

[4]

OR

A single - cylinder air compressor compresses air from 1 bar to 7 bar. The clearance volume is 2 litres and law of compression and expansion is $P.V^{1.2} = \text{constant}$. If the volumetric efficiency of the compressor is 80%, determine :

- i) The stroke volume and
- ii) The cylinder dimensions.

Assume stroke of the piston equal to diameter of the cylinder.

Unit - V

- 5. a) State the different types of steam condensers. What are the functions of condenser in a steam plant?
- b) Define vacuum efficiency of a condensing plant? On what factors does this efficiency depends?
- c) How are heat exchangers classified? Discuss in detail.
- d) State the various types of cooling towers. Explain any one of them.

OR

Write short note on LMTD approach to design a heat exchanger.

Total No. of Questions :5]

[Total No. of Printed Pages :4

Roll No

ME - 404

B.E. IV Semester

Examination, December 2016

Thermal Engineering and Gas Dynamics

Time : Three Hours

Maximum Marks : 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each questions are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.
v) Steam tables and mollier chart is permitted.

Unit - I

- 1. a) What do you understand by "Equivalent evaporation" from and at 100°C as applied to a steam boiler?
- b) Enlist the various heat losses in boiler.
- c) What do you understand by the term "boiler draught"? What are the various types of draughts used in usual practice?
- d) Describe with neat sketch the working and construction of "Benson Boiler".

[2]

OR

A boiler generates 800kg of steam per hour at a pressure of 10 bar and with 50°C superheat and burns 100kg of coal per hour. If the calorific value of the coal is 30,000 kJ/kg and feed water temperature is 40°C, calculate :

- i) The factor of equivalent evaporation
- ii) The actual evaporation per kg of coal
- iii) The equivalent evaporation from and at 100°C per kg of coal and
- iv) The boiler efficiency

Unit - II

2. a) What are the difficulties experienced in carrying out Carnot cycle for a vapour?
- b) Sketch the Rankine cycle on P-V and T-S plots.
- c) State the effects of boiler and condenser pressure on the efficiency of Rankine cycle.
- d) Explain binary vapour cycle with the help of T-S diagram. Obtain an expression for its thermal efficiency.

OR

Steam at 50 bar, 400°C expands in a Rankine cycle to 0.34 bar. For a mass flow rate of 150kg/s of steam, determine :

- i) The power developed
- ii) The thermal efficiency and
- iii) Specific steam consumption

[3]

Unit - III

3. a) What do you mean by stagnation properties?
- b) What is Mach number? What is the significance of Mach number in compressible fluid flow?
- c) Discuss the process of super saturation in steam nozzles with the help of h-s diagram.
- d) Deduce a formula relating change of area of a convergent-divergent nozzle with change in pressure and deduce results regarding subsonic, sonic and supersonic flow of gas.

OR

Dry saturated steam enters a nozzle at a pressure of 10 bar and with an initial velocity of 90m/s. The outlet pressure is 6 bar and the outlet velocity is 435m/s. The heat loss from the nozzle is 9kJ/kg of steam flow. Calculate the dryness fraction and the area at the exit, if the area at inlet is 1256mm².

Unit - IV

4. a) How are compressors classified?
- b) What are the advantages of multistage compression?
- c) Explain that the volumetric efficiency depends on clearance volume and pressure ratio for a single stage compressor.
- d) Derive an expression for the minimum work required to compress and deliver 1kg of air in a two-stage compressor. State carefully the assumptions made.