

Code No: RT41021

R13

Set No. 1

IV B.Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018

RENEWABLE ENERGY SOURCES AND SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Question paper consists of Part-A and Part-B

Answer ALL sub questions from Part-A

Answer any THREE questions from Part-B

PART-A (22 Marks)

1. a) Explain about extra terrestrial radiation in brief. [3]
- b) Distinguish between flat and concentrating collectors. [4]
- c) Draw the I-V characteristic of a solar cell. [3]
- d) What are the advantages of wind energy conversion system? [4]
- e) What are limitations of micro hydro-electric power stations? [4]
- f) What are the different types of fuel cells? [4]

PART-B (3x16 = 48 Marks)

2. a) Explain briefly about the different parameters that describes the amount of solar energy reaching the earth surface? [8]
- b) Calculate the angle of incidence of beam radiation on a surface located at New Delhi, at 1:30 (Solar time) on 20 March, if the surface is tilted 45° from the horizontal and pointed 30° west of South. [8]
3. a) By defining various parameters, explain transmissivity based on reflection and refraction? [8]
- b) Describe various types of solar air heaters with neat schematic diagrams in brief. [8]
4. a) What are the different considerations of PV modules to be connected in series and parallel for deciding PV system design? [8]
- b) Explain the necessity of using maximum power point tracking with the help of P-V and I-V curves and describe on which factors efficiency of PV cell depends? [8]
5. a) Explain how the wind energy systems (WECS) are classified? Discuss in brief? [8]
- b) Explain different schematics of wind power generation using induction generator as an option? [8]
6. a) Describe different types hydro turbines that can work with larger water flow? [8]
- b) Explain various advantages and disadvantages of tidal energy generation system? [8]
7. a) What are the reactions phases that take place in a digester, explain them in detail? [8]
- b) Describe working principle of fuel cell with neat sketch and draw the performance characteristics of hydrogen-oxygen fuel cell? [8]

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Answer ALL sub questions from Part-A

Answer any THREE questions from Part-B

PART-A (22 Marks)

1. a) Explain terrestrial solar radiation assuming air mass zero? [3]
- b) What is the principle of working of solar pond? [4]
- c) Draw the typical power-voltage characteristics of a solar cell under varying input conditions. [4]
- d) Define tip speed ratio in the wind energy conversion system? [3]
- e) What are the advantages of small hydro-electric power stations? [4]
- f) What are the various prospects of geothermal energy? [4]

PART-B (3x16 = 48 Marks)

2. a) What is declination angle? Explain seasonal variation in the declination angle? [8]
- b) Calculate the number of daylight hours (sunshine hours) in Delhi on 20th June and azimuth angle New Delhi at 2.30 pm on 20th February? [8]
3. a) Express heat lost from collector in terms of overall loss coefficient? Explain bottom loss coefficient in detail? [10]
- b) Explain the advantages of solar water heater with respect to conventional water heaters. [6]
4. a) Explain balance of system components in the PV system application? [8]
- b) How the maximum power is tracked from solar pv systems explain any method? [8]
5. a) Show that ideal maximum power coefficient is 0.59 for a horizontal axis windmill? [8]
- b) Explain different types and characteristics of windmill rotors with relevant diagrams? [8]
6. a) Describe principle of flow rate Q measurement and explain any one method. [8]
- b) Describe how wave energy is extracted from the surface wave of deep water? [8]
7. a) Explain in detail about anaerobic digestion and the different phases involved in this process? [8]
- b) Explain working principle of fuel cell and describe energy storage system using fuel cells? [8]

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PART-A (22 Marks)

1. a) Explain extraterrestrial solar radiation assuming air mass zero? [3]
- b) What is principle of working of solar air heater? [4]
- c) Draw the equivalent circuit of solar cell, how do you obtain its simplified circuit? [4]
- d) What is meant by cut-in speed in wind energy conversion system? [3]
- e) What are the economic aspects of small hydro-electric power stations? [4]
- f) Explain the characteristics of hydrogen-oxygen fuel cell? [4]

PART-B (3x16 = 48 Marks)

2. a) Describe in brief different empirical relations which predict the availability of solar radiation? [8]
- b) Calculate the hour angle at sunrise and sunset on plane surface tilted at an angle of 20° , given that $\phi = 28^\circ N$, $\delta = -21^\circ$ and $\gamma = 48^\circ$ [4]
- c) Calculate the angle made by the beam radiation with normal to the flat plate collector on February 20, at 12.00 h (local apparent time), the collector is located at New Delhi ($28^\circ 35' N$, 77° , $12^\circ E$). [4]
3. a) Deduce the expression for heat gain rate in a collector and hence obtain collector heat removal factor? [8]
- b) Draw the schematic and give functional description of solar pond in detail? [8]
4. a) Explain the effect of radiation intensity and temperature on short circuit current, open circuit voltage and power generated in PV cell? [8]
- b) Draw the electrical layout of a typical solar PV system, state the functions of essential equipment? [8]
5. a) Explain principles of wind energy conversion and describe factors affecting wind speed? [8]
- b) Describe salient features of horizontal axis and vertical axis wind turbines? [8]
6. a) Describe principle of working of reaction turbine? Briefly describe about different types reaction turbines? [8]
- b) Explain about small Hydro electric scheme with a neat layout diagram. [8]
7. a) Explain working principle of fuel cell and describe energy storage system using fuel cells? [8]
- b) Describe principle of geo-thermal energy? What are the limitations of harnessing geo-thermal energy? [8]

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Question paper consists of Part-A and Part-B

Answer ALL sub questions from Part-A

Answer any THREE questions from Part-B

PART-A (22 Marks)

1. a) What is meant by local apparent time for calculating hour angle? [3]
- b) What are the various types and arrangements of solar air heaters? [4]
- c) Explain the factors that are considered for pv system design. [4]
- d) What is meant by cut-out speed is in wind energy conversion system? [3]
- e) What are the disadvantages of small hydro-electric power stations? [4]
- f) Why does water in geothermal aquifer remain in the liquid state? [4]

PART-B (3x16 = 48 Marks)

2. a) What is declination angle? Find the value of this angle on March 21st and December 31st? [8]
- b) Derive expression for the daily extraterrestrial radiation which falls on the surface having a slope β and facing south? [8]
3. a) Express heat lost from collector in terms of overall loss coefficient? Explain top loss coefficients in detail? [8]
- b) Draw the schematic and give functional description of cylindrical parabolic collector? [8]
4. a) Derive an expression for efficiency and power produced by PV cell? Describe effect of cell temperature on cell efficiency? [8]
- b) Explain hill-climbing method of maximum power extraction in PV system in detail? [8]
5. a) List and explain the different types of turbines considered in wind energy system. [8]
- b) Explain different parameters which are required in the extraction of maximum power under varying wind speed conditions? [8]
6. a) What is a tidal power plant and what factors are considered in order to install it? [8]
- b) Describe the wave power basic theory and obtain equation for its kinetic energy? [8]
7. a) What are the different factors which affect the size of the bio gas plants? [8]
- b) Describe various advantages and disadvantages of geothermal energy forms? [8]