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

Question Paper Code : 60854

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Mechanical Engineering

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

(Common to Sixth Semester Mechanical Engineering (sandwich))

(Regulations 2008/2010)

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

Time : Three hours Maximum : 100 marks

Use of approved thermodynamics tables, Mollier diagram, Psychrometric chart and Refrigerant property tables permitted in the Examinations)

Answer ALL questions.

PART A — (10 × 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 is unit injection system?

4. What do you mean by short circuiting in two-stroke engines?

5. What is metastale flow?

6. What are the different methods of governing steam turbine?

7. List out the applications of compressed air.

8. What are a slip factor and a pressure co-efficient?

9. What is purging?

10. What is stack effect or chimney?

PART B — (5 × 16 = 80 marks)

11. (a) Derive an expression for air the air standard efficiency of diesel cycle. Explain why the efficiency of Otto cycle is more than that of the diesel cycle for the same compression ratio. (16)

Or

(b) In an oil engine working on dual cycle, the heat supplied at constant pressure is twice that of heat supplied at constant volume. The compression and expansion ratios are 8 and 5.3. The pressure and temperature at the beginning of cycle are 0.93 bar and 27° C. Find the efficiency of the cycle and mean effective pressure. Take C_p = 1.005 kJ/kgK and C_v = 0.718 kJ/kgK. (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) (i) Explain the physical significance of Wilson's line as referred to super-saturated flow through steam nozzles. (8)

(ii) Steam enters a nozzle in a dry saturated condition and expands from a pressure of 2 bar to a pressure of 1 bar. It is observed that super-saturated flow is taking places and the steam flow reverts to a normal flow at 1 bar. What is the degree of under cooling and increases in entropy and the lass in the available heat drop due to irreversibility. (8)

Or

(b) (i) Describe briefly the various methods of steam turbine governing. (6)

(ii) 300 kg/min of steam (2 bar, 0.98 dry) flows through a given stage of reaction turbine. The exit angle of fixed blades as well as moving blades is 20° and 3.68 kW of power is developed. It the rotor speed is 360 rpm and tip leakage is 5 per cent, calculate the mean drum diameter and the blade height. The axial flow velocity is 0.8 times the blade velocity. (10)

14. (a) In a two stage compressor in which inter-cooling is perfect, prove that work done in the compressor is minimum when the pressure in the inter-cooler is geometric mean between the initial and final pressure. Draw the P-V & T-S diagram for Two Stage Compression. (16)

Or

(b) Explain the construction and working principles of Multi stage compressor and discuss the perfect and im-perfect intercooling with neat sketch. (16)

15. (a) The sling psycrometer in a laboratory test recorded the following readings. DBT = 35°C and WBT = 25° C. Calculate

(i) Specific humidity

(ii) Relative humidity

(iii) Vapour density in air

(iv) Dew point temperature

(v) Enthalpy of mixture per kg of dry air.

Take atm. Pressure as = 1.0132 bar. (16)

Or

(b) A Freon -12 refrigerator producing a cooling effect of 20 kJ/s operates on a simple cycle with pressure limits of 1.509 and 9.607 bar. The vapour leaves the evaporator dry saturated and there is no under cooling. Determine the power required by the machine. If the compressor operates at 300 rpm and has a clearance volume of 3% of stroke volume, determine the piston displacement of the compressor. For compressor assume that the expansion follows $pV^{1.3}$ = constant. Given : (16)

Temperature °C	p_s bar	v_g m^3/kg	Enthalpy kJ/kg h_f	h_g	Entropy kJ/kgK s_f	s_g	Specific heat kJ/kgK
–20	1.509	0.1088	17.8	178.61	0.073	0.7082	–
40	9.607	–	74.53	203.05	0.2716	0.682	0.747