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Question Paper Code : 41062

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

ORO 551 – RENEWABLE ENERGY SOURCES

(Common to : Aeronautical Engineering/Aerospace Engineering/Agriculture Engineering/Automobile Engineering/Biomedical Engineering/Civil Engineering/ Electronics and Communication Engineering/Electronics and Telecommunication Engineering/Environmental Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/ Material Science and Engineering/Mechanical Engineering/Medical Electronics/ Petrochemical Engineering/Production Engineering/Bio Technology/Chemical Engineering/Chemical and Electrochemical Engineering/Fashion Technology/Food Technology/Handloom and Textile Technology/Petrochemical Technology/Petroleum Engineering/Pharmaceutical Technology/Textile Chemistry/Textile Technology)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the classification of methods for solar energy utilization.

2. What is beam, diffuse and global radiation?

3. List few applications of low temperature water heaters in domestic and industrial use.

4. Define the terms: Aperture (W), area concentration ratio (C), intercept factor (Y); and the acceptance angle $(2\theta_a)$ in concentrating collectors.

5. Briefly explain the working of solar photovoltaic cell.

6. How does a solar pond work?

7. What are the most favourable sites for installing the wind turbines?

8. What is Biomass Gasifier? What are their uses?

9. What is wave energy? How power available in waves is calculated?

10. What are the advantages and disadvantages of Tidal Power?

PART B — (5 × 13 = 65 marks)

11. (a) What is solar Thermal Radiation? Explain the Spectral distribution of extraterrestrial solar radiation with the help of graph. What is Plank's Law used for finding spectral emissive power and Stefan Boltzmann Law used for finding Emissive power of a black surface? What is Local Apparent Time (LAT) and Indian Standard Time (IST)? Determine the Local Apparent Time (LAT) corresponding to 1430 h (IST) at Mumbai (19°07' N, 72°51' E) on July 1. In India, Standard Time is based on 82°30' E. Take time correction as –3.5 minutes.

Or

(b) With the help of neat sketch, explain and give equations for declination angle, hour angle, zenith angle, solar azimuth angle and angle of incidence. Determine the monthly average value of daily global radiation on a horizontal surface at a location (latitude 22° 13' N, Longitude 73° 13' E) during the month of March. If constants a and b are given equal to 0.28 and 0.48 respectively and average sunshine hours per day is 10.15.

12. (a) Explain in detail, effect of various parameters on the Performance of a Flat Plate Collector.

Or

(b) With the help of neat sketch explain the construction and working of central receiver collector. Where they are used? What are its advantages?

13. (a) What is sensible and Latent heat storage? What are its advantages and disadvantages? Which different liquids and solids are used for sensible and Latent thermal storage? What are their important properties?

Or

(b) Draw the current-voltage and power-voltage characteristics of a solar cell. What is fill-factor? Elaborate in detail the battery for solar applications. Compare working of DC to DC and DC to AC, converters. What is MPPT? What are the different MPPT algorithms?

14. (a) What is the composition and Properties of Biogas? What are the differences between a fixed dome digester and floating dome digester? What modifications are required in an SI Engine to run it on biogas? How biogas affects the emission of SI engine?

Or

(b) Derive an expression for energy available in wind. Using Betz model of a wind turbine, derive the expression for power extracted from wind, What is the maximum power that can be extracted and under what condition? Derive the expression for maximum axial thrust experienced by a wind turbine and also find the condition for such operation.

15. (a) What is OTEC system? Explain with the help of neat sketches working principle of Closed cycle and open cycle OTEC system, Describe the advantages of closed system over open system. How the site for OTEC plant is selected.

Or

(b) Explain the applications, and advantage and disadvantages of Geothermal Energy.

PART C — (1 × 15 = 15 marks)

16. (a) Calculate Sunrise and Sunset Solar (LAT) as well as (IST) time, and Day-length at Pune (18.53° N, 73.85° E) on 15th October. Estimate monthly-mean-hourly Direct, Diffuse and Global Radiation at 10, 12, and 14, (LAT) hours at Pune in the month of October on Horizontal surface taking the Constants A = 1136 W/m², B = 0.155 and C = 0.113 for these calculations.

Or

(b) Estimate monthly-mean-daily Total Radiation falling on a FPC facing South with a slope of 20° with horizontal surface at Pune. (18.53° N, 73.85' E) in October at 2.00 pm taking surrounding reflectivity of 0.2. Take constants $a = 0.31$ and $b = 0.43$ for Pune to estimate monthly-mean-daily Global and Diffuse Radiation. Assume average sunshine hours as 9 hrs.

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