

**IV B.Tech I Semester Regular Examinations, November 2005**  
**NON CONVENTIONAL ENERGY SOURCES**  
**(Electrical & Electronic Engineering)**

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) What are the differences between renewable and conventional energy sources  
(b) List out the consequences of low power factor on electrical appliances. [8+8]
2. Derive the necessary equations for thermal analysis of flat plate collector and useful heat gained by the fluid. [16]
3. (a) Enumerate the advantages and disadvantages of wind power.  
(b) Write short notes on potential wind power in India.  
(c) List few companies manufacturing WEC devices. [6+6+4]
4. (a) Draw a neat layout diagram of a typical OTEC plant showing salient features and explain the principle of operation.  
(b) In a Claude's cycle of OTEC conversion producing 100 KW power, warm water at 27°C. is admitted into flash-evaporator, where a pressure corresponding to saturation temperature of water at 25°C is maintained. Saturated vapor is then sent through a turbine having a polytropic efficiency of 80%. The pressure in the direct contact condenser is maintained at a value corresponding to saturation temperature of water at 15°C by means of deep sea cold water at 13°C calculate.
  - i. Turbine mass flow rate of vapor
  - ii. Mass flow rate of deep sea cold water.
  - iii. Mass flow rate of warm water.
  - iv. Gross cycle efficiency on the basis of energy available from warm surface water.Also explain the reasons of obtaining low value of efficiency. [8+8]
5. With neat sketches explain the working of wave energy conversion machines. [16]
6. (a) Describe the difference between spring tides, neap tides, high tide, and low tide.  
(b) Discuss the possible reasons why energy output in double-effect generation is usually lower than for single-effect generation. [8+8]
7. (a) Explain the advantages and disadvantages of Geothermal energy over the other forms of energy.  
(b) What are the applications of Geothermal energy in the field of Agriculture?

- (c) Explain briefly the possible sources of Geothermal pollution? How these are avoided? [6+5+6]
8. (a) What are the different inputs which produce Biogas? List out the factors affecting bio-digestion.
- (b) Give a neat sketch of Biogas production plant for domestic use for a family of 5-6 persons.
- (c) Explain “Energy Plantation” and state its advantages and disadvantages. [5+5+6]

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1. (a) Bring out the importance of solar energy in comparison to other types of renewable energy resources.  
(b) What are pie charts? Explain their significance in energy audit with a suitable example. [8+8]
2. (a) Define the terms:
  - i. Solar Altitude angle
  - ii. Beam angle
  - iii. Zenith angle
  - iv. Solar azimuth angle(b) With line diagram, explain how power can be generated from photovoltaic cells. [8+8]
3. (a) Explain briefly the formation of wind and the energy potential of it.  
(b) Describe with neat sketches, the working of different kinds of wind energy conversion systems. [8+8]
4. (a) Draw a neat layout diagram of a typical OTEC plant showing salient features and explain the principle of operation.  
(b) In a Claude's cycle of OTEC conversion producing 100 KW power, warm water at 27°C. is admitted into flash-evaporator, where a pressure corresponding to saturation temperature of water at 25°C is maintained. Saturated vapor is then sent through a turbine having a polytropic efficiency of 80%. The pressure in the direct contact condenser is maintained at a value corresponding to saturation temperature of water at 15°C by means of deep sea cold water at 13°C calculate.
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5. Discuss the advantages and limitations of wave energy conversion. [16]

6. (a) Describe the difference between spring tides, neap tides, high tide, and low tide.  
(b) Discuss the possible reasons why energy output in double-effect generation is usually lower than for single-effect generation. [8+8]
7. (a) What are the prospects of Geothermal energy in of Indian context.  
(b) Explain the schematic and thermodynamic cycle of any one type of geothermal power plant. [6+10]
8. (a) What are the different inputs which produce Biogas? List out the factors affecting bio-digestion.  
(b) Give a neat sketch of Biogas production plant for domestic use for a family of 5-6 persons.  
(c) Explain “Energy Plantation” and state its advantages and disadvantages. [5+5+6]

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1. (a) Briefly explain the following
  - i. Energy Planning.
  - ii. Energy Efficiency.(b) Explain what are energy efficient electric motors. How do they differ from conventional motors? [10+6]
2. Calculate the angle made by beam radiation with the normal to a flat collector on December 1 at 9.00AM, solar time for a location at  $28^{\circ}35'$  N. The collection is tilted at an angle of latitude plus  $10^{\circ}$ , with the horizontal and is pointing due south. [16]
3. (a) What control arrangements are used with a wind mill when the speed of wind exceeds the rated speed? Illustrate your answer with neat sketch.  
(b) Explain with neat sketch a suitable windmill for water pumping. [8+8]
4. (a) What is the basic principle of OTEC? Discuss the advantages of the closed cycle system over open cycle system.  
(b) The efficiency of power plant working on OTEC system is very less. However, the secondary advantages make it commercially attractive. Discuss. [8+8]
5. Discuss the advantages and limitations of wave energy conversion. [16]
6. (a) Explain with neat sketches the basic principle of tidal power generation. What are the limitations of each method.  
(b) A tidal project has installed capacity of 2176MW in 64 units each of 34MW rated output. The head at rated output is 5.52m. The embankment is 6.4 km long. Assume 93% efficiency for both turbine and generators. The generation is 5 hours twice a day calculate:
  - i. The quality of water flowing through each turbine.
  - ii. The surface area of reservoir behind the embankment. [8+8]
7. (a) What are the sub classifications of hydrothermal convective system?  
(b) Describe a liquid dominated system or wet steam field.  
(c) A hot water geothermal plant of the total flow type, receives water at  $250^{\circ}\text{C}$ . The pressure at turbine inlet is 10 bar. The plant uses a direct contact type condenser that operates at 0.3 bar. The turbine has a polytropic efficiency of 70%. For a cycle, net output of 10MW. Calculate:

- i. The hot water flow rate,
  - ii. The condenser cooling water flow rate,
  - iii. Cycle efficiency and
  - iv. Plant heat rate. [4+4+8]
8. (a) How bio-gas can be utilized in Spark ignition engine? Explain with neat sketch.
- (b) What is meant by anaerobic digestion? What are the factors which affect biodigestion? Explain briefly. [8+8]

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1. (a) Explain in detail different kinds of renewable energy resources.  
(b) Discuss the availability, prospects and economic feasibility of each.  
(c) Elaborate on the comprehensive approaches to Energy Management. [6+4+6]
2. (a) Write short notes on the following:
  - i. Solar constant
  - ii. Local solar time
  - iii. Surface azimuth angle.(b) Determine the local solar time and declination at a location latitude  $23^{\circ}15'$  N, longitude  $77^{\circ}30'$  E at 12.30 IST on June 19. Equation of time correction is given from standard table to be  $= - (1^{\circ} 01'')$ . [8+8]
3. (a) Describe the main considerations in selecting site for locating wind generators  
(b) Describe in detail the basic components of wind electric system. [6+10]
4. (a) Draw the schematic diagram and explain the Open cycle OTEC system. What are the operational difficulties encountered in OTEC plants?  
(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 1.0MW of energy. Assume the density of ocean water as  $1010 \text{ kg/m}^3$  and the specific heat of water as  $4200 \text{ J/kg K}$ . [10+6]
5. Discuss the various wave energy conversion devices. [16]
6. (a) Explain with neat sketches the energy extraction techniques from tidal waves  
(b) A tidal power development has total installed generation of 7500 MW operating at a maximum head of 8 m. The minimum head at the end of cycle of generation is 2.5 m after 5 hours. Assume two cycles of generation in 24 hr. The generated power decreases linearly from 7500 MW to zero. The turbine and generator have efficiencies of 93% and 97%, respectively. The length of embankment is 20 km. Calculate:
  - i. Quantity of water flowing through the turbines a maximum output in  $\text{m}^3/\text{s}$ .
  - ii. Surface area of reservoir in  $\text{km}^2$ .
  - iii. Wash behind the embankment at maximum reservoir capacity.
  - iv. Energy delivered per year at a load factor of 0.8. [4+3+3+3+3]

7. (a) What are the sub classifications of hydrothermal convective system?  
(b) Describe a liquid dominated system or wet steam field.  
(c) A hot water geothermal plant of the total flow type, receives water at  $250^{\circ}\text{C}$ . The pressure at turbine inlet is 10 bar. The plant uses a direct contact type condenser that operates at 0.3 bar. The turbine has a polytropic efficiency of 70%. For a cycle, net output of 10MW. Calculate:
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