Roll No.

Total No. of Pages : 2

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B.Tech. (IE/ME) (Sem.-3) APPLIED THERMODYNAMICS-I Subject Code : ME-209 (2008-09 Batch) Paper ID : [A0805]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

- 1. SECTION-A is COMPULSORY.
- 2. Attempt any FOUR questions from SECTION-B.
- 3. Attempt any TWO questions from SECTION-C.

SECTION-A

 $(10 \times 2 = 20 \text{ Marks})$

- 1. (a) What do you mean by stoichiometric air fuel ratio?
 - (b) Define dryness fraction of steam.
 - (c) What do you mean by boiler mountings?
 - (d) Show T-S diagram for simple Rankine cycle.
 - (e) What do you mean by convergent and divergent type of nozzle?
 - (f) What do you mean by pressure compounding of steam turbine?
 - (g) Write about any two losses in steam turbines.
 - (h) What do you mean by degree of reaction in reaction steam turbine?
 - (i) Enlist elements of a condensing plant.
 - (j) Define polytropic efficiency of reciprocating compressor.

SECTION-B $(4 \times 5 = 20 \text{ Marks})$

2. By mass, the ultimate analysis of coal burnt in a boiler is C=84%, H_2 =9% and incombustibles=7%. If volumetric composition of flue gas is CO=2.25%, CO₂=8.75%, O₂=8% and N₂=81%, determine mass of dry flue gas per kilogram of coal burnt.

- 3. Explain construction and working of Cochran boiler with the help of a neat sketch.
- 4. Dry saturated steam at a pressure of 15 bar enters a nozzle and discharges at a pressure of 1.5 bar. Find velocity of steam at exit of the nozzle if velocity of steam at inlet is negligible. Also find velocity of steam at exit of the nozzle if 10% of enthalpy drop is lost due to friction.
- 5. Explain construction and working of parallel 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

(2 × 10 = 20 Marks)

- 7. What do you mean by binary vapor cycle? Explain mercury-steam binary vapor cycle with the help of T-S diagram.
- 8. Draw combined velocity triangle for a single stage reaction turbine and derive an expression for work done per stage.
- 9. A single stage single acting reciprocating air compressor without clearance is required to compress 72 m^3 of air per minute. Compressor sucks air at 1 bar and 15 °C. If pressure after compression is 8 bar, determine temperature of air at the end of compression and work done during
 - (i) isothermal compression and
 - (ii) isentropic compression. Take γ =1.4.