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**

INSTRUCTION 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 briefly :**

   a) What do you mean by stoichiometric air fuel ratio?

   b) Show T-S diagram for formation of superheated steam.

   c) Write about function of economizer fitted in a boiler.

   d) Write about any method used for improving efficiency of Rankine cycle.

   e) Define nozzle efficiency.

   f) What do you mean by blade speed ratio?

   g) What do you mean by pressure compounding of steam turbine?

   h) What do you mean by blade velocity coefficient of a steam turbine?

   i) Define condenser efficiency.

   j) Define isothermal efficiency of reciprocating compressor.

SECTION-B

2. The percentage composition of a fuel by mass is C = 90.5%, H_2 = 3%, O_2 = 2.5%, N_2 = 0.8%, S = 1%, ash = 7% by mass. Calculate minimum mass of air required for complete combustion, of 1 kg of this fuel. Also calculate mass of nitrogen in the products of combustion. Air by mass contains oxygen and nitrogen as 23% and 77% respectively.

3. Explain construction and working of Lancashire boiler with the help of a neat sketch.

4. Calculate mass flow rate of steam in a nozzle having inlet pressure = 10 bar, inlet temperature = 200°C, exit pressure = 0.5 bar and throat diameter = 12 mm.

5. Explain construction and working of counter flow jet condenser with the help of a neat sketch.

6. Steam enters single stage impulse turbine through nozzle with a velocity of 500 m/s at an angle of 20° to the direction of blade motion. The blade speed is 200 m/s and exit angle of the moving blade is 25°. If mass flow rate of steam is 1kg/s and blade velocity coefficient is 1, find

    (i) inlet angle of the moving blades

    (ii) exit absolute velocity of steam

    (iii) direction of exit steam and

    (iv) power developed by the turbine.

SECTION-C

7. What do you mean by reheating and regeneration? Explain efficiency improvement of Rankine cycle with reheating and regeneration. (10)

8. What are the different methods of governing a steam turbine? Explain any two with the help of neat sketches. (10)

9. a) Write about use of compressed air in industry. (4)

    b) A single stage single acting reciprocating air compressor without clearance sucks air at 1 bar and 20 °C. If pressure after compression is 10 bar, determine

      (i) temperature of air at the end of compression and

      (ii) work done per kg of air during polytropic compression (n = 1.25). Take R = 287 J/kg K. (6)