15-12-14

QP Code : **12546**

[3 Hours] [Total Marks: 80

N.B. (1) Question no. **1** is **compulsory**.
   (2) Attempt any **three** questions out of remaining **five** questions.
   (3) Figures to the right indicate full marks.
   (4) Assume suitable **data** wherever necessary.
   (5) Use of steam Table and moiller chart permitted.

1. Attempt any five:—   20
   (a) Explain the following terms:-
      (i) System
      (ii) State
      (iii) Property
      (iv) Process.
   (b) Prove that Internal energy is a property of a system
   (c) 2 kg of steam is at 10 bar and 0.85 Dry determine its enthalpy and specific volume.
   (d) Write a short note on Perpetual motion machines of first and second kind
   (e) Explain Clausius Inequality
   (f) Define availability, unavailability and irreversibility
   (g) Give similarities and dissimilarities between Heat and Work

2. (a) 1kg of air at 1bar and 300k is compressed adiabatically till its pressure   10
      becomes five times the original pressure, then it is expanded at constant
      pressure and finally cooled at constant volume to return to original
      conditions. Calculate heat transfer & internal energy for each process &
      for the cycle. $C_v = 718$ kJ/kg k, γ =1.4
   (b) Explain principle increase of entropy.   4
   (c) Explain Reheat and regenerative rankine cycle.   6

3. (a) An inlet to a certain nozzle the enthalpy of a fluid is 2500kJ/kg and   10
      velocity of is 50m/s, at the discharge the enthalpy is 2000kJ/kg, the heat
      loss and elevation can be neglected,
      find (1) velocity at the exit (2) calculate mass flow rate if the inlet area
      is 0.2m2 and specific volume is 015m3/kg.(3) If the specific volume at
      outlet is 0.5m3/kg, find the exit area.
   (b) Explain in brief inversion curve and joule Thompson coefficient   5
   (c) Derive an expression for workdone in a reversible polytropic process   5
      executed by a closed system.

[TURN OVER

GN-Con: 11498-14.

4. (a) In an air standard diesel cycle the piston strike is 30 cm and cylinder   10
        diameter is 20 cm. the pressure and temperature at beginning of
        compression are 1bar and 27° c .the cut off takes place at 10% of the
        stroke and the compression ratio is 16. find pressure and temperature at
        all the points and efficiency of the cycle.
    (b) State and prove carnots theorem.   5
    (c) State the Zeroth law of thermodynamics. What is its significance?   5

5. (a) Derive an expression for air standard efficiency of otto cycle.   8
    (b) A reversible heat engine is supplied with heat from two constant temperature   12
        source at 900k and 600k and rejects heat to a constant temperature at 300
        if the engine executes number of cycles while develops 100 KW power
        and rejecting 3600 KJ of heat per min, Determine the heat supplied by
        heat source per min and efficiency of the cycle.

6. (a) State the Kelvin-Planck and Clausius statement of the second law of   6
        thermodynamics and explain the same in brief.
    (b) Write the steady flow energy equation and apply it to-   4
            (i) Nozzle
            (ii) Compressor
    (c) In a Rankine cycle the steam at the inlet to the turbine is at 100 bar and   10
        500°C and the exhaust pressure is 0.5 bar determine the pump work, turbine
        work, condenser heat flow and Rankine efficiency

GN-Con: 11498-14.