$\boxed{\textbf{Set No. 1}}$

IV B.Tech I Semester Regular Examinations, November 2007
NON-CONVENTIONAL SOURCES OF ENERGY
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours   **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) With neat diagram, explain the working of sun-shine recorder.

   (b) Write short notes on solar radiaition data.   [10+6]

2. Describe with neat sketches, the procedure for thermal performance testing of a cylindrical parabolic collector.   [16]

3. (a) With suitable sketches explain the working of a solar cell.

   (b) What are the various materials used for solar cells.   [12+4]

4. Determine the wind mill rotor diameter to operate a centrifugal pump, which will have a discharge of 40,000 litres/day with a total head of 10 m. The pump operates for 10 hours in a day. The rated speed of wind is 6 m/s. The power coefficient is 0.3. Density of air is $1.2 Kg/m^3$. Assume transmission efficiency 95%, Pump efficiency as 35%.   [16]

5. (a) What is biogas? How is it produced?

   (b) Explain in detail about anaerobic digestion and the different phases and the processes involved in it?   [6+10]

6. (a) Write about the concept of interconnecting geo thermal-fossil systems.

   (b) With the help of neat diagram, explain the working of geo thermal-preheat hybrid system.   [6+10]

7. (a) Explain with neat sketches the various methods of tidal power generation. What are the limitations of each method?

   (b) What are the advantages, limitations and operational difficulties encountered in OTEC plants?   [10+6]

8. (a) Why is Carnot cycle not applicable in the estimation of efficiency of thermo-electric generator?

   (b) Explain the principle of working of thermo-electric generator.   [4+12]

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Set No. 2

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NON-CONVENTIONAL SOURCES OF ENERGY
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours
Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Determine the value of Hav over a horizontal surface on August 15, at the latitudea of $18^0 29'$; if a = 0.31, b = 0.43 and ratio of average daily hours of bright sun shine to maximum daily hours of bright sunshine = 0.58.

   (b) Determine the sunset hour angle and daylength at a location latitude of $35^0 N$, on February 14. [10+6]

2. Describe the method of testing of solar collectors using water and air as heat transfer fluid. [16]

3. (a) List out the various solar applications.

   (b) Discuss in detail about any three of the solar applications. [4+12]

4. Determine the wind mill rotor diameter to operate a centrifugal pump, which will have a discharge of 40,000 litres/day with a total head of 10 m. The pump operates for 10 hours in a day. The rated speed of wind is 6 m/s. The power coefficient is 0.3. Density of air is $1.2 Kg/m^3$. Assume transmission efficiency 95%, Pump efficiency as 35%. [16]

5. (a) What are the different methods used to decompose organic matter in the production of biogas. Write about them.

   (b) What are the advantages of anaerobic digestion? Explain. [6+10]

6. (a) What is meant by petro thermal systems.

   (b) With the help of a neat diagram, explain how heat is extracted from hot dry rocks? [6+10]

7. (a) With reference to neat layout diagrams, explain the operation of a closed cycle OTEC plant.

   (b) Find the quantity of water to be pumped to OTEC plant working with surface water at 27 C and with cold water at 8 C at a depth of 600 m from the surface to obtain 1.0 MW of thermal energy. Assume the density of ocean water as 1010 kg/m^3 and the specific heat of water as 4200 J/kg K. [8+8]

8. Describe the operation of a thermionic converter. [16]

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Set No. 3

IV B.Tech I Semester Regular Examinations, November 2007
NON-CONVENTIONAL SOURCES OF ENERGY
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours   **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain the followings:
     i. Solar time
     ii. Solar altitude
     iii. Zenith angle

   (b) Determine the local solar time corresponding to 10.00 am IST on February 8 for a location at 87.5^0 east longitude. [10+6]

2. Calculate the top loss coefficient for a single glass cover with the following details:
   Plate emittance = 0.95
   Plate to cover spacing = 2.54 cm
   Ambient temperature = 25 C
   Wind speed = 3 m/sec
   Back insulation thickness = 5 cm
   Insulation conductivity = 0.045 w/ mk
   Mean plate temperature = 75 C
   Collector tilt = 40^0 [16]

3. (a) What are the various methods of storing solar energy.

   (b) Discuss in detail any two of the solar energy storage methods. [4+12]

4. (a) How do you measure the speed and the direction of a wind? Explain in detail.

   (b) What are the various characteristics of the wind? Discuss them in detail.
   [9+7]

5. What are the applications of biogas? Can it be used as a fuel in IC engines? What are the modifications required in the regular SI and CI engines to adapt biogas as a fuel. Is it economical to use it for IC engines? [16]

6. (a) What are the advantages and disadvantages of geo thermal energy over other energy forms?

   (b) Discuss the applications of geo thermal energy. [6+10]

7. (a) Explain with neat sketches the various methods of tidal power generation. What are the limitations of each method?

   (b) What are the advantages, limitations and operational difficulties encountered in OTEC plants? [10+6]

8. (a) Discuss the direct and indirect energy conversion systems emphasizing on the advantages and limitations of each.

(b) How is the operation of thermoelectric generator different from that of conventional generators? [12+4]

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$$\boxed{\textbf{Set No. 4}}$$

IV B.Tech I Semester Regular Examinations, November 2007
NON-CONVENTIONAL SOURCES OF ENERGY
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours   **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Define solar constant.
   (b) Determine for the following atmospheric conditions, the atmospheric total transmittance for scattering only, when the sun is at zenith.
      Wave length $= 0.5\mu m$
      Total pressure $= 750$ mm of Hg.
      Dust particle concentration at the ground particles $= 800/cm^3$
      Depth of perceptible water $= 20$mm
      Assume monochromatic atmospheric tranmittance
      Considering absorption only which is $= 0.6$. [4+12]

2. Determine the intercept factor and CR for a paraboloidal concentrator and reciever with (r/R) = 0.02 and 0.03, if h = 60 and system is axially symmetric. [16]

3. (a) With a neat sketch, explain the suitability of solar dryer for the products like Tea and Tobacco.
   (b) With a neat sketch, explain the working of solar water heater. [8+8]

4. (a) Prove that the maximum power coefficient (C_p) for a wind mill is 0.593.
   (b) How are the wind mills classified? [12+4]

5. What are different biomass conversion technologies? Write about them in detail. [16]

6. (a) Write about the concept of interconnecting geo thermal-fossil systems.
   (b) With the help of neat diagram, explain the working of geo thermal-preheat hybrid system. [6+10]

7. (a) Explain with a neat sketch the energy extraction techniques from tidal waves.
   (b) The efficiency of power plant working on OTEC system is very less. However, the secondary advantages make it commercially attractive. Discuss. [8+8]

8. Describe briefly the working of a thermoelectric generator. [16]

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