

**GANPAT UNIVERSITY**  
**B.TECH SEM. VIII<sup>TH</sup> MECHANICAL ENGINEERING**  
**CBCS REGULAR EXAMINATION MAY/JUNE - 2013**  
**ME801 ALTERNATIVE ENERGY SOURCES**

TIME: - 3 HOURS

TOTAL MARKS-70

- INSTRUCTIONS:** (1) All questions are compulsory.  
 (2) Assume suitable data if necessary.  
 (3) Figure to the right indicates full marks.  
 (4) Scientific calculator and steam table is allowed.

## SECTION - I

- Que.-1** a Define the following terms with diagram: 04  
 (i) Latitude angle (ii) Declination angle  
 (iii) Hour angle (iv) Solar constant.
- b What are the main applications of Solar pond? Describe briefly. 04
- c Estimate the daily global radiation a horizontal surface at Baroda ( $22^{\circ} 13' N$ ,  $73^{\circ} 13' E$ ) during the month of march. If constants a and b are given equal to 0.28 and 0.48 respectively and average sunshine hours for day are 9.5. 04
- OR**
- Que.-1** a Explain the method of heat extraction from a Solar pond. 04  
 b Describe types of pyranometers with a neat sketch. 04  
 c Calculate the angle made by beam radiation with the normal to a flat collector on December 11, at 11:00 A.M., solar time for location at  $28^{\circ} 35' N$ . The collector is tilted at an angle of latitude plus  $10^{\circ}$ , with the horizontal and is pointing due south. 04
- Que.-2** a Data for a flat plate collector used for heating are given below: 08  
 Location and Latitude is Coimbatore  $11^{\circ} 00' N$ , Day and Time is March 22, 14.30 – 15.30 (LST), Average intensity of solar radiation is  $560 W/m^2$ , Collector tilt is  $26^{\circ}$ , No. of glass cover is 2, Heat removal factor for collector is 0.82, Transmittance of glass is 0.88, Absorptance of plate is 0.93, Top loss coefficient ( $U_L$ ) for collector is  $7.95 W/m^2 ^{\circ}C$ , Collector fluid temperature is  $75^{\circ}C$ , Ambient temperature is  $25^{\circ}C$ .  
 Calculate:  
 (i) Solar attitude angle  
 (ii) Incident angle, and  
 (iii) Collector efficiency.
- b What are the advantages and disadvantages of concentrating collectors over a flat plate collector? 03
- OR**
- Que.-2** a Enumerate the different types of concentrating collectors. Describe a collector used in power plant for generation of electrical energy. 06  
 b Explain the solar air collectors with porous absorbers. In which manner it is better than non porous type collectors. 05

Que.-3

Attempt Any Three.

- a Write short note on Solar water still.
- b List out different solar water heating system. Explain any one.
- c What are the main components of flat plate collector, explain the function of each.
- d How can we calculate total solar radiation on tilted surfaces?

SECTION - II

- Que.-4 a Propeller type wind turbine operating at a speed of 50 rpm at maximum efficiency. Turbine diameter is 135 m. This turbine is operating in wind having a condition like 1 atm pressure and 24°C temperature has velocity of 21 m/s, Calculate: (i) The total power density in the wind stream (ii) The maximum obtainable power density (iii) A reasonably obtainable power density (iv) The total power, and (v) The torque and axial thrust, 07
- b Explain the lift and drag mechanism for wind energy conversion. 05

OR

- Que.-4 a Describe Darrieus rotor principle with a neat sketch. Write its merits and demerits over horizontal axis machine. 06
- b Derive an expression of maximum forces on the blades and thrust on turbine. 04
- c Write merits and demerits of WECS. 02

- Que.-5 a A hot water geothermal plant of the total flow type receives water at 250°C. The pressure at the turbine inlet is 11 kg/cm<sup>2</sup>. The plant uses a direct contact condenser that operates at 0.40 kg/cm<sup>2</sup>. The turbine has a polytropic efficiency of 0.65. For a cycle net output of 13MW, Calculate : (i) The hot water flow, in kg/hr (ii) The condenser cooling water flow, in kg/hr, if such water is available at 27°C, (iii) The cycle efficiency (iv) Plant heat rate. 07
- b Explain the double basin arrangement method of utilization of tidal energy. 04

OR

- Que.-5 a Describe with a neat sketch vapour dominated system. 06
- b In Gulf of Cambay, which is being considered for possible tidal power generation, during the tide cycle, the observed difference between the high and low water of the tide was 10.8 m. It has been estimated that this estuary having an area of 10 sq. km. can generate power for 3 hours in each cycle. Assuming the average available head to be 10 m, and the overall efficiency of the generation system to be 75%. Calculate: (i) The power in HP at any instant and (ii) The total energy generated in the year. Take specific weight of sea water = 1025 kg/m<sup>3</sup>. 05

Que.-6

Attempt Any Three.

- a Explain the continuous type biogas plant with a neat sketch.
- b The following data are given for a family biogas digester suitable for the output of five cows: The retention time is 20 days, temperature 30°C, dry matter consumed per day is 2 kg, and biogas yield is 0.24 m<sup>3</sup> per kg. The efficiency of burner is 60%, methane proportion is 0.8. Heat of combustion of methane is 28 MJ/m<sup>3</sup>. Calculate: (i) The volume of biogas digester (ii) The power available from digester.
- c Describe the principle of MHD power generation.
- d Write short note on Energy conservation approach.

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END OF PAPER