

IV B. Tech I Semester Regular Examinations, November – 2022**RENEWABLE ENERGY SYSTEMS****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 75**

*Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks*

UNIT-I

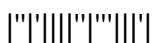
- 1 a) Explain how to estimate solar radiation on Earth surface. [7]
b) Describe renewable energy scenario in Andhra Pradesh. [8]
(OR)
- 2 a) Explain the non-conventional energy resources available in Indian energy scenario. [7]
b) i). Write about Extra-terrestrial radiation and terrestrial radiation. [8]
ii). Calculate the angle made by the beam radiation with normal to a flat plate collector, pointing due south located New Delhi ($28^{\circ} 38'N$, $77^{\circ} 17'E$) at 9:00 hr, solar time on December 1. The collector is tilted at an angle of 360 with the horizontal.

UNIT-II

- 3 a) Draw V-I characteristics of a solar cell and explain briefly. [7]
b) Describe the Hill Climbing MPPT Technique using a neat algorithm and explain its advantages. [8]
(OR)
- 4 a) Draw and describe the analogous circuit of a practical solar PV cell. [7]
b) Explain the outcome and different considerations that need to be taken care while connecting PV cells in series and parallel. [8]

UNIT-III

- 5 a) What are the advantages and disadvantages of Wind Energy Conversion? How wind mills are classified? What are the basic components of wind mills? [7]
b) State different types of speed control strategies for wind turbine. [8]
(OR)
- 6 a) Distinguish between synchronous generator and Induction Generator. [7]
b) Using the schematic diagram, explain the working of Doubly-Fed Induction Generation and its control for wind energy conversion system. [8]



UNIT-IV

- 7 a) Explain the potential and kinetic energies associated with wave energy. [7]
b) Explain with neat sketches the various methods of tidal power generation. [8]

(OR)

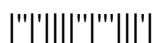
- 8 a) What are the advantages and limitations of small-scale hydro-electric power generation [7]
b) Write a note on, tidal energy conversion. [8]

UNIT-V

- 9 a) Discuss economic aspects of biogas. [7]
b) Explain the energy extraction technique from hot dry rock. [8]

(OR)

- 10 a) List out the differences between anaerobic and aerobic digestion systems. [7]
b) Explain the potential of geothermal sources in India. [8]



Code No: R1941023

R19

Set No. 2

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UNIT-I

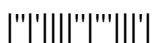
- 1 a) What is the present status of various modes of renewable power generations in India? Explain. [7]
b) What are the reasons for variation in solar radiation reaching the earth than received at the outside of the atmosphere? [8]
(OR)
- 2 a) Define and explain the following angles as related to solar geometry: [7]
(i) Surface azimuth angle (ii) Declination angle (iii) Latitude angle
iv) inclination angle and iv) angle of incidence.
b) What is a flat plate collector? Explain its operation in detail with neat diagrams. [8]

UNIT-II

- 3 a) Explain the V-I characteristics for a PV cell. [7]
b) Describe the configuration of the PV system and emphasize the importance of the converter circuit and MPPT block in it. [8]
(OR)
- 4 a) Explain from solar photovoltaic cells to a module and from module to Arrays? [7]
b) Explain the current – voltage characteristics of a solar cell and define Fill Factor and give its significance. [8]

UNIT-III

- 5 a) List out the differences between horizontal and vertical axis wind mills. [7]
b) The following data relate to a wind turbine: [8]
Velocity of wind at 15°C = 10 m/s
Turbine diameter = 10m
Operating speed of the machine = 35 rpm at maximum efficiency of 40% .Calculate:
i) total power density in the wind stream
ii) The maximum power density
iii) The actual power density
iv) Power output of the turbine



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(OR)

- 6 a) Explain the advantages and limitations of wind energy conversion systems. [7]
b) Discuss the performance characteristics of wind. [8]

UNIT-IV

- 7 a) What is small hydro power? How is it classified? Obtain an expression for the power that can be generated from a small hydro power station. [7]
b) What are the advantages and limitations of wave energy conversion? [8]

(OR)

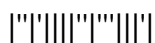
- 8 a) Enumerate the difficulties in tidal power developments? [7]
b) Discuss the propeller type of turbine used for hydroelectric projects with diagram. [8]

UNIT-V

- 9 a) Identify the applications of biomass energy along with its impact on environment. [7]
b) What is the geothermal energy? Explain its extraction process. [8]

(OR)

- 10 a) What is the present state of development in the fuel cell technology? [7]
b) With line diagram, explain the heat extraction from hot dry rocks. [8]



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UNIT-I

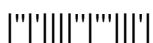
- 1 a) Describe the energy scenario in India. What are the various non-conventional energy resources relevant to India? [7]
b) i. What is solar constant? What is the expression for solar constant? [8]
ii. Calculate the sunset hour angle and day length at location latitude of 35°N, on Feb 14.
- (OR)
- 2 a) What are energy resources available in India? Explain [7]
b) What are the different instruments used for the measurement of solar radiation? Explain in detail. [8]

UNIT-II

- 3 a) Define the following parameters for solar cell: [7]
i) Short-circuit current ii) Open-circuit voltage iii) Fill Factor
iv) Efficiency of solar cell
State the relationship between these factors.
b) Explain maximum power point tracking procedure for a photovoltaic System. [8]
- (OR)
- 4 a) Discuss the effect of temperature and insolation on the characteristics of solar cell. Draw the P-V characteristics of Solar cell under varying temperature and irradiation level. [7]
b) Show the components of PV system with energy storage device. Also, draw energy flow diagram for this system. Write the broad steps of design for this configuration. [8]

UNIT-III

- 5 a) Derive that the maximum power that can be extracted from a horizontal axis wind turbine is only 59.5%. [7]



- b) State the following terms with expressions: [8]
i). Power contained in Wind ii). Power coefficient iii). Torque acting on turbine iv). Torque-Speed ratio v). Wind turbine efficiency

(OR)

- 6 a) Describe the different types of wind turbines in brief. [7]
b) A HAWT having the rotor diameter as 80m is rotating at 40 rpm. The wind speed is 20 m/s at 1 atm and 27°C. Calculate the torque produced at the shaft for maximum output of the turbine. [8]

UNIT-IV

- 7 a) Write down the major components of a tidal power plant and describe the basic principle of tidal energy production. [7]
b) Explain the design and selection of different types of turbines used for small hydro plants. [8]

(OR)

- 8 a) Explain the methods for the utilization of tidal energy in single basin Arrangement? [7]
b) Explain wave energy conversion technique in detail with neat layout diagrams. [8]

UNIT-V

- 9 a) Explain the process of anaerobic digestion of biomass into biogas. Draw the schematic diagram of a biodigester. [7]
b) What are the possible sources of geothermal pollution? How to avoid them? [8]

(OR)

- 10 a) What are different technologies used in biomass to energy conversion [7]
b) Describe the fuel cell V-I characteristics using a neat sketch. [8]



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UNIT-I

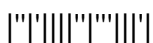
- 1 a) Write short notes on the advantages and disadvantages of any three types of non-conventional energy sources. [7]
b) Define Solar Constant. Calculate the number of daylight hours in Srinagar for 22nd June. The latitude of Srinagar as 34°05'N. [8]
(OR)
- 2 a) Elaborate the availability and limitations of conventional sources of energy and its impact on human life. What are the alternate solutions? [7]
b) Illustrate the functions of various components in flat plate collectors. [8]

UNIT-II

- 3 a) Explain the importance of Fill Factor (FF) in a solar cell and derive its expression. Also, discuss in details the efficiency of solar cell. [7]
b) For various input quantities of irradiance and temperature, draw and describe the P-V and I-V characteristics of the PV system. [8]
(OR)
- 4 a) Write a short note on sizing of PV system and its storage. [7]
b) List different methods for determining the solar PV system's Maximum Power Point and discuss the P&O method. [8]

UNIT-III

- 5 a) Derive the expression for power extracted from the wind. [7]
b) With neat diagram explain the working principle of horizontal axis wind turbine. [8]
(OR)
- 6 a) Explain how variation in tower height varies the different parameters in wind energy system. [7]



- b) A horizontal shaft, propeller type wind-turbine is located in area having speed of wind 10 m/s at 1 atm and 15°C. Calculate the following: [8]
- Air density ρ , kg/m³
 - Total power density in wind stream, W/m²
 - Maximum possible obtainable power density, W/m²
 - Total power from the wind-turbine of 120 m dia.

UNIT-IV

- 7 a) Explain the design and selection of different types of turbines used for small hydro plants. [7]
- b) Explain the principle of operation of a tidal power plant. How it is classified? Draw the layout of a double basin tidal power plant and label all the components. [8]
- (OR)
- 8 a) List the benefits and limitations of small-scale hydroelectric power system. [7]
- b) Obtain an expression for the power that a tidal power system produces. [8]

UNIT-V

- 9 a) Explain how a hydrogen fuel cell operates using a line diagram. [7]
- b) What is geothermal energy? How can geothermal energy be utilized for electric power generation? [8]
- (OR)
- 10 a) Explain the geo thermal resources. How the electric power can be developed from geothermal resources? [7]
- b) Explain about various fuel cells and its applications. [8]

