

IV B.Tech. II Semester Regular Examinations, April/May -2005
NON-CONVENTIONAL SOURCES OF ENERGY
(Mechanical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the importance of solar radiation geometry.
(b) Determine the solar time and azimuth angle for sunrise on August 10, for a location of $40^{\circ}N$ latitude.
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?
3. (a) With suitable sketches explain the working of a solar cell.
(b) What are the various materials used for solar cells.
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 Kg/m^3 . Find the pressure decrease across the rotor.
(b) How do you classify wind mills? Explain about any one type with neat sketches.
5. (a) Write about different materials used for biogas generation?
(b) What is meant by wet fermentation and dry fermentation? Explain.
6. (a) Give a brief account of different arrangements used in geo thermal-fossil (hybrid) plants?
(b) With the help of neat diagram, explain the working of fossil-super heat hybrid system.
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 $27^{\circ}C$ 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.
8. Give the working principle of Salter's Ducts with a neat diagram.

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1. (a) Determine the altitude and azimuth angle at 3 pm (IST) on June 15, for Mumbai (latitude $18^{\circ} 54'N$, longitude $72^{\circ} 49'E$).
(b) For above location, determine the angle of incidence over a south facing surface with tilt angle of 15° with the horizontal.
(c) Also calculate the hour of the sunrise and the length of the day.
2. Prove for air heaters, transparent cover system, $q_u = F'F''(S - U_L(T_1 - T_a))$.
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.
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.
5. (a) What are the different phases of anaerobic digestion? Explain.
(b) Write about the bio-chemical processes that occur in anaerobic digestion.
6. (a) Give a brief account of different arrangements used in geo thermal-fossil (hybrid) plants?
(b) With the help of neat diagram, explain the working of fossil-super heat hybrid system.
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. Discuss the advantages and limitations of wave energy conversion.

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1. (a) Determine the solar time and declination at Ahamedabad (*longitude* $72^{\circ}40'E$, latitude $23^{\circ}0'N$) corresponding to 14:30 IST on December 15.
(b) Determine the sunset hour angle and daylength for Allahabad (*longitude* $81^{\circ}58'E$, latitude $24^{\circ}25'N$) for the following dates: January 1, March 22, July 15.
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°
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.
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 $1.2Kg/m^3$. Find the pressure decrease across the rotor.
(b) How do you classify wind mills? Explain about any one type with neat sketches.
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?
6. (a) Discuss the prospects of geo thermal energy in context to India.
(b) Explain how the space heating is done using geo thermal energy.
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. Explain the operation and advantages of single pool modulated tidal system as compared to unmodulated system.

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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.
2.
 - (a) Define collection efficiency of a flat plate collector. What are the parameters on which it depends?
 - (b) What are the main measuring instruments used for testing the solar collectors? Describe in brief.
3.
 - (a) List out the various solar applications.
 - (b) Discuss in detail about any three of the solar applications.
4.
 - (a) What is a wind-mill?
 - (b) What are the various classifications of a wind mill? Explain them in detail with neat sketches.
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.
 - (a) What are the advantages and disadvantages of geo thermal energy over other energy forms?
 - (b) Discuss the applications of geo thermal energy.
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. Briefly explain the working principle of Dam-Atoll model for Ocean Wave Energy conversion with a neat a diagram.
