

d) An air compressor takes in air at 1 bar and 27°C and delivers it after compression at 5 bar. Find the :

- i) Work done
- ii) Heat transfer
- iii) Change in internal energy when compression process are

- a) Isothermal
- b) Reversible adiabatic

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OR

Derive the equation for minimum work done in terms of intermediate pressure of multistage compressor.

5. a) Explain the term vacuum and how it is measured?
- b) How air leakage affects the performance of condenser?
- c) What is fouling factor? What is difference between counter flow and parallel flow condenser.
- d) A steam condenser is equipped in a steam power plant which handles 15000 kg/hr of steam and develops 2.5MW power. The initial condition of steam 27 bar, 300°C, the exhaust after condenser maintained at 72 cm of Hg. While barometer reading 76 mm of Hg. Temperature at circulating water increases from 20°C to 28°C. While condensate removed at a temperature of 27°C, work out followings:
 - i) 7.5 diagram
 - ii) Dryness fraction of steam entering the condenser
 - iii) Mass rate of circulating water and cooling ratio
 - iv) Degree of under cooling

OR

Explain various types of cooling tower and its design construction.

Roll No

ME - 404 rgpvonline.com**B.E. IV Semester**

Examination, December 2015

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 question 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.

1. a) Define super critical boiler.
- b) What are difference between forced circulation and natural circulation?
- c) What are the advantages of High pressure Boiler?
- d) The following reading were obtained during a boiler trial of 5 hours duration.

Mean steam pressure = 15 bar
 Mean of steam generated = 50,000 kg
 Mean dryness fraction = 0.85
 Mean water temperature = 30°C
 Coal used = 4000kg,
 Calorific value of coal = 33400 kJ/kg

Calculate:

- i) Factor of equivalent evaporation
- ii) Equivalent evaporation from and at 100°C
- iii) Efficiency of boiler

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OR

- i) How much air used 1 kg of coal burnt in a boiler having Chimney height 50m to create a draught of 30.2 mm of water column when the temperature of the gases in the Chimney is 370°C and the temperature of boiler house is 25°C.
- ii) What are advantages of artificial draught over natural draught.

2. a) What are limitations of Carnot cycle?
- b) How can we increase the efficiency of Rankine cycle?
- c) Derive an expression of thermal efficiency for regenerative cycle.
- d) In a Rankine cycle, the steam at inlet to turbine is saturated at pressure of 30 bar and the exhaust pressure is 0.25 bar.

Determine:

- i) Pump work
- ii) Turbine work
- iii) Rankine efficiency
- iv) Condenser heat flow
- v) Dryness at the end of expansion
- vi) Work ratio

Assume mass flow rate = 10 kg/sec

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OR

- i) Explain the binary vapour cycle with neat line diagram.
- ii) Explain the modified Rankine cycle and show the modification by P-V and T-S curve.

3. a) How can we find the stagnation state? Write the equation for stagnation properly in isentropic flow.
- b) What is Mach number? How is it useful for calculation of gas-flow?
- c) Derive the equation

$$\frac{dA}{A} = \frac{dV}{V} (m^2 - 1)$$

Where A = area of cross section of duct

V = velocity of gas through duct

- d) Define the critical pressure ratio, for the nozzle of steam turbine and derive the equation for maximum flow rate at throat in terms of critical pressure ratio.

OR

- i) Explain metastable flow of steam in nozzle.
- ii) Derive the expression for nozzle efficiency.

4. a) What are effect of clearance on the performance of reciprocating compressor.
- b) Why is multistage essential for high compression ratio?
- c) Classify the rotary compressor and write comparison of rotary and reciprocating compressor.