Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 71132

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Mechanical Engineering

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/Medical Electronics/Petrochemical Engineering/Production Engineering/Safety and Fire 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. Write a note on solar irradiance.

2. Define solar constant.

3. What is the working principle of a solar flat plate collector?

4. Write any two advantages and two disadvantages of concentrating collector system.

5. What is thermal stratification?

6. What is the principle of solar distillation?

7. Define cut-in speed and cut-out speed.

8. What is tip speed ratio? What is its significance?

9. What is the principle of conversion of geothermal energy into electric power?

10. What is the need for direct energy conversion?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Derive the Planck's distribution function in terms of energy density of radiation per unit frequency interval. (7)

      (ii) Write a note on extraterrestrial and terrestrial solar radiation. (6)

Or

(b) (i) Discuss the instruments used for measuring the solar radiation and sun shine. (7)

      (ii) Write a note on the merits and demerits of solar power. (6)

12. (a) (i) Derive and use Hottel Whillier Bliss equation to measure the performance of a solar collector. (7)

      (ii) Distinguish between concentrating and non-concentrating collectors. (6)

Or

(b) (i) Discuss the methods to increase the efficiency of a solar collector. (7)

      (ii) Discuss the advantages of a dual axis tracking system. (6)

13. (a) (i) Use the Shockley Diode equation to arrive at the IV characteristics of a solar cell. (10)

      (ii) What is the effect of temperature on PV cell characteristics? (3)

Or

(b) (i) Distinguish between latent heat and sensible heat storage. (5)

      (ii) Draw a solar pond and explain its working with a neat labeled diagram. (5)

      (iii) Write a note on Shockley Quiesser limit. (3)

14. (a) (i) What do you understand by aerobic and anaerobic digestion in biogas generation? (7)

      (ii) Distinguish between horizontal and vertical axis wind mills. (6)

Or

(b) (i) Explain the combustion characteristics of biogas. (7)

      (ii) Write a note on environmental issues due to wind energy harvesting. (6)

15. (a) (i) Discuss the working of a single basin tidal power plant.   (7)

 (ii) Distinguish between open and closed OTEC cycles.   (6)

Or

 (b) (i) Discuss the working of a wave energy conversion system.   (7)

 (ii) Distinguish between tidal and wave energy systems.   (6)

PART C — (1 × 15 = 15 marks)

16. (a) Derive and prove the Betz limit.

Or

 (b) Discuss the differences with diagrams.

 (i) Drag and lift type blades

 (ii) Imaging and non-imaging concentrators

 (iii) Direct and indirect band gap semiconductors