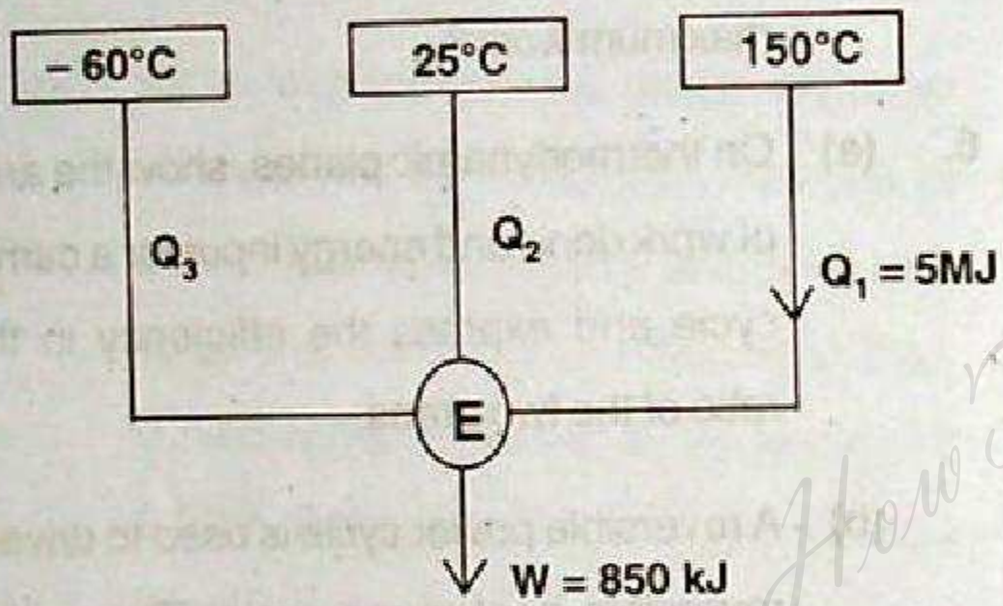
7. A reversible engine, as shown, during a cycle draws 5 MJ from 150°C reservoir and does 850 KJ of work. Find the amount and direction of heat interaction with other reservoirs. 10



Or

Discuss with schematic diagram electric power generation in a thermal power plant. How the plant efficiency is calculated ? 10

8. Write short notes on : 2.5×4

(a) Point and path functions

(b) Control volume

(c) Heat pump and refrigerators

(d) Calibration of thermometers.

(b) Differentiate between extensive and intensive property with one example.

(c) One Kilogram of air is compressed at constant temperature of 100°C until the volume is halved. How much heat is rejected ?

(d) A heat pump is to provide 2000 kJ / hr to a house maintained at 20°C. If it is –20°C outside, what is the minimum power requirement ?

(e) Define Zenoth law of thermodynamics with an example.

(f) Define pure substance. Can air be considered as a pure substance ?

(g) Differentiate between enthalpy and internal energy of a system.

(h) Find the volume ocupied by 4 kg of steam at 200°C at a quality of 80%.

(i) Steam, in a system, is condensed by rejecting heat to the environment. The entropy of the system increases or decreases. Justify.

j) A subcooled liquid (water) is heaed to superheated vapour. Show the process on a p-v plane.

Air flows through the supersonic nozzle. The inlet conditions are 7kPa and 420°C. The nozzle exit diameter is adjusted such that the existing velocity is 700 m/s. Calculate :

(a) the exit temperature

(b) the mass flow rate

(c) the exit diameter. Neglect the heat loss. 10

3. (a) Air contained in a circular cylinder is heated until a 100 kg weight is raised 0.4 m. Calculate the workdone by the expanding air on the weight. Atmospheric pressure is 80 kPa and the cylinder diameter is 0.3 m. Neglect friction. 5

(b) Air is expanded in a piston.Cylinder arrangement at a constant pressure of 200 kPa from a volume of 0.1 m^3 to a volume of 0.3 m^3. Then the temperature is held constant during an expansion of 0.5 m^3. Determine the total work done by the air. 5

4. The inside pressure of a steam boiler is 0.95 MPa. It contains 6.0 m^3 of steam and 3 m^3 of water. Steam is taken out at constant pressure until 2 m^3 of water is left. What is the heat transfer during the process ? 10

5. (a) Show that for an ideal gas, the slope of the constant volume line on the T-s diagram is more than that of the constant pressure line. 5

(b) Why does isothermal compression need minimum work and adiabatic compression maximum work ? 5

(a) On thermodynamic planes, show the area of work done and energy input for a carnot cycle and express the efficiency in the ratio of the two areas. 5

(b) A reversible power cycle is used to drive a reversible heat pump cycle. The power cycle takes in Q_1 heat units at T_1 and rejects Q_2 at T_2. The heat pump abstracts Q_4 from the sink at T_4 and discharge Q_3 at T_3. Develop an expression for the ratio $\frac{Q_4}{Q_1}$ in terms of the four temperatures. 5

Total number of printed pages – 7

B. Tech

BENG 1103/BE 2103

Second Semester Examination – 2009

THERMODYNAMICS

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

Use of steam table is allowed.

1. Answer the following questions : 2 × 10

   (a) What is the standard atmosphere (in meter) when measured by ammonia coloumn. (Density of ammonia = 600 kg/m^3).

P.T.O.