

IV B.Tech I Semester Supplementary Examinations, February 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) Calculate the day length on May 1, for a south facing surface located at New Delhi ( $28^{\circ}38'N, 77^{\circ}17'E$ ) and tilted at an angle of  $40^{\circ}$ .  
(b) Determine the atmospheric transmittance for scattering only for  $\lambda = 0.5 \mu m$  and pressure 750 mm Hg.,  $d = 800 Cm^2$  and  $\omega = 20 mm$ , when the sun is at zenith. [8+8]
2. Write short notes on:
  - (a) Selecting absorber coatings
  - (b) Materials for flat plate collectors
  - (c) Evacuated solar collectors [5+5+6]
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) 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) Explain the classification of biomass resources.  
(b) How the biomass conversion takes place? What is the difference between biogas and biomass? [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) Draw a neat layout diagram of a typical OTEC plant showing salient features and explain the principle.  
(b) Discuss the advantages and limitations of wave energy conversion. [12+4]
8. (a) What is thermoelectric generator?  
(b) On what effects does its function depend? Explain the working with a sketch. [6+10]

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1. Explain the followings:
  - (a) Beam and diffus solar radiation
  - (b) The hour angle
  - (c) The Sun's declination
  - (d) The latitude and longitude [6+3+3+4]
2. Describe with neat sketches, the procedure for thermal performance testing of a cylindrical parabolic collector. [16]
3. (a) Explain the working of photo voltaic energy conversion with a neat sketch.  
(b) With a neat sketch explain the process of drying food grains. [8+8]
4. (a) Neglecting losses, determine the maximum power that can be extracted by a wind mill from a steady wind of 5 m/s. Assume a wind mill rotor diameter of 25m, with air density  $1.2\text{Kg}/\text{m}^3$ . Find the pressure decrease across the rotor.  
(b) How do you classify wind mills? Explain about any one type with neat sketches. [8+8]
5. (a) What are the factors to be considered for the selection of site for the biogas plant?  
(b) What are the factors, which affect the size of biogas plant? [8+8]
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 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  $1010\text{ kg}/\text{m}^3$  and the specific heat of water as 4200 J/kg K. [8+8]
8. (a) What is thermoelectric generator?

- (b) On what effects does its function depend? Explain the working with a sketch.  
[6+10]

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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 = 20mm  
 Assume monochromatic atmospheric transmittance  
 Considering absorption only which is = 0.6. [4+12]
  
2. Data for a flat plate collector used for heating are given below:  
 Location and latitude: Coimbatore  $11^{\circ}00'N$   
 Date and time: March 22, 14:30 - 15:30 (LST)  
 Average intensity of solar radiation (annual):  $560W/m^2$   
 Collector tilt:  $26^{\circ}$   
 No. of glass covers :2  
 Heat removal factor for collector: 0.82  
 Transmittance of glass :0.88  
 Absorptance of the plate: 0.93  
 Top loss coefficient for collector:  $7.95W/m^2C$   
 Collector fluid temperature: 25 C  
 Ambient Temperature: 25 C  
 Calculate:  
  - (a) Solar altitude angle
  - (b) Incident angle
  - (c) Collector efficiency [16]
  
3. (a) List out the advantages of photo-voltaic solar energy conversion.  
 (b) How can solar energy can be stored in the form of thermal energy? Explain and discuss in brief. [10+6]
  
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) Briefly explain about solid bio fuels? Also write about their applications?

- (b) Explain the process “Photosynthesis”. What are the conditions, which are necessary for it? [8+8]
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 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]
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2. Describe with neat sketches, the procedure for thermal performance testing of a cylindrical parabolic collector. [16]
  
3. What is a solar pond? How is energy stored in solar pond? Explain its mechanism with a neat diagram. [16]
  
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 is geothermal energy? Explain.  
(b) Give the classification of different geothermal sources in detail. [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. (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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