

IV B.Tech I Semester Regular Examinations, November 2005
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

1. (a) Classify the different solar energy measuring equipments. What is the difference between a pyrheliometer and a pyranometer?
(b) Determine the average value of total radiation on a horizontal surface at a location (latitude $22^{\circ}13'N$, longitude $77^{\circ}13'E$) during the month of March. If constants a and b are given equal to 0.28 and 0.48 respectively and average sunshine hours per day are 10.15. [8+8]
2. (a) What are the main applications of a solar drier?
(b) What are the advantages and disadvantages of focusing type collector over a flat-plate collector? [8+8]
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) List out the difficulties encountered in general in operating large wind power generators.
(b) Discuss in detail with a neat sketch about the working of a wind mill. [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) Explain the closed cycle OTEC system with advantages and disadvantages over the open cycle OTEC plant.
(b) Estimate the amount of electrical energy obtained from an OTEC plant working with surface water at $27^{\circ}C$ and with a temperature difference of $15^{\circ}C$. Assume the density of ocean water as $1010 kg/m^3$, specific heat of water as $4200 J/kg K$, turbine efficiency is 0.75, generator efficiency is 0.96 and diameter of tube is 60 cm, when the velocity of water is limited to 0.2 m/s. [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. Define the followings:
 - (a) Solar azimuth angle
 - (b) angle of incidence
 - (c) solar azimuth angle
 - (d) sunrise, sunset and daylength. [4×4]
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) With suitable sketches explain the working of a solar cell.
 - (b) What are the various materials used for solar cells. [12+4]
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. Explain in detail about the factors which affect the bio-digestion. [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) What is the basic principle of OTEC? Describe the closed cycle OTEC system with its advantages over open cycle system.
 - (b) Find the quantity of water to be pumped to OTEC plant to obtain 1 MWe working with surface water at 27 C and with a temperature difference of 15 C. Assume the density of ocean water as $1010\text{kg}/\text{m}^3$, specific heat of water as 4200 J/kg K, turbine efficiency is 0.75, generator efficiency is 0.96 and diameter of tube is 60 cm. [8+8]
8. Explain Seebeck, Peltier and Thomson effects. [16]

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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. Describe with neat sketches, the procedure for thermal performance testing of a cylindrical parabolic collector. [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) 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. (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) 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) What is the basic principle of OTEC? Describe the closed cycle OTEC system with its advantages over open cycle system.
(b) Find the quantity of water to be pumped to OTEC plant to obtain 1 MWe working with surface water at 27 C and with a temperature difference of 15 C. Assume the density of ocean water as $1010kg/m^3$, specific heat of water as 4200 J/kg K, turbine efficiency is 0.75, generator efficiency is 0.96 and diameter of tube is 60 cm. [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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1. (a) How to estimate the average solar radiation.
(b) Determine the value of H_{av} over a horizontal surface for June 22, at the latitude of $10^{\circ}N$, if $a = 0.3$, $b = 0.51$ and $n/N = 0.55$. [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. Write in brief on the following
(a) Limitations of photo-voltaic energy converters.
(b) Solar energy storage devices.
(c) Solar ponds.
(d) Solar heating. [4+4]
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 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 is geothermal energy? Explain.
(b) Give the classification of different geothermal sources in detail. [6+10]
7. (a) With a schematic diagram, explain briefly the working of open cycle OTEC plant.
(b) With reference to typical examples, explain the nature and magnitude of energy possessed by ocean tides. [8+8]
8. Bring out the advantages of single pool modulated tidal plant compared to unmodulated system. [16]
