

III B. Tech I Semester Regular Examinations, Dec/Jan – 2022-23
RENEWABLE ENERGY SOURCES
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

UNIT-I

1. a) How do you calculate solar radiation on tilted surfaces? [7M]
b) Calculate the angle made by the beam radiation with the normal to a flat collector on Dec 1, at 9:00 A.M. solar time for a location at 28°35'N. The collector is tilted at an angle of latitude plus 10°, with the horizontal and is pointing due south. [7M]

(OR)

2. a) How solar collectors are classified? What are the main applications of a solar drier? [7M]
b) Explain the working principle of solar pond. [7M]

UNIT-II

3. a) Derive the expression for power developed due to wind. [7M]
b) Explain the working of Wind Energy Conversion System (WECS) with main components. [7M]

(OR)

4. a) Explain Betz model of expanding air stream tube to determine extraction of wind energy by windmill. [7M]
b) Write short notes on applications of wind energy. [7M]

UNIT-III

5. a) Explain the process of production of biogas from biomass. What are the main advantages of anaerobic digestion of biomass? [7M]
b) List the advantages, disadvantages and environmental impacts of Biomass. [7M]

(OR)

6. a) Write note on fixed dome type biogas plant with neat sketch [7M]
b) With a neat sketch explain biomass gasification? [7M]

UNIT-IV

7. a) Explain the basic components of Tidal Power Plants and give their significance. [7M]
b) A tidal power plant of the simple single basin type has a basin area of 30x10⁶m². The tide has a range of 12m. The turbine, however, stops operating when the head on it falls below 3m. Calculate the energy generated in 1 filling (or emptying) process in kWh if the turbine generator efficiency is 0.73. [7M]



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SET - 1

(OR)

8. a) Describe the closed cycle OTEC system with its advantages over open cycle system. [7M]
b) What are the site requirements to construct a Tidal Power Plant? [7M]

UNIT-V

9. a) Explain the binary cycle geothermal power system. [7M]
b) List out the advantages, disadvantages and applications of geothermal energy. [7M]

(OR)

10. a) Explain the working details of MHD accelerator. [7M]
b) Discuss the prospects of geo thermal energy in context to India. [7M]

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UNIT-I

1. a) Explain the terms extraterrestrial radiation and terrestrial radiation w.r.t solarradiation. [7M]
b) Write a short notes on i) Solar constant ii) Beam radiation [7M]
iii) Diffuse radiation

(OR)

2. a) Derive the equation for solar energy balance equation and collector efficiency their advantages and limitations. [7M]
b) Draw the schematic diagram for Solar pond based electric plant along with itsworking. [7M]

UNIT-II

3. a) Describe with a neat sketch the working of a wind energy system with maincomponents? [7M]
b) Find the maximum power output of a turbine if wind speed is 10 m/sec, airdensity as 1.4 Kg/m³ and rotor diameter as 64 m. [7M]

(OR)

4. a) Explain the variation of output of a wind turbine with tip speed ratio of therotor. [7M]
b) Discuss the factors for wind turbine site selection. [7M]

UNIT-III

5. a) What is biomass, bio-fuel , bio energy and biogas? Explain briefly. [7M]
b) Differentiate between fixed dome type and floating drum type biogas plants. [7M]

(OR)

6. a) What are the constituents of biomass materials? Explain proximate and ultimate analysis. [7M]
b) What are the factors affecting the generation of bio gas? [7M]

UNIT-IV

7. a) Classify the Tidal power plants. [7M]
b) Derive an expression for Power generated by a Tidal System. [7M]

(OR)

8. a) Draw the line diagram and explain the working of hybrid OTEC cycle. [7M]
b) Explain the various methods of OTEC power generation. [7M]



UNIT-V

9. a) What are the advantages and disadvantages of geothermal energy over other energy forms? [7M]
b) Explain about dry, wet and Hot water geo thermal systems? [7M]
- (OR)**
10. a) What are the geothermal power plants, explain binary cycle power plant with neat diagram [7M]
b) Explain the principle of MHD power generation? [7M]



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UNIT-I

1. a) List out the steps involved in the calculation of local solar time and day length and give needed formulae. [7M]
- b) Derive the equation for solar energy balance equation and collector efficiency their advantages and limitations. [7M]

(OR)

2. a) Enumerate different types of concentrating collectors and also list out advantages and limitations. [7M]
- b) Explain the working of solar distillation and solar cooker with neat sketch. [7M]

UNIT-II

3. a) Discuss about the performance characteristics of wind turbines and power extracted by wind turbine? [7M]
- b) Write short notes on potential wind power in India and list out few companies manufacturing WEC devices. [7M]

(OR)

4. a) What are the rules for site selection of wind turbine and advantages and disadvantages of wind turbine ? [7M]
- b) What are the advantages and disadvantages of vertical axis wind mills over horizontal type? [7M]

UNIT-III

5. a) What is fermentation, aerobic and anaerobic, hydrolysis explain each. [7M]
- b) What are the biomass resources for the production of bio mass energy? [7M]

(OR)

6. a) What are different biomass conversion technologies? Write about them in detail [7M]
- b) Explain the various factors affecting the generation of biogas and biogas programs in india. [7M]

UNIT-IV

7. a) Explain the working of single basin tidal power plant. [7M]
- b) List the advantages and limitations of Tidal power generation. [7M]

(OR)

8. a) Describe the principle of OTEC system with neat sketch. [7M]
- b) What are the site requirements to construct a Tidal Power Plant? [7M]



UNIT-V

9. a) Explain the liquid dominated systems of geothermal energy ? [7M]
b) Discuss about the sources of Geothermal energy and their potential in India ? [7M]

(OR)

10. a) Write a short notes on carbon credits and Environmental and social impacts in geothermal energy. [7M]
b) Explain important factors to be considered for selecting materials for MHD generator [7M]



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UNIT-I

1. a) Explain the following terms used in Solar radiation analysis: [7M]
i) Hour angle ii) Solar azimuth angle iii) Declination angle
 - b) Calculate the angle made by the beam radiation with normal to a flat plate collector, pointing due south located New Delhi (28°38'N, 77°17'E) at 9:00 hr, solar time on December 1. The collector is tilted at an angle of 360 with the horizontal. [7M]
- (OR)**
2. a) Derive an expression for efficiency and power produce by PV cell. [7M]
Explain thevarious factors that affect the performance of cell.
 - b) Describe the layout and working of a continuous solar cooling system. [7M]

UNIT-II

3. a) Explain the working of real diagram of wind electric generating system. [7M]
 - b) Explain the advantages and limitations of wind energy conversion systems. [7M]
- (OR)**
4. a) Derive the expression for maximum power generation for the wind mill. [7M]
 - b) Discuss the aerodynamic considerations in wind mill design in detail. [7M]

UNIT-III

5. a) Discuss about the operation of floating drum type bio digester with a neat sketch? [7M]
 - b) Classify biogas plants and discuss their salient features. [7M]
- (OR)**
6. a) What are the methods used for biomass conversion to energy? Explain briefly. [7M]
 - b) Write a short notes on Environmental impact on biogas generation and biomass programs in India. [7M]

UNIT-IV

7. a) Discuss about various types of turbines used for tidal energy conversion. [7M]
 - b) Sketch and explain single basin type tidal power plant operation. [7M]
- (OR)**
8. a) Discuss the technology Ocean Thermal Energy Conversion (OTEC). What are possible environmental effects as a result of an operation of an OTEC plant? [7M]



- b) Draw the line diagram and explain the working of hybrid OTEC cycle. [7M]

UNIT-V

9. a) Explain the operation of vapour dominated geothermal energy system with a neat schematic diagram. [7M]
b) What are the advantages and disadvantages of geothermal energy? [7M]
- (OR)**
10. a) What are the difficulties in large scale utilization of geothermal energy? What development could increase the role of geothermal energy in future? [7M]
b) Explain the principle and working of MHD accelerator. [7M]

