Roll No .....

ME - 404

B.E. IV Semester Examination, June 2014

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) Differentiate between subcritical and super critical boiler.
   b) What is Boiler efficiency?
   c) What is Boiler Draught? Differentiate between artificial and natural draught.
   d) Draw a neat sketch of any High pressure boiler.

   OR

   The following observations were made in a boiler trial. coal used = 200kg c.v. of coal = 29,800 kj/kg steam pressure = 11.5 bar, water evaporated = 2000kg, feed water temperature = 34°C. The steam produced is 0.95 dry and sensible heat and latent heat requirement at 11.5 bar are 790 kj/kg and 1992 kj/kg. Calculate equivalent evaporation from and at 100°C and efficiency of the boiler.

2. a) Why is carnot cycle not practicable for a steam power plant?
   b) Draw the T-S and h-s diagram of the reversible cycle representing simple steam power plant.
   c) Explain the effect of regeneration on the specific output, cycle efficiency and mean temperature of heat addition of a steam power plant.
   d) A steam power station uses following cycle steam at boiler outlet -150 bar, 550°C reheat at 40 bar to 550°C. Condenser at 0.1 bar. Using Mollier chart and assuming ideal process find (i) Quality of turbine exhaust (ii) Cycle efficiency and (iii) Steam rate.

   OR

   A Rankine cycle is operating between a pressure of 80 bar and 0.1 bar. The maximum cycle temperature is 600°C. If the steam turbine and condensate pump efficiency are 0.9 and 0.8 respectively. Calculate the specific work and thermal efficiency.

3. a) What is stagnation state? What do you mean by stagnation properties?
   b) What is critical pressure ratio? What is it's value for air?

c) Show that the discharge through a nozzle is maximum when there is a sonic flow at it's throat.

d) An aircraft flies with a speed of 800 km/hr having 100kPa and 30°C as stagnation conditions. Find the static condition and flight mach number.

OR

Air flows through a convergent divergent nozzle. At some section in the nozzle pressure = 2 bar , velocity = 170 m/sec, Temp = 200°C cross sectional area = 10 cm^2. Assuming isotropic flow condition determine velocity, Mach No and flow rate at the outlet of nozzle where the pressure is 1.1 bar. Also determine the temp, velocity and flow area at the throat of nozzle. Take Y for air = 1.4, cp = 1.005 and R = 0.287 kj/kgk.

4. a) Define volumetric efficiency of a reciprocating compressor.

b) What is the ideal compression process in a reciprocating compressor and why?

c) Discuss the advantages of multistage compression.

d) An air compressor takes in air at 1 bar and 20°C and compresses it according to law pV 1.2 = C. It is then delivered to a receiver at a constant pressure of 10 bar. Determine temperature at the end of compression and heat transferred during the compression and the work done per kg of air and work done during delivery. Take R = 287 J/kg K and Y = 1.4.

OR

Derive an expression for optimum intermediate pressure for a two stage compress with perfect inter cooling and same index of compression for minimum work done of compression.

5. a) What is the necessity of condenser in a steam power plant?

b) Define condenser efficiency.

c) With a neat sketch explain working of jet condenser.

d) Differentiate between

i) Recuperator and Regenerator

ii) Parallel flow and Counterflow heat exchanger.

OR

Calculate the vacuum efficiency and condenser efficiency if the following data were available in a test on condenser.

Condenser vacuum	=	700 mm of Hg
Barometer reading	=	754 mm of Hg
Hot well temp	=	30°C
Inlet temp. of cooling water	=	12°C
Outlet temp. of cooling water	=	26°C

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