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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
MECHANICAL ENGINEERING

(2020 SCHEME)

Course Code : 20MET303

Course Name: Thermal Engineering

Duration: 3 Hours

Max. Marks : 100

Use of Steam tables. Refrigeration tables, Charts and Psychrometric charts are permitted.

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain Rankine cycle with help of Temperature Entropy diagram.
2. List the methods adopted for improving the efficiency of Rankine cycle.
3. What is governing of steam turbines?
4. Define degree of reaction of steam turbine
5. Write short notes on (i) indicated thermal efficiency and (ii) volumetric efficiency
6. What is the significance of Morse test?
7. What do you mean by Cetane number?
8. Explain the significance of equivalence ratio in combustion.
9. Write short notes on (i) wet compression and (ii) dry compression in vapour compression cycles.
10. Briefly describe (i) relative humidity, (ii) dew point temperature and (iii) wet bulb temperature.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Dry saturated steam at 10 bar expanded isentropically in a nozzle to 0.1 bar. Find the dryness fraction of the steam at exit. Also find the velocity of steam at exit . (8)
    b) Explain with a neat diagram the working of a Binary vapour cycle. (6)

OR

12. a) A simple Rankine cycle works between pressures 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency and work ratio (10)
    b) Differentiate between water tube boiler and fire tube boiler (4)

MODULE II

13. a) What is the significance for compounding of steam turbines? Describe different types of compounding of steam turbines. (12)

b) What is reheat factor? (2)

OR

14. a) In a single stage simple impulse turbine, the steam flows at a rate of 5 kg/s. It has a rotor of 1.2 m diameter running at 3000 rpm. Nozzle angle is 18°, blade speed ratio is 0.4, velocity coefficient is 0.9, outlet angle of blade is 3° less than inlet angle. Determine blade angles and power developed. (8)

b) Derive the condition for maximum efficiency of a reaction turbine. (6)

MODULE III

15. a) With neat sketch explain the working of the Wankel engine. Discuss its merits and demerits over conventional piston engine (12)

b) What is supercharging? (2)

OR

16. a) In an air standard Otto cycle, the compression ratio is 7 and the compression begins at 1 bar and 313K. The heat added is 2510kJ/kg.
Find
(i) maximum temperature and pressure of the cycle (8)
(ii) work done per kg of air
(iii) cycle efficiency and
(iv) mean effective pressure.

b) Explain the procedure for the heat balance test and its significance. (6)

MODULE IV

17. a) With the help of pressure crank angle diagram explain the process of combustion in SI engine (10)

b) How Exhaust gas recirculation in engine controls the emissions in IC engines? (4)

OR

18. a) What are the different types of combustion chambers used in SI engines ? Explain with a neat figure. (8)

b) Discuss detonation in SI engines cause and its effects and engine variables influencing the same (6)

MODULE V

19. a) A refrigerator uses refrigerant-134a as the working fluid and operates on an ideal vapor-compression refrigeration cycle between 0.14 and 0.8 MPa. If the mass flow rate of the refrigerant is 0.05 kg/s, determine (a) the rate of heat removal from the refrigerated space and the power input to the compressor, (b) the rate of heat rejection to the environment, and (c) the COP of the refrigerator. (8)

b) Compare Carnot refrigeration cycle with vapour compression cycle. (6)

OR

20. a) With neat diagrams, explain the working of Summer and Winter Air Conditioning systems. (8)

b) Derive an expression for COP of a Bell-Coleman cycle (6)

****