Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech
BE 2103

First Semester (Back / Special) Examination – 2013

THERMODYNAMICS

QUESTION CODE : D 179

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.

1. Answer the following questions : 2×10

   (a) Write two thermodynamic systems with one example on each.

   (b) Write two differences between isentropic and adiabatic processes.

   (c) What is the principle of temperature measurement by a thermocouple. Give one example of it.

   (d) Name and state the law of partial volume for a gas mixture.

   (e) Derive the energy equation for an isothermal process.

   (f) Write two reasons 'why Carnot cycle is not practically possible'.

   (g) Explain the critical point of water vapour and show it on h-s plain.

   (h) All forms of energy are equivalent in their ability to do work, is it true ? Explain.

   (i) What is the function of a compression ring in an I.C. engine ?

   (j) What do you mean by 1.5 Ton Air conditioner ?

P.T.O.

2. (a) Explain the phase transformation of water from freezing state to superheated state. 4

(b) Steam at 15 bar and 0.9 dry is supplied to a super heater at the rate of 5000 kg/h,the temperature of the steam coming out of the super heater is 300° C. the temperature of feed water supplied to the boiler at 45° C. Calculate :

(i) heat supplied in the boiler.

(ii) heat supplied in the super heater. 6

3. (a) Show that for an ideal gas, $C_p - C_v = R$. 4

(b) 0.4 kg of air at 6 bar receives an amount of heat at constant value, so that its temperature rises from 383 K to 923 K. It is then expanded polytropically according to $pV^{1.32}$= constant to initial temperature and finnaly, it is compressed isothermally to its original volume. Calculate 6

(i) pressure at end states, and

(ii) work transfer and heat transfer during each process.

Take : $C_v = 0.718$ and $R = 0.287$ kj/kg.K

4. Steam at 5 MPa and 500° C enters a nozzle steadily at a velocity of 80 m/s and it leaves at 2 MPa and 400° C. The inlet area of the nozzle is 38 cm^2 and the heat is being lost at a rate of 8 kJ/s. Determine 10

(a) mass flow rate of the steam

(b) the exit velocity of the steam and

(c) the exit area of the nozzle.

5. Two carnot refrigerators A and B are arranged in series. Prove that the overall COP of the combined system is given by $\{(COP)_A \times (COP)_B\}/\{1 + (COP)_A + (COP)_B\}$ 10

6. (a) State and prove the Carnot theorm. 5

(b) Determine the minimum heat input to a heat engine that operates between 350° C and 25° C and produces 100 kj of work. 5

7. Describe a thermal power plant with a neat schematic diagram and explain the function of each component. 10

8. Write notes on the following : 2.5×4

(a) Throttling calorimeter

(b) Principle of entropy increase

(c) Bourden pressure gauge

(d) Heat transfer by radiation.