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

Total No. of Questions : 09

B.Tech. (Mechanical Engineering) (Sem.–4)

APPLIED THERMODYNAMICS

Subject Code : BTME-401-18

M.Code : 77546

Date of Examination : 02-07-22

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 briefly :

a) What is meant by saturation temperature and saturation pressure?

b) Give the classification of steam turbines.

c) Distinguish between impulse and reaction turbines.

d) What is steady flow energy equation as applied to steam nozzles? Explain its use in the calculation of a steam velocity at the exit of a nozzle.

e) Explain the effect of friction on the performance of a steam nozzle.

f) What is the main difference between boiler mountings and boiler accessories?

g) What are differentiating features between a water tube and fire tube boiler?

h) Compare supercharger with turbo charger.

i) Define stoichiometric air-fuel ratio.

j) Define draught, what is the use of draught in thermal power plants?

SECTION - B

2. Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2 bar. If the dry fraction of discharge steam is 0.96, what will be the final velocity of steam? Neglect initial velocity of steam. If 10 % of heat drop is lost in friction, find the percentage reduction in the final velocity.

3. "*Auto ignition is responsible for knocking in S.I. engines or not*?" Justify your answer by suitable diagram.

4. In a De Laval turbine steam issues from nozzle with a velocity of 1200 m/s the nozzle angle is 20°, the mean blade velocity is 400 m/s, and the inlet and outlet angles of baldes are equal. The mass of steam flowing through the turbine per hour is 1000 kg. Take Blade velocity co-efficient as 0.8. Calculate

   a) Blade angles

   b) Relative velocity of steam entering the blade

   c) Tangential force on the blade

   d) Power developed

   e) Blade efficiency

5. What is the significance of critical pressure ratio for nozzle of a steam turbine? Obtain analytically its value in terms of the index of expansion.

6. Steam enters a nozzle passing amass flow of 14 kg/s at a pressure of 30 bar and a temperature of 300°C. After expansion to an exit pressure of 5 bar, the exit velocity is 800 m/s. (a) Determine the nozzle efficiency and exit area (b) If the losses occur only in the divergent portion, determine the velocity of steam at the throat.

SECTION – C

7. During the trail of a four-stroke cylinder gas engine the following data were recorded, Determine the Indicated mean effective pressure and Indicated power

   - Area of indicator diagram= 565.8 mm^2
   - Length of indiclfbr diagram= 74.8 mm
   - Spring index =0.9 bar/mm
   - Cylinder diameter = 220 mm
   - Stroke length =430 mm
   - Number of explosions/min= 100

8. In a reaction turbine, the fixed blades and moving blades are of the same shape but reversed in direction. The angles of the receiving tips are 35° and of the discharging tips are 35° and the discharging tips 20°. Find the power developed per pair of blades for a steam consumption of 2.5 kg/s, when the blade speed is 50 m/s. If heat drop per pair is 10.04 kJ/kg, find the efficiency of the pair.

9. Why there is no chimney in case of locomotive boilers? Can we correlate maximum discharge rate of gases through the chimney for a given height of the chimney. Drive an expression.