DIPLOMA IN MECHANICAL ENGINEERING (DME) /ADVANCED LEVEL CERTIFICATE IN MECHANICAL ENGINEERING (DMEVI/ACMEVI)

Term-End Examination

December, 2013

BME–052 : BASICS OF THERMAL ENGINEERING

Time : 2 hours   *Maximum Marks : 70*

Note : *Answer **any five** questions. Use of scientific calculator is **permitted**. Use of steam table, Mollier chart are **permitted**.*

1.   (a)   Explain the following :   5+9
         (i)   Thermodynamic properties
         (ii)   Thermodynamic equilibrium
     (b)   Calculate the change in internal energy, heat transfer and change in enthalpy for 0.5 kg of air expanding according to the law $Pv_{1.2}=c$ from 10 bar and 300°C to 1 bar. What will be the work done by the air during the expansion ? $R=287$ J/kgK.

2. (a) Explain Clausius inequality   **4+10**
   (b) A reversible heat engine receives heat from a reservoir at 1000 K and rejects heat at a temperature at T_2. A second reversible heat engine receives heat rejected by the first engine and rejects heat at a temperature of 100K. Determine temperature T_2 for
      (i) equal efficiency of both engines
      (ii) equal work of both engines.

3. (a) What is the purpose of steam safety valve ?   **6+8** Explain its working with neat sketch.
   (b) 1 kg of steam at 10 bar and 0.95 dry is throttled to 3 bar. Determine :
      (i) final quality of steam
      (ii) change in internal energy
      (iii) change in entropy

4. (a) Explain regenerative steam cycle with neat   **4+10** sketch.
   (b) Steam is supplied to a turbine at a pressure of 32 bar and temperature of 420°C. It expands isentropically to a pressure of 0.08 bar. What is the dryness fraction at the end of expansion and thermal efficiency of the cycle ? Calculate the turbine power if the flow rate is 10kg/s.

5. (a) Explain the working and construction of   **7+7** impulse steam turbine.
   (b) Explain the working of Babcock and Wilcox Boiler with neat sketch.

6. (a) Explain the construction of any one type of   **7+7** natural draft type cooling tower with the help of a neat sketch.
   (b) Briefly explain the fuel handling process circuit in a power plant.

7. (a) Explain the following : 6+8
   (i) Thermal Radiation
   (ii) Stefan Boltzmann's law
   (iii) Kirchoff's law of radiation.
   (b) A standard CI pipe (inner dia 50mm and outer dia 55mm) is insulated with magnesium insulation ($K = 0.02$ W/m°C). Temperature at interface between pipe and insulation is 300°C. The allowable heat loss is 600W/m length of pipe and for the safety, outside surface temperature must not exceed 100°C. Determine the minimum thickness of insulation required and temperature of the inside surface of the pipe. Assume K of pipe 20 W/m°C

8. Write short notes on the following : 7+7
   (a) Wind Energy
   (b) Nuclear Energy.