

**IV B.Tech I Semester Supplementary Examinations, February 2008**  
**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 radiation data. [10+6]
2. (a) Define optical efficiency. How optical losses in focusing collectors are minimized?  
(b) Determine the intercept factor for a parabolic cylinder concentrator producing an image in the focal plane with  $h = 60$ , if the receiver is symmetrical with respect to the centre of the focus and the receiver has a width of 0.02 and 0.03 of the width of the concentrator? [8+8]
3. (a) Discuss in detail about the mechanism of salt-gradient solar pond, with the aid of neat sketches.  
(b) Discuss the following
  - i. packed bed storage system,
  - ii. Photo-voltaic cell. [8+8]
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. (a) What are the different wet processes used in bio mass conversion? Explain.  
(b) What are the different dry processes used in bio mass conversion? Explain. [8+8]
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) 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  $1010 \text{ kg/m}^3$  and the specific heat of water as 4200 J/kg K. [8+8]
8. (a) Why is Carnot cycle not applicable in the estimation of efficiency of thermo-electric generator?

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

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1. (a) Determine the value of  $H_{av}$  over a horizontal surface on August 15, at the latitude of  $18^{\circ}29'$ ; 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  $35^{\circ}N$ , 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) 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) What is a wind-mill?  
(b) What are the various classifications of a wind mill? Explain them in detail with neat sketches. [4+12]
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 hydrothermal resources? Explain.  
(b) Write about the vapor dominated system. With the help of a neat diagram explain the working of a vapor-dominated power plant. [6+10]
7. (a) Explain the operation and advantages of single pool modulated tidal system as compared to unmodulated system.  
(b) Discuss on the difficulties and limitations in tapping OTE on a commercial scale. [8+8]
8. Describe the operation of a thermionic converter. [16]

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1. (a) What is zenith angle and azimuth angle of the sun of July 4, at 4:30 pm IST at a location latitude  $38^{\circ}51'$  and longitude  $77^{\circ}$ . Given equation of time  $E=-4.4$  min.  
(b) Calculate the sun's altitude angle and azimuth angle at 7:30 am. Solar time on August 1 for a location at  $40^{\circ}N$  latitude. [8+8]
2. Describe the method of testing of solar collectors using water and air as heat transfer fluid. [16]
3. (a) With neat sketch, explain the suitability of solar dryer for food grains.  
(b) With a neat sketch, explain the working of solar distillation plant. [4+12]
4. (a) What is a wind-mill?  
(b) What are the various classifications of a wind mill? Explain them in detail with neat sketches. [4+12]
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 liquid dominated hydrothermal convective systems? Write about them.  
(b) With the help of a neat diagram, explain the working of a liquid dominated double flash steam system. [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  $27^{\circ}C$  and with cold water at  $8^{\circ}C$  at a depth of 600 m from the surface to obtain 1.0 MW of thermal energy. Assume the density of ocean water as  $1010 \text{ kg/m}^3$  and the specific heat of water as  $4200 \text{ J/kg K}$ . [8+8]
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1. Discuss the estimation of direct and diffused radiation during the following conditions.
  - (a) Days with no clouds
  - (b) Cloudy days [8+8]
2. (a) Write short notes on solar driers.  
(b) Explain the role of solar energy as a heat source in crop drying. [8+8]
3. (a) Discuss in detail about the mechanism of salt-gradient solar pond, with the aid of neat sketches.  
(b) Discuss the following
  - i. packed bed storage system,
  - ii. Photo-voltaic cell. [8+8]
4. (a) What is a wind-mill?  
(b) What are the various classifications of a wind mill? Explain them in detail with neat sketches. [4+12]
5. Explain in detail about the factors which affect the bio-digestion. [16]
6. (a) What are hydrothermal resources? Explain.  
(b) Write about the vapor dominated system. With the help of a neat diagram explain the working of a vapor-dominated power plant. [6+10]
7. (a) Explain the operation and advantages of single pool modulated tidal system as compared to unmodulated system.  
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