

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022**MECHANICAL ENGINEERING****(2020 SCHEME)****Course Code : 20MET303****Course Name: Thermal Engineering****Max. Marks : 100****Duration: 3 Hours**

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain the methods of improving the thermal efficiency of Rankine cycle.
2. Derive the equation for exit velocity of steam for a Nozzle.
3. Draw the combined velocity triangle for moving blade of an impulse steam turbine, clearly denote all the components.
4. Define the terms (i) Blade Efficiency, (ii) Nozzle Efficiency and (iii) Stage Efficiency
5. With a neat diagram explain the Super Charging process in I.C. engines.
6. Explain (i) Volumetric Efficiency and (ii) Mechanical Efficiency
7. How EGR reduces NO_x emission?
8. Explain the Cetane rating of fuel.
9. Define One Tonne of Refrigeration.
10. Expand the acronyms (i) DBT, (ii) WBT and (iii) DPT

PART B

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

MODULE I

11. a) In a Rankine cycle the steam at inlet to turbine is saturated at a (10) pressure of 30bar and exhaust pressure is 0.1bar. Determine
 - (i) The pump work
 - (ii) The turbine work
 - (iii) The Rankine efficiency
 - (iv) The condenser heat flow
 - (v) The dryness fraction at the end of expansion.Take a flow rate of 10kg/sec.
- b) Draw the schematic of reheat vapour cycle. (4)

OR

12. a) With the help of neat sketch explain the working of a Cochran Boiler. (7)
b) Explain the Metastable flow/ Saturated flow in a nozzle with h-S diagram (7)

MODULE II

13. a) A Steam jet enters the row of blades with a velocity of 375 m/s at an angle of 20° with the direction of motion of moving blades. If the blade speed is 165m/s, find the suitable inlet and outlet blade angles assuming that there is no thrust on the blades. The velocity of steam passing over the blades is reduced by 15%. Also determine power developed by the turbine per kg of steam flowing over the blades per second. (8)
b) With necessary diagrams, explain the Pressure-Velocity compounding in a steam turbine (6)

OR

14. a) List the method of Nozzle Governing (2)
b) With an h-s diagram, explain the Reheat Factor for a 3-stage turbine. (12)
List the parameters influencing the value of Reheat Factor.

MODULE III

15. a) Derive air standard efficiency of a Diesel Cycle. (6)
b) The compression ratio of an ideal air standard Diesel cycle is 15. The heat transfer is 1465 kJ/kg of air. Find the pressure and temperature at the end of each process and determine the cycle efficiency. What is mean effective pressure of the cycle, if the inlet conditions are 300 K and 1 bar? (8)
Take C_p for air = 1.005 kJ/kg K and C_v for air = 0.712 kJ/kg K.

OR

16. a) Explain how frictional power can be obtained by using retardation test? (6)
b) Write short notes on Stratified Charge Engine (neat diagrams are mandatory). (8)

MODULE IV

17. a) Name the stages of combustion in a CI engine and explain with the aid of Pressure-Crank angle diagram. (7)
b) Make a comparison of Knock in CI and SI engine? (7)

OR

18. a) Discuss briefly about various pollutants coming out of an IC engine and its harmful effects (12)
b) List the factors that affect the delay period during combustion in a CI engine. (2)

MODULE V

19. a) List the limitation of reversed Carnot Cycle. (2)
b) With neat sketch, explain the working of a Vapour Compression Refrigeration System. (12)

OR

20. a) Explain with a neat figure Year-Round air conditioning system. (6)
b) Discuss about various factors affecting human comfort. (8)
