

Elective-III : Renewable Energy Systems

P. Pages : 3

Time : Three Hours



NJR/KS/18/4728

Max. Marks : 80

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

1. a) Define the terms with value/equation 6
i) Solar constant.
ii) Declination angle.
iii) Hour angle.
- b) Explain with neat sketch, why orientation of solar flat plate collector is facing towards south. 3
- c) Write short notes on beam and diffuse radiation. 4

OR

2. a) Estimate monthly average of daily global and diffused radiation on horizontal surface at Baroda (22°00" N, 73° 10" E) in the month of April 16. Average sunshine hours per day are 10 hours constant $a = 0.27$ and $b = 0.49$. 6
- b) Which instruments are used for measuring solar beam radiation, global radiation and sunshine intensity. Describe principle of Angstrom pyrheliometer. 7
3. a) Give the effect of following parameter on the performance of solar collector. 6
i) Material used for solar collector.
ii) Selective coating used for solar collector and material used for selective coating.
iii) Number of glass cover.
- b) Calculate angle of incidence (θ_t) of beam radiation on a flat plate collector for the following situation. 7
Location : 21° N, 79°E
Slope of collector : 30°
Date : Dec. 1st
Time : 9.00 AM (I.S.T.)
Collector pointing due south.

OR

4.	Calculate collector efficiency of flat plate collector used for heating given data	13
	Factor	Specification
	1) Latitude	: 30°N
	2) Day & Time	: March 21 st , 10:30 AM
	3) Measured intensity of solar radiation	: 450 w/m ² hr
	4) Collector tilt	: 30°
	5) No. of glass cover	: 2
	6) Transmittance of glass	: 0.88 and independent of direction
	7) Absorptance of glass	: 0.95
	8) Top loss coefficient for collector	: 8.0 w/m ² °k
	9) Collector fluid temp	: 65°C
	10) Ambient temperature	: 22°C
	11) Thermal conductivity of plate	: 210 w/m ² °k with negligible bond and wall resistance.
	12) Tube diameter	: 1cm
	13) Fluid to tube H.T. coefficient	: 1500 w/m ² °k
	14) C _p (Water)	: 4.187 kJ/kg °k
	15) Collector Area	: 2m ²
	16) Mass flow rate of water	: 0.02 kg/sec
	17) Fin Thickness	: 0.05cm
	18) Centre to centre distance	: 15cm

- 5.** Write short notes on **any three**. **14**
- i) Parabolic Through collector.
 - ii) Power Tower.
 - iii) Parabolic Dish Collector.
 - iv) Compound parabolic collector.
 - v) Flat plate collector with adjustable mirror.

OR

- 6.** Write short notes on **any three**. **14**
- i) Solar pumping.
 - ii) Solar photovoltaic cell.
 - iii) Solar cooking.
 - iv) Solar water heating.
 - v) Solar Distillation.

- 7.** a) How temperature, pH value and carbon to nitrogen ratio affects biogas generation. **6**

- b) Explain constructional details and working of floating drum biogas plant with advantages and disadvantages over fixed dome biogas plant. 7

OR

8. a) How Biogas is used in S.I. engine? Explain with neat sketch. 7

- b) What do you mean by thermal gasification? Give classification of gasifier and constructional details of it. 7

9. a) With the following specification for MHD generator 6

Plate area : 0.4m^2
Distance between plate : 0.5m
Flux Density : 3Wb/m^2
Average gas velocity : 1200 m/sec
Gas conductivity : 10 Mho/m

Calculate

- i) Open circuit voltage
ii) Maximum power output.

- b) Explain constructional details and working of MHD open cycle with advantages and disadvantages. 7

OR

10. a) Describe geo-pressure system with neat sketch. 6

- b) Explain the schematic and thermodynamic cycle of liquid dominated single flashed system of geothermal power plant. 7

11. a) Explain site selection parameters for Wind Energy conversion system. 6

- b) With neat sketch explain horizontal axis wind mill with its basic components. 7

OR

12. a) Describe with neat sketch "Open cycle" Ocean Thermal Energy Conversion System. 6

- b) A tidal power plant of simple single basin type has basin area of $30 \times 10^6\text{ m}^2$. The tide has range of 12m. The turbine stops working when head falls below 3m. Calculate energy generated in one emptying in kWh if turbine generating efficiency is 0.73. 7
