Code: 9A14302

R09

B.Tech II Year I Semester (R09) Supplementary Examinations June 2017
ENGINEERING THERMODYNAMICS
(Mechatronics)

Time: 3 hours   Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

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1   (a)   What do you mean by homogenous and heterogeneous systems?

    (b)   A closed cylinder of 0.25 m diameter is fitted with a light frictionless piston. The piston is retained in position by a catch in the cylinder wall and the volume on one side of the piston contains air at a pressure of 750 kN/m^2. The volume on the other side of the piston is evacuated. A helical spring is mounted coaxially with the cylinder in this evacuated space to give a force of 120 N on the piston in this position. The catch is released and the piston travels along the cylinder until it comes to rest after a stroke of 1.2 m. The piston is then held in its position of maximum travel by a ratchet mechanism. The spring force increases linearly with the piston displacement to a final value of 5 kN. Calculate the work done by the compressed air on the piston.

2   (a)   Define internal energy. How is energy stored in molecules and atoms?

    (b)   A gas of mass 1.5 kg undergoes a quasi-static expansion which follows a relationship $p = a + bV$, where a and b are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.20 m^3 and 1.20 m^3. The specific internal energy of the gas is given by the relation:
$$u = 1.5\, pV - 85\ kJ/kg.$$
Where p is in kPa and V is in m^3/kg. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion.

3   (a)   Establish the equivalence of Kelvin – Planck and Clausius statements.

    (b)   Show that the efficiency of a reversible engine operating between the same temperature levels is the same.

4   Show that the efficiency of Otto cycle depends only on the compression ratio.

5   With a neat sketch, explain the working of vapour compression cycle.

6   (a)   What is a heat engine?

    (b)   Explain the working principle of 2-S S.I engine with a neat sketch.

7   What are the four stages of combustion in C.I engine? Explain each stage clearly.

8   Discuss about open and closed gas turbine cycle clearly with a neat sketch.

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