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Question Paper Code: 71854

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fifth Semester

Mechanical Engineering

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

(Common to Sixth Semester Mechanical Engineering (Sandwich))

(Regulation 2008/2010)

(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 — $(10 \times 2 = 20 \text{ marks})$

- 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. What are the basic components of an IC engine?
- 4. What are the exhaust emissions from a diesel engine?
- 5. What are the effects of friction on steam nozzles?
- 6. What is the principle of an impulse turbine?
- 7. How are compressors classified?
- 8. What are the advantages of multistage compression over a single stage compression for the same compression ratio?
- 9. List out the alternate refrigerants used in vapour-compression systems.
- Define the terms: wet bulb temperature, relative humidity, specific humidity and dew point temperature.

PART B — $(5 \times 16 = 80 \text{ marks})$

11.	(a)	An engine working on the Otto cycle has an air standard cycle efficied of 56% and rejects 544 kJ/kg of air. The pressure and temperature of at the beginning of compression are 0.1 MPa and 60°C respective Compute:	f air
		(i) The compression ratio of the engine	(4)
		(ii) The work done per kg of air	(4)
		(iii) The pressure and temperature at the end of compression, and	(4)
		(iv) The maximum pressure in the cycle.	(4)
		Or	
	(b)	Draw the actual and theoretical p-v diagrams of a four stroke diengine and compare them.	esel
12.	(a)	With a neat sketch explain the working principle of a simple carburet	tor.
		Or	
	(b)	Explain the battery ignition system with a suitable diagram.	
13.	(a)	The inlet condition to a steam nozzle are 10 bar and 250°C. The pressure is 2 bar. Assuming isentropic expansion and negligible i velocity determine:	
		(i) The throat area	(6)
		(ii) Exit velocity and	(6)
		(iii) Exit area of the nozzle.	(4)

Or

- (b) What is velocity compounding? List the advantages and limitations of velocity compounding.
- 14. (a) A single stage single acting compressor delivers 15 m³ 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 pv¹.³ = constant and clearance is 1/16th 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 m³ 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. Cylinder.
- 15. (a) A vapour compression machine is used to maintain a temperature of a -23°C in a refrigerated space. The ambient temperature is 37°C. The compressor takes in dry saturated vapour of F-12. A minimum 10°C temperature difference is required at the evaporator as well as at condenser for effective heat transfer. There is no sub-cooling of liquid. If the refrigerant flow rate is 1 kg/min, find

(i) Tonnage of refrigeration (6)

(ii) Power requirement (6)

(iii) Ratio of C.O.P. of this cycle to C.O.P. of Carnot cycle. (4)

Or

(b) One kg of air at 35°C DBT and 60% R.H is mixed with 2 kg of air at 20°C DBT and 13°C dew-point temperature. Calculate the specific humidity of the mixture.