Roll No. | | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(IE) (2008/09 Batch)/(ME) (Sem.–3)

APPLIED THERMODYNAMICS–I

Subject Code : ME-209

Paper ID : [A0805]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write short notes on :

(a) Differentiate between water tube and fire tube boilers.

(b) Explain the difference between Impulse & Reaction turbines.

(c) Define Dalton's law of partial pressure. How it is applicable on steam condensers?

(d) Write note on Labyrnth packing, why it is used in steam turbines.

(e) Discuss the effects of air leakage in-condensers.

(f) Write note on Isothermal and polytrophic efficiency of reciprocating compressors.

(g) Define stage efficiency and overall efficiency.

(h) What is reheat cycle discuss?

(i) What is function of economizer in boiler?

(j) What is Degree of Reaction? Explain.

SECTION-B

2. The fuel supplied to an I.C. engine has the following composition by mass : C=87% and H_2 = 13%. The air : fuel ratio is 13:1. If all the carbon is burnt either to CO or CO_2 and if there is no free oxygen in the combustion products, determine: Volumetric analysis of products of combustion.

3. Explain Rakine cycle. Derive expression for work output and efficiency of the cycle.

4. How does a condenser employed in steam power plant improves the performance? Differentiate between Jet and surface condensers.

5. Explain the effect of friction in nozzle performance, also evaluate nozzle efficiency and coefficient of velocity, write values of C_v for various nozzles.

6. What is the need of multi stage compression; derive an expression for work input for multi–stage compression with perfect inter cooling in intermediate stages.

SECTION-C

7. A five stage steam turbine has steam entering at 20 bar, 300°C and leaving at 0.05 bar and 0.95 dry. Determine the Reheat factor, condition of steam at exit from each stage considering efficiency ratio (η_s) = 0.555 and all stages doing equal work.

8. (a) Explain the principle of working of Parson Reaction Turbine.

   (b) The blade speed of single ring of impulse blading is 300m/s and the nozzle angle is 20°. The isentropic heat drop is 475kJ/kg and the nozzle efficiency is 0.85. Given that blade velocity coefficient is 0.7 and blades are symmetrical, draw vector diagrams and calculate for a mass flow rate of 1kg/s :

   (a) Axial thrust on blading,

   (b) Diagram efficiency and maximum blade efficiency

   (c) Heat equivalent of friction of blading.

9. A two stage single acting compressor takes in air at the rate of 0.2 m^3/s. The intake pressure and temperature of air are 0.1 MPa and 16 °C. The air is compressed to a final pressure of 0.7MPa. The inter cooling is perfect and the intermediate pressure is for minimum work input conditions. The compression index in both the stages is 1.25 and compressor runs at 600r.p.m. Neglecting clearance, determine :

   (a) Intermediate pressure,

   (b) Total volume of each cylinder,

   (c) The ower required to drive compressor and total heat rejected in intercooler. Take C_p=1.005 kJ/kg K and R=0.287 kJ/kg K.