[Time: 3 Hours]   [Marks:80]

Please check whether you have got the right question paper.

N.B: 1.   **Question No 1 is compulsory.**
         2.   Attempt any three out of remaining five questions.
         3.   Figures to the right indicate full marks.
         4.   Assume suitable data if required.
         5.   Use of steam Table and moillerchart permitted.

Attempt any five

Q.1   a)   Explain the following terms:-   20
           i)   System.
           ii)   State
           iii) Property
           iv)   Process.
      b)   Explain briefly first law of thermodynamics and explain its signifance.
      c)   2 kg of steam is at15 bar and 0.95 Dry determine its enthalpy and specific volume.
      d)   Explain Intensive and extensive properties with examples.
      e)   Compare Otto, Diesel and Dual cycle based on same compression ratio.
      f)   Define availability, unavailability and irreversibility.
      g)   Give similarities and dissimilarities between Heat and Work.

Q.2   a) $0.2 m^3$ of air at 4bar and $130^0 c$ is contained in a system. A reversible adiabatic expansion   10
           takes place till the pressure falls to 1.02bar.the gas is then heated at constant pressure till
           the enthalpy increases by 72.5kJ.Calculate;1)work done 2)index of expansion, if the above
           processes are replaced by a single reversible polytrophic process giving the same work
           between the same initial and final states?
      b)   State the Kelvin-Planck and Clausius statement of the second law of thermodynamics and   06
           explain the same in brief.
      c)   Write the steady flow energy equation and apply it to −1) Boiler2)   condenser   04

Q.3   a)   Airflows steadily at the rate of 0.5kg/s through an air compressor, entering at 7m/s   10
           velocity, 100kpa pressure and 0.9m3/kg volume, and leaving at5m/s, 700kpa and
           0.19m3/kg.The internal energy of the air leaving is 90kJ/kg greater than that of the air
           entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of
           58KW. (a) Compute the rate of shaft work input to the air in K.W. (b) find the ratio of the
           inlet pipe diameter to the outlet pipe diameter.
      b)   Explain in brief inversion curve and joule Thompson coefficient   05
      c)   Derive an expression for work done in a Adiabatic process executed by a closed system.   05

Q.4   a)   A dual cycle has a compression ratio of 15 and compression begins at 1   bar and 400c.   10
           The maximum pressure is 65bar.The heat transferred to air at constant pressure is equal to
           that at constant volume. Estimate: 1)Pressure and temperature at all the points and 2)
           Cycle efficiency
      b)   State and explain clausius inequality.   05
      c)   State the Zeroth law of thermodynamics. What is its significance?   05

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Q.5 a) Derive an expression for air standard efficiency of Diesel cycle. **08**

   b) Three Carnot engine R1, R2, R3operate in series between two heat reservoirs which are at **12**
      1000k and 300k.calculate the intermediate temperatures if the amount of work produced
      by the engine is in the proportion of 5:4:3.

Q.6 a) In a Rankine cycle the steam at the inlet to the turbine is at 10Mpa and 4500 C and the **10**
      exhaust pressure is 0.6 bar determine the pump work, turbine work, condenser heat flow
      and Rankine efficiency.

   b) Explain principle increase of entropy. **04**

   c) Explain Reheat and regenerative Rankine cycle. **06**