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Question Paper Code : D 2523

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010.

Fourth Semester

Mechanical Engineering

ME 1251 — THERMAL ENGINEERING

(Regulation 2004)

(Common to B.E. (Part–Time) Third Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

(Use of standard thermodynamic tables, Mollier diagram, Psychrometric chart and refrigerant property tables are permitted)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the effect of compression ratio on efficiency of Otto cycle?

2. Define Mean Effective Pressure (MEP).

3. What is scavenging in two stroke engine?

4. What do you understand by Cetane Number?

5. What is the effect of friction on the dryness fraction of steam leaving a nozzle?

6. What is compounding in turbines? Why is compounding necessary?

7. How does inter cooling reduce the work input of compressor?

8. How does the valve operation of a compressor differ from the valve operation of an I.C. Engine?

9. How does the sub cooling influence the refrigerating effect of a vapour compression refrigerator?

10. Define sensible heating and cooling process.

PART B — (5 × 16 = 80 marks)

11. (a) Derive an expression for the air standard efficiency and MEP of a Diesel cycle. (16)

Or

(b) The compression ratio of an air standard Dual cycle is 12 and the maximum pressure in the cycle is limited to 70 bar. The pressure and temperature of the cycle at the beginning of compression process are 1 bar and 300K. Calculate the thermal efficiency and mean effective pressure.

Assume Cylinder bore = 250 mm, stroke length = 300 mm,

c_p = 1.005 kJ/kgK c_v = 0.718 kJ/kgK. (16)

12. (a) Explain the following with sketches.

(i) Splash Lubrication of IC Engines. (8)

(ii) Thermosyphon cooling of IC Engines. (8)

Or

(b) During the trial (60 minutes) on a single cylinder oil engine having cylinder diameter 300 mm, stroke 450 mm and working on the four stroke cycle, the following observations were made :

Total fuel used : 9.6 liters

C.V. of the fuel : 45000 kJ/kg

Total No. of Revolutions : 12624

Gross IMEP : 7.24 bar

Pumping IMEP : 0.34 bar

Net load on the brake : 3150N

Diameter of the brake wheel drum : 1.78m

Diameter of the rope : 40 mm

Cooling water circulated : 545 liters

Cooling water temperature rise : 25°C

Specific gravity of oil : 0.8.

Determine the indicated power, brake power and mechanical efficiency. (6 + 6 + 4)

13. (a) Derive expressions for the exit velocity, mass flow rate and critical pressure ratio of a steam nozzle. (16)

Or

(b) One stage of an impulse turbine consists of a converging nozzle ring and one ring of moving blades. The nozzles are inclined at 22° to the blades whose tip angles are both 35°. If the velocity of steam at exit from the nozzle is 660 m/s, find the blade speed so that the steam passes without shock. Find the diagram efficiency neglecting losses if the blades are run at this speed. (16)

14. (a) Explain the working of a single stage single acting reciprocating compressor with a neat sketch and p–V diagram. Also explain the need and the advantages of multi stage compression, with a p–V diagram. (16)

Or

(b) Estimate the volumetric efficiency and power consumption of a single stage single acting reciprocating compressor, given the following data :

Cylinder diameter : 30 cm

Stroke : 22 cm

Clearance ratio : 0.03

Delivery pressure : 8 bar

Suction pressure : 1 bar

Speed : 400 rpm

Compression and expansion follows $pv^{1.3}$ = constant. (16)

15. (a) With the help of a suitable sketch explain the working of lithium bromide–water based vapour absorption system. Also list the advantages and disadvantages of vapour absorption systems. (12 + 4)

Or

(b) In an air conditioning system, re–circulated air is mixed with fresh air and the mixture is sent through the conditioner coil. After the conditioner coil, the conditioned air enters the room. Draw the block diagram of this system and show the related psychrometric processes on a psychrometric chart. Also explain RSHF, GSHF and ESHF in connection with this AC system. (16)

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