INDIAN MARITIME UNIVERSITY
(A Central University, Govt.of India)

May/June 2015 End Semester Examinations

SEMESTER – I, B.TECH (MARINE ENGINEERING)

BASIC THERMODYNAMICS (T 2103 / T 1103)

Date:12.06.2015   **Max.Marks:100**
Time:-3 Hrs   **Pass Marks:50**

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PART – A   (3 x10 = 30 Marks)
Compulsory Questions

1. a) Define path function & point function?

    b) Define first law of thermodynamics? And write the different types of thermodynamic systems.

    c) What is an equation of state? Write its expression.

    d) Prove $\gamma= 1+R/C_v$

    e) Name the different types of steam? And explain the dryness fraction.

    f) Define specific volume of steam? Write the enthalpy equation for wet steam.

    g) Define equivalent evaporation?

    h) Define boiler efficiency?

    i) Define mean effective pressure, and air standard cycle efficiency?

    j) Draw the P-V and T-S diagram for the dual cycle?

PART -B   (5x14=70 Marks)

2. In a boiler And turbine plant the steady flow conditions are 3600kg of water per hour enter the boiler at specific enthalpy of 840 kJ/kg and velocity of 300 m/min at 5m elevation. Water receives heat at constant pressure in the boiler and increases the specific enthalpy to 3140 kJ/kg and the steam formed enters the turbine. The steam leaves the turbine at velocity of 3000m/min at an elevation of 1m and specific enthalpy of 2640 kJ/kg. Heat loss from the turbine and the boiler to the surroundings is 72000 kJ/hour. Determine the power output of the turbine?

3. Prove the specific heat relation $(C_{p-} Cv) = vT\beta^2/k$.

4. Draw the phase equilibrium diagram for a pure substance on T-S plot with relevant constant property lines? Show the isobars on T-S plot, and explain with suitable example.

5. A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250^0 C.The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy, and the internal energy.

6. A coal fired boiler plant consumes 400 kg of coal per hour. The boiler evaporates 3200 kg of water at 44.5^{0}C in to superheated steam at 12 bar and 274.5^{0}C. If the calorific value of fuel is 32760 kJ/kg of coal, Determine 1. Equivalent evaporation "from and at 100^{0}C", 2. Thermal efficiency of the boiler.

7. An air standard dual cycle has a compression ratio of 16, and compression begins at 1 bar,50^{0}C. The maximum pressure is 70 bar. The heat transferred to air at constant pressure is equal to heat at constant volume.
   Estimate (a) the pressure and temperature at the cardinal points of the cycle.
           (b) The cycle efficiency and
           (c) The M.E.P. of the cycle. C_v = 0.718 kJ/kg K, C_p = 1.005 kJ/kg K.

8. A four cylinder diesel engine works on four – stroke cycle has a cylinder bore of 900 mm and a stroke of 150 mm. The crank speed is 370 rpm, and fuel consumption is 15 kg/hr, having a calorific value of 39000 kJ/kg. The indicated mean effective pressure is 5 bar. If the compression ratio is 14 and cut off ratio is 2.3. Calculate the relative efficiency.

   Taking γ = 1.4.

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