

Code: ME4T2

II B.Tech - II Semester – Regular Examinations - JUNE 2015

**APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Describe the different operations of Rankine cycle and derive the expression for its efficiency. 10 M
b) Explain about stoichiometry. 4 M

2. a) Give the classification of steam boilers and explain with the help a sketch any one of the High Pressure boiler. 10 M
b) To provide a natural draught a chimney of height 16 m is used. Calculate 4 M
 - i) The draught in 'mm' of water when the temperature of chimney gases is such that the mass of the gases discharged is maximum.
 - ii) If the temperature of flue gases does not exceed 350°C find air supplied per kg of fuel, when discharge is maximum. Take ambient temperature as 20°C .

3. a) Derive the expression for discharge through the Nozzle. 10 M

b) Steam having pressure of 10.5 bar and 0.95 dryness is expanded through a convergent- divergent nozzle and the pressure of steam leaving the nozzle is 0.85 bar. Find the velocity at throat for maximum discharge condition. Index of expansion may be assumed as 1.135. Calculate mass rate of flow of steam through the nozzle. 4 M

4. In an impulse turbine with single row of blades the mean diameter of the blade is 1.05 m and the speed is 3000 r.p.m. The nozzle angle is 18° , the ratio of blade speed to steam speed is 0.42 and the ratio of the relative velocity at outlet from the blade to that at inlet is 0.84. The outlet angle of the blade is to be made 3° less than the inlet angle. The steam flow is 10 kg/s. Determine the following. 14 M

- i) Tangential Thrust on the blade
- ii) Axial Thrust on the blade
- iii) Resultant Thrust on the blade
- iv) Power developed in the blade
- v) Blade efficiency

5. Derive the expression for maximum blade efficiency of a Reaction turbine. 14 M

6. a) How will you classify Steam condensers? 4 M

b) With the help of neat sketch explain the working of Down flow and Evaporative surface condensers. 10 M

7. A single stage single acting air compressor delivers 0.6 kg of air/minute at 6 bar. The temperature and pressure at the end of suction stroke are 30°C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of swept volume. Assuming the index of compression and expansion to be 1.3. Determine 14 M
- i) Volumetric efficiency.
 - ii) Power required if η_{mech} is 85%
 - iii) Speed of compressor in rpm.
8. With the help of neat diagram explain the working of centrifugal compressor and also derive work done by impeller in terms of pressure ratios. 14 M