ☐

xiii) The turbine normally employed in tidal power is

a) simple impulse type b) propeller type

c) reaction type d) reversible type. ☐

GROUP – B

(Short Answer Type Questions)

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

2. a) What is the basic principle of tidal power ?

   b) What are the limitations of tidal power schemes ? 3 + 2

3. a) Give a list of materials used for biogas generation.

   b) Write the main applications of biogas. 3 + 2

4. With a block diagram, describe an ethanol plant from sugarcane.

5. A deep ocean wave of 2 m peak appears at a period of 8s. Find the wavelength, phase velocity, power associated with the wave. At this power rate, find the average annual wave energy in MWh/m. 3 + 2

6. An acid-lead battery bank is required for a solar generator serving a building with a load of 2542 W.h.day^{-1} for 3 days. The rated voltage of a battery is 12 V.

   Determine the battery storage capacity for battery efficiency of 83%, maximum depth of discharge 0·8 and reserve factor of 1·2. Also calculate the number of batteries connected in parallel if the capacity of a single battery is 180 A.h.

GROUP – C

(Long Answer Type Questions)

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

7. a) What are photovoltaic device ?

   b) Outline briefly the principle of operation of a photovoltaic device.

   c) Describe the different types of solar energy collectors in common use along with diagram. 2 + 5 + 8

8. a) A propeller wind turbine has a diameter of 120 m and runs at 1 standard atmosphere and 18°C has a velocity of 15 m/s. Calculate

      i) the total power density in the wind stream

      ii) the total power

      iii) the torque and the thrust.

b) Describe the main components of a wind power plant.

c) What is Magnus effect ?

d) What are the factors to be considerd for selecting wind power plant ?

6 + 4 + 2 + 3

9. What is meant by geo-thermal energy ? By what methods this energy is extracted ? What are the difficulties and disadvantages of a geo-thermal generation ? What are the possible sources of geo-thermal pollution ? How are these avoided ?

2 + 2 + 4 + 4 + 3

10. Define 'Betz Limit' and derive the expression for maximum power coefficient for wind turbine. Explain the following terms showing velocity duration and power duration curve of wind energy

i) cut in speed

ii) rated wind speed

iii) cut out speed. 7 + 8

11. Write short notes on any *three* of the following : 3 × 5

i) Bio-diesel

ii) NCES potential : Indian perspective

iii) Solar desalination

iv) Electro-chemical energy storage

v) Different components of environment suitable for non-conventional energy development.

END