B.E. (Mechanical Engineering) Eighth Semester (C.B.S.)

Elective – III : Renewable Energy Systems

P. Pages : 2 **TKN/KS/16/7676**

Time : Three Hours * 0 7 2 2 * 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) What is the difference between pyrheliometer and pyranometer ? Describe the principle of Angstrom type pyrheliometer. **6**

b) Calculate the Indian standard Time of sunrise at Nagpur (21.5ºN, 79ºE) on March 11, if equation of correction is -4 minute and standard longitude is 82.5ºN. Also calculate maximum day length. **7**

OR

2. a) Define following terms with reference to solar radiation. **6**
i) Solar constant ii) Declination angle
iii) Incident angle

b) Calculate **7**
a) Zenith angle and
b) Solar azimuth angle for a place with latitude 43º at 9.30a.m. Solar time on Feb 13.

3. a) Explain construction of liquid flat plate collector with neat sketch. Also explain why space is provided between absorber and cover (glass). **6**

b) Determine the average value of solar radiation for June 22, at the latitude of 10ºN, if constant a & b are given as equal to 0.30 and 0.51 resp. and the ratio $\frac{\bar{n}}{N} = 0.55$. **4**

c) Give the specific reasons. **4**
i) Why water is allowed to pass through tubes from bottom to top in flat plate collector?
ii) Why insulation is provided in flat plate collector ?

OR

4. a) Calculate useful energy and efficiency of solar collector between 10.00A.M. and 11.00 A.M on March 21st for location latitude 30ºN, tilt 30º measured radiation is $450 W/m^2$, over horizontal surface. Ambient temperature is 22ºC for a collector Top loss coefficient is $8.0 w/m^{2o}k$ Thermal conductivity of plate is $210 w/m^{2o}k$ Fin Thickness is 0.05cm, centre to centre distance is 15cm, Tube diameter is 1cm Fluid to tube heat transfer coefficient is $1500 w/m^{2o}k$, with negligible bond resistance and wall resistance, cover transmittance of solar radiation is 0.88 and independent of direction. Solar absorptance for absorber plate is 0.95. Collector width is 1m, length 2m, flowrate 150.02kg/sec, water inlet temperature is equal to 22ºC. Assume C_p water = 4.187 kJ/kgºk. **14**

5. a) Enumerate the different type of concentrating collector with advantages and disadvantages over flat plate collector. **6**

b) With neat sketch explain working of parabolic dish collector. Also state the type of tracking mechanism required for parabolic dish collector. **7**

OR

6. a) Explain working of Thermal electric conversion system. **6**

b) With neat sketch explain power Tower. **7**

7. a) What is Betz coefficient ? Derive equation for maximum power developed by horizontal axis wind turbine. **6**

b) Wind at 1 std atmospheric pressure and 150ºC has velocity of 10 m/sec. The turbine has diameter of 120m. and operating speed 40rpm at maximum efficiency. Calculate. **7**

i) Total power density on wind stream
ii) Maximum obtainable power density. Assume $\eta = 40$ %.
iii) Total power produced in kw.
iv) Torque and axial Thrust.

OR

8. a) Explain the working of Anderson cycle OTEC system by giving neat sketch. **7**

b) The observed difference between high and low water tide is 8.5m for a proposed tidal site. The basin area is about 0.5sq.km. Which can generate power for 3hrs in each cycle. the average available head is to be 8m. Overall efficiency of generator to be 75%. Calculate power in H.P and yearly power output. **7**

9. a) Explain the constructional details and working of KVIC digester. **7**

b) How biogas can be used in S. I. Engine ? Also explain what are modifications required with figure. **7**

OR

10. a) Discuss Thermal gasification with neat sketch. **6**

b) What are the factors affecting Bio-digestion ? Explain any four factors in details. **7**

11. a) Explain vapour dominated geothermal system with neat sketch. **6**

b) Explain total flow concept of geothermal system. Also state that how it differs from other systems. **7**

OR

12. a) Explain principle of MHD power generation. **6**

b) Explain working of MHD closed cycle system with neat sketch. Also explain advantages of closed cycle over open cycle system. **7**

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