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Question Paper Code: 31373

B.E. / B.Tech. DEGREE EXAMINATION, NOVEMBER 2015

Third Semester

Mechanical Engineering

01UME303 – ENGINEERING THERMODYNAMICS

(Use of steam table, charts may be permitted)

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Explain the concept of continuum.
2. Give the energy equation applicable for an adiabatic nozzle and an adiabatic turbine.
3. What are the conditions for reversibility?
4. Define the term Entropy.
5. Explain throttling process of steam.
6. Define specific steam consumption.
7. What is an equation of state?
8. What is Joule-Thomson coefficient? Why it is zero for an ideal gas?
9. What is specific humidity? When does it become maximum?
10. What is adiabatic mixing and write the equation for that?

PART - B (5 x 16 = 80 Marks)

11. (a) 1 kg of air at a pressure of 1 bar and 25°C heated at constant volume till the pressure is doubled. It is then expanded isothermally to the original pressure and then cooled to the initial condition at constant pressure. Show that the process on P-V and T-S diagrams and calculate the work and heat interactions during the cycle. (16)

Or

- (b) Derive the general equation for a steady flow system and apply the equation to a nozzle and derive an equation for velocity at exit. (16)
12. (a) (i) 1200 kJ of heat is supplied to an engine from a source of 20°C , the sink temperature is 2°C . Which of the following cycle represents reversible, irreversible or impossible cycle?
- 1) 275 kJ heat is rejected to sink
 - 2) 825 kJ heat is rejected
 - 3) 350 kJ heat is rejected
- (8)
- (ii) Show that a violation of the Kelvin Planck statement of the second law implies a violation of the clausius statement. (8)

Or

- (b) Derive clausius inequality. (16)
13. (a) A steam boiler initially contains 9 m^3 of water and 1 m^3 of steam at 2 MPa pressure. Heat is added and steam is utilized at constant pressure, till the boiler finally contains 1 m^3 of water and 9 m^3 of steam. Calculate (i) the mass of steam utilized and (ii) the required steam supply. (16)

Or

- (b) A steam power plant operates between 20 bar and 0.08 bar. If the maximum temperature of the steam is 260°C , calculate the specific net work and cycle efficiency if the pump work is (i) considered and (ii) neglected. (16)
14. (a) Molar analysis of air indicates that it is composed primarily of nitrogen (78%) and oxygen (22%). Determine (a) the mole fractions (b) the gravimetric analysis (c) its molecular weight (d) its gas constant. (16)

Or

- (b) Using Maxwell relations deduce the two important Tds equations. (16)

15. (a) (i) Air at 20°C , 40% R.H is mixed with air at 40°C , 40% R.H in the ratio of (former) 1:2 (later) on dry basis. Determine the final condition of air. (10)
- (ii) Briefly discuss about evaporative cooling process. (6)

Or

- (b) Atmospheric air at 1.0132 bar has 20°C DBT and 65% RH. Find the humidity ratio, Wet bulb temperature, dew point temperature, degree of saturation, enthalpy of the mixture and density of air and density of vapour in the mixture. (16)
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