Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 11527

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Fifth Semester

Mechanical Engineering

ME 2301/ME 51/ME 1351 A/10122 ME 402 — THERMAL ENGINEERING

(Regulation 2008)

(Common to PTME 2301 – Thermal Engineering for B.E. (Part-Time) Fourth Semester – Mechanical Engineering – Regulation 2009)

Time : Three hours | Maximum : 100 marks

Use of Steam Tables, R and AC Tables, Mollier Chart and Humidity charts permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define the terms actual thermal efficiency and relative efficiency.

2. What is an air-standard cycle? Why such cycles are conceived?

3. What are the characteristics of an efficient cooling system?

4. The bore and stroke of a water-cooled, vertical, single-cylinder, four-stroke diesel engine are 80 mm and 110 mm respectively and the torque is 23.5 Nm. Calculate the mean effective pressure of the engine.

5. Define critical pressure ratio. Calculate the value of critical pressure ratio for saturated and supersaturated steam.

6. What is the effect of supersaturated flow in steam nozzle?

7. What do you mean by perfect intercooling?

8. Define Free air delivery.

9. What are the expansion devices used in a vapour compression plant? When are they used?

10. What is sensible heating or cooling?

PART B — (5 × 16 = 80 marks)

11. (a) A spark ignition engine working on ideal Otto cycle has the compression ratio 6. The initial pressure and temperature of air are 1 bar and 37°C. The maximum pressure in the cycle is 30 bar. For unit mass flow, calculate

(i) p, V and T at various salient points of the cycle and

(ii) The ratio of heat supplied to the heat rejected. Assume $\gamma = 1.4$ and R = 8.314 kJ/kmol K. (16)

Or

(b) An air standard dual cycle has a compression ratio of 18, and compression begins at 1 bar, 40°C. The maximum pressure is 85 bar. The heat transferred to air at constant pressure is equal to that at constant volume. Estimate :

(i) The pressures and temperatures at the cardinal points of the cycle.

(ii) The cycle efficiency and

(iii) The mean effective pressure of the cycle. (16)

12. (a) Compare SI and CI engines with respect to (16)

(i) Basic cycle (ii) Fuel used

(iii) Introduction of fuel (iv) Ignition

(v) Compression ratio (vi) Speed

(vii) Efficiency (viii) Weight.

Or

(b) Mention the various important qualities of good ignition system and with a neat sketch explain the battery and magneto ignition system.

13. (a) Derive the condition for maximum discharge and expression for maximum discharge in steam nozzle. (16)

Or

(b) (i) Steam at a pressure of 10.5 bar and 0.95 dry is expanded through a convergent divergent nozzle. The pressure of steam leaving the nozzle is 0.85 bar. Find the velocity of steam at the throat for maximum discharge take n = 1.135. Also find the area at the exit and steam discharge if the throat area is 1.2 cm^2. Assume flow is isentropic and there are no friction losses. (12)

(ii) Distinguish between impulse and reaction turbines. (4)

14. (a) A single-acting two-stage air compressor deals with 4 m^3/min of air at 1.013 bar and 15°C with a speed of 250 rpm. The delivery pressure is 80 bar. Assuming complete intercooling. Find the minimum power required by the compressor and the bore and stroke of the compressor. Assume a piston speed of 3 m/s, mechanical efficiency of 75% and volumetric efficiency of 80% per stage. Assume the polytropic index of compression in both the stages to be n = 1.25 and neglect clearance. (16)

Or

(b) Explain with neat sketch the construction and working of Roots blower with two lobe and three lobe rotor and Vane type compressor. (16)

15. (a) (i) Explain the construction and working of vapour absorption refrigeration system with neat sketch. (10)

(ii) Write the advantages and disadvantageous of vapour absorption and vapour compression refrigeration system. (6)

Or

(b) Explain the construction and working of summer and winter air conditioning systems. (16)
