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

Question Paper Code : 31345

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Mechanical Engineering

ME 2301 — THERMAL ENGINEERING

(Common to Mechanical Engineering (Sandwich))

(Regulation 2008)

(Also common to PTME 2301 – Thermal Engineering for B.E. (Part-Time) Mechanical Engineering – Fourth Semester – Regulation 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. Draw the P-v and T-s diagrams of a dual cycle and write the various processes.
2. What is meant by mean effective pressure?
3. List the main parts of a lubrication system.
4. What is known as pre ignition? State its effect.
5. What is metastable flow?
6. What are the different methods of governing steam turbine?
7. List the effects of inter-cooling in a multi stage compression process.
8. Give the classification of compressor based on movement of piston.
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) 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 = 0.7 18 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) A convergent divergent nozzle required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 7 bar and 180°C and discharge takes place against a back pressure of 1 bar. The expansion up to throat is isentropic and the frictional resistance between the throat and the exit is equivalent to 63 kJ/kg of steam. Take approach velocity of 75 m/s and throat pressure 4 bar, estimate

(i) suitable areas for the throat and the exit, and

(ii) overall efficiency of the nozzle based on the enthalpy drop between the actual inlet pressure and the temperature and the exit pressure. (16)

Or

(b) In a stage of impulse reaction turbine operating with 50% degree of reaction the blades are identical in shape. The outlet angle of the moving blade is 19° and the absolute discharge velocity of steam is 100 m/s in the direction 70° to the motion of the blades. If the rate of flow through the turbine is 15000 kg/hr, calculate the power developed by the turbine. (16)

14. (a) A single - stage single - acting compressor delivers 15 m^3 of free air per minute from 1 bar to 8 bar. The speed of compressor is 300 r.p.m. Assuming that compression and expansion follow the law $pv^{1.3}$ = constant and clearance is $1/16^{th}$ of swept volume, find the diameter and the stroke of the compressor. Take L/D = 1.5. The temperature and pressure of air at the suction are 20°C and 1 bar respectively.

Or

(b) A two-stage compressor delivers 2 m^3 free air per minute. The temperature and pressure of air at the suction are 27°C and 1 bar. The pressure at the delivery is 50 bar. The clearance is 5% of the respective stroke in L.P. cylinder as well as in H.P. cylinder. Assuming perfect intercooling between the two stages, find the minimum power required to run the compressor at 200 rpm. Also find the diameters and strokes assuming the strokes of both cylinders are equal to the diameter of the L.P. cyclinder.

15. (a) The temperature limits of Ammonia Refrigeration System are 25°C and 10°C. If the gas is dry at the end of Compression. Calculate the COP of the cycle assuming no under-cooling of the liquid ammonia. The properties of Ammonia are given below. (16)

Temperature in °C	Liquid Heat	Latent Heat	Liquid Entropy
25	298.90	1166.94	1.2420
–10	135.37	1297.68	0.5443

Or

(b) Explain the construction and working of Vapour compression refrigeration system with neat sketch. (16)