Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB04

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations(Regular) - November, 2019

Regulation: IARE – R18

THERMODYNAMCIS

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain the terms state, path, process and cyclic process **[7M]**

   (b) A new temperature scale is to be defined. The boiling and freezing points on the scale are 400^oN and 100^oN respectively.

   i) Correlate this with Centigrade scale and Fahrenheit scale.

   ii) What will be the reading on a new scale corresponding to 60^oC. **[7M]**

2. (a) Distinguish between macroscopic and microscopic view of thermodynamics **[7M]**

   (b) One kg of fluid enters a nozzle with a velocity of 300 m/min and enthalpy of 2990kJ/kg. The enthalpy of the fluid at the exit of the nozzle is 2760 kJ/kg. The nozzle is place horizontally and neglects the heat loss from the nozzle. Determine i) The velocity of the fluid at the exit of the nozzle, ii) The mass flow rate if the area at the inlet is 0.095 m^2 and the specific volume at the inlet is 0.19 m^3/kg and iii) The exit area of the nozzle if the specific volume at the exit is 0.5 m^3/kg . **[7M]**

UNIT – II

3. (a) State the limitations of first law of thermodynamics? Differentiate between available energy and availability. **[7M]**

   (b) Two reversible heat engines A and B are arranged in series with A rejecting heat directly to B through an intermediate reservoir. A receives 200kJ of heat from a reservoir at 421^oC and engine B is in thermal communication with a sink at 4.4^oC. If the work output of the A is twice that of B find.

   i) Intermediate temperature between A and B,

   ii) The efficiency of each engine and

   iii) The heat rejected to the cold sink **[7M]**

4. (a) Define entropy? Prove that entropy is a point function. **[7M]**

   (b) A heat engine working on Carnot cycle converts 1/5th of the heat input into work. When the temperature of the sink is reduced by 80^0C, the efficiency gets doubled. Determine the temperature of sink?

   [7M]

UNIT – III

5. (a) Explain the phase equilibrium diagram for a pure substance on T-s plot with relevant constant property lines. **[7M]**

   (b) A rigid closed tank of volume 3 m^3 contains 5 kg of wet steam at a pressure of 200 kPa. The tank is heated until the steam becomes dry saturated. Determine the final pressure and heat transfer to the tank. **[7M]**

6. (a) Explain : i) Sensible heat ii) Latent heat iii) Saturated liquid and saturated vapour iv) Dryness fraction v) Enthalpy of a wet steam vi) Enthalpy of a dry steam vii) Enthalpy of a super-heated steam **[7M]**

   (b) A spherical shaped balloon of 12 m diameter contains H_2 at 30^oC and 1.21 bar. Find the mass of H_2 in the balloon using real gas equation **[7M]**

UNIT – IV

7. (a) How gravimetric analysis can be compared with volumetric analysis. **[7M]**

   (b) A gas mixture contains 0.5 kg of CO, 1kg of CO2 and 1.5 kg of Nitrogen. Determine i) Mass fraction of the each component ii) Mole fraction of each component iii) Gas constant of the mixture. **[7M]**

8. (a) What is transition flow. Explain the psychometric chart **[7M]**

   (b) One kilogram of moist air initially at a total pressure of 1 atm has a dry bulb temperature of 20^oC and a RH of 60% and is contained in a closed rigid container. Determine the heat that must be transferred to the moist air in order to increase the DBT to 40^oC. Calculate the final pressure and final RH of the mixture. Suppose that heat is transferred to the system from a heat source at 100^oC, determine the total entropy change associated with this process. **[7M]**

UNIT – V

9. (a) Obtain the expression for the air standard efficiency of Otto cycle. **[7M]**

   (b) An engine is working on Otto cycle has a volume of $0.45m^3$ pressure, 1bar and temperature 30^0C at the beginning of the compression stroke. At the end of the compression stroke the pressure is 11bar, 210kJ of heat is added at constant volume. Determine efficiency and mean effective pressure. **[7M]**

10. (a) Explain Brayton cycle with a neat sketch of P-V and T-s diagrams and write the expression for the air standard efficiency. **[7M]**

    (b) An engine equipped with a cylinder having bore of 15 cm and stroke of 45 cm operates on an Otto cycle. If the clearance volume is 2000 cm^3, compute the air standard efficiency. **[7M]**