

B.E. (Mechanical Engineering) Eighth Semester (C.B.S.)  
**Elective - III : Renewable Energy Systems**

P. Pages : 3

Time : Three Hours



NRJ/KW/17/4728

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Assume suitable data whenever necessary.
  9. Illustrate your answers whenever necessary with the help of neat sketches.
  10. Use of non programmable calculator is permitted.

1. a) Write short note on beam, diffuse and global radiation. 6
- b) Estimate the average daily global radiation and diffuse radiation on a horizontal surface at Nagpur ( $21^{\circ}06'N, 79^{\circ}03'E$ ) during the month of March (16). if the average sunshine hour per day are 9.5 constant a and b are 0.27 and 0.50 respectively. 7

**OR**

2. a) Explain any one type of solar Radiation measuring instrument with neat sketch. 6
- b) Calculate the Indian Standard Time of sunrise of Nagpur ( $21.5^{\circ}N, 79^{\circ}E$ ) on March 11, if equation of correction is  $-4$  minute and std. longitude is  $82.5^{\circ}N$ . Also calculate max. day length. 7
3. a) Explain with neat sketch main components of flat plate collector. 6
- b) Calculate the angle made by beam radiation with normal to flat plate collector, pointing due south location in New Delhi ( $28^{\circ}38'N, 77^{\circ}17'E$ ) at 9.00 Hrs. solar time on Dec 1. The collector is tilted at angle of  $36^{\circ}$  with the horizontal. Also calculate day length. 7

**OR**

4. a) Give the effect of following parameter on the performance of solar collector 6
- i) Material used for solar collector
  - ii) Selective coating for solar collector
  - iii) No. of glass cover.

- b) Calculate the collector efficiency factor for the following specification 7
- |                               |   |                            |
|-------------------------------|---|----------------------------|
| Overall heat loss coefficient | : | 8.0 w / m <sup>2</sup> c   |
| Tube Spacing                  | : | 150 mm                     |
| Tube diameter                 | : | 10 mm                      |
| Plate thickness               | : | 0.5 mm                     |
| Plate thermal conductivity    | : | 210 w / mk                 |
| Heat transfer coefficient     | : | 1500 w / m <sup>2</sup> °k |

5. a) Enumerate the different type of concentrating type of collectors. Describe a collector used in power plant for generating electrical energy. 7
- b) A compound parabolic collector, 1 m long has an acceptance angle of 20°. The absorber surface of the collector is flat and has a width of 10 cm. Calculate : concentration ratio, the aperture, height and surface area of collector. 7

**OR**

6. Write short notes on **any three**. 14
- |                  |                                |
|------------------|--------------------------------|
| i) Solar cooking | ii) Parabolic Dish collector   |
| iii) Solar Tower | iv) Solar photo - voltaic cell |

7. a) Explain the constructional details and working of fixed dome biogas plant with advantages and limitations. 7
- b) What are the various factors affects biogas generation? Explain any four factors in details. 7

**OR**

8. a) What parameters are considered for selection of site for installing biogas plant? Explain in brief. 7
- b) How gasifiers are classified? Explain with neat sketch any one. 7

9. a) Define the following terms as applied to wind energy conversion system 6
- |                    |                       |
|--------------------|-----------------------|
| i) Tip speed ratio | ii) Power coefficient |
|--------------------|-----------------------|
- b) Explain working of Claude's cycle OTEC system by giving neat sketch. 7

**OR**

10. a) A tidal power plant of simple single type has a basin area of  $30 \times 10^6 \text{ m}^2$ . The tide has range of 12 m. The turbine stops operating when the head on it falls below 3 m. Calculate the energy generated in cme filling (or emptying) process in KWh of turbine generator efficiency is 0.73. 6

- b) Wind at 1 standard atmospheric pressure and 15°C has a velocity of 15 m/sec. The turbine has diameter of 120 m and operating speed 40 rpm at max. Efficiency **7**  
Calculate.
- i) The total power density in wind stream.
  - ii) Max. obtainable power density.
  - iii) Reasonably obtainable power density.
  - iv) The total power.
  - v) The torque and axial thrust
- 11.** a) Explain working of MHD open cycle system with neat sketch. State the advantages and limitation over closed cycle system. **6**
- b) Explain liquid dominated isothermal system with neat sketch. Also represent on thermodynamic cycle. **7**

**OR**

- 12.** a) A MHD generator has following parameter **6**  
plate area :  $0.4 \text{ m}^2$   
Distance between plate : 0.5 m  
Flux Density :  $3 \text{ wb/m}^2$   
Average gas velocity : 1200 m/sec.  
Conductivity of gas : 10 mho/m  
Calculate maximum power and open circuit voltage.
- b) Explain Petrathernal (H.D.R.) system with neat sketch. **7**

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