Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (R, S), NOVEMBER 2024

POWER SYSTEMS

(2021 Scheme)

Course Code: 21PS104-A

Course Name: Green Energy Systems

Max. Marks: 60 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Illustrate the working principle of a solar concentrator.
2. Explain the physics involved behind photovoltaic generation using a neat diagram.
3. Explain the various considerations for the selection of site for a wind generator.
4. State the advantages and limitations of hybrid PV-wind power generation.
5. Explain any one method for the forecasting of ocean thermal energy.
6. Elucidate how ethanol can be produced from biomass.
7. Give the classification of geothermal resources.
8. Explain the process of extraction of biodiesel from algae.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. From first principles, derive the expression for the instantaneous collector efficiency of a liquid flat plate collector. (6)

OR

10. Determine the angle of incidence in Mumbai at solar noon on 1st November on the horizontal plane. Assume that the latitude is 19.12^0. (6)

MODULE II

11. From fundamentals, obtain the two-diode model of a solar cell. (6)

OR

12. Design a solar photovoltaic system wherein the load consists of a CFL, TV, fan, refrigerator and computer. The system should allow the use of loads in the non-sunshine hours with two days' autonomy. The operating hours and the power rating of these loads are as follows: (6)

CFL (2 Nos.), 9 W, 8 h/day
Fan (1 No.), 60 W, 6 h/day
TV (1 No.), 150 W, 3 h/day
Fridge (1 No.), 150 W, 10 h/day
Computer (1 No.), 250 W, 4 h/day
Consider that PV module of 75 Wp is available with voltage and current at maximum power point of 15 V and 5 A, respectively. Assume the efficiencies of inverter, battery, and charge controller circuit as 90%, 85%, and 92%, respectively. Assume the depth of discharge of 12 V, 100 Ah batteries as 70%.

MODULE III

13. Prove that the maximum wind turbine output can be achieved when $V_d = 1/3\ V_u$, where V_d and V_u are the down-stream and up-stream wind velocity, respectively. (6)

OR

14. Explain any three types of rotors used for wind power generation with neat diagram. (6)

MODULE IV

15. Justify the need for storage systems in wind-PV hybrid systems. (6)

OR

16. With the help of a block diagram. explain the components and features of hybrid PV-wind power generation system. (6)

MODULE V

17. Describe the working principle of an closed cycle OTEC system with the aid of a neat diagram. (6)

OR

18. Illustrate and explain the working of a KVIC biogas plant. (6)

MODULE VI

19. With a neat diagram, describe vapour dominated geothermal power plants. (6)

OR

20. Describe mini hydropower systems with the help of a neat schematic diagram. (6)

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