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ET-201(B)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) / B.Tech. (Aerospace Engineering)

Term-End Examination

01100

June, 2015

ET-201(B) : ENGINEERING THERMODYNAMICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Use of steam tables and calculator is permitted.*

1. (a) A vessel of cylindrical shape is 50 cm in diameter and 75 cm high. It contains 4 kg of gas. The pressure measured with manometer indicates 650 mm of Hg above the atmosphere when the barometer reads 760 mm of Hg. Determine

(i) the absolute pressure of the gas in the vessel, in bar,

(ii) specific volume and density of the gas. *6*

(b) Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. *4*

2. A Carnot engine working between 400°C and 40°C produces 130 kJ of work. Determine

(i) the engine thermal efficiency,

(ii) the heat added,

(iii) the entropy changes during heat rejection process. *10*

3. (a) Define heat transfer. Differentiate between conduction, convection and radiation. *5*

(b) What is the first law of thermodynamics ? Describe enthalpy, internal energy and entropy. *5*

4. (a) Draw the layout and explain the working of a steam power plant. *5*

(b) Draw a schematic diagram and explain the working of a refrigerator. *5*

5. (a) On a steam power plant the work output of the turbine is 150 kJ, while heat supplied at the boiler is 400 kJ. Given that during the same period work input to the pump is 0·5 kJ. Find the heat rejected at the condenser and thermal efficiency of the plant. *6*

(b) Explain the following : *4*

(i) Reversible and Irreversible adiabatic processes

(ii) Available and Unavailable energy

6. An insulated cylinder having an initial volume of 25 litres contains oxygen at 150 kPa, 227°C. The gas is compressed to 1·5 MPa in a reversible adiabatic process. Calculate the final temperature and work assuming oxygen behaves as an ideal gas with C_p = 0·922 kJ/kg.K and R = 259·82 J/kg.K. *10*

7. (a) Draw a schematic diagram and explain the working of an Aircraft cooling system. *4*

(b) In an ideal air cycle refrigeration system, air enters the compressor at 1 bar, 5°C and is compressed to 3 bar. The air is then cooled at constant pressure to 50°C and then expanded in a turbine to 1 bar. The cooling capacity of the system is 10 kW. Assume air behaves as a perfect gas with C_p = 1·005 kJ/kg.K and C_v = 0·718 kJ/kg.K. Find the

(i) COP,

(ii) Mass flow rate of air and

(iii) Power required by the system. *6*

8. An air compressor has a volumetric efficiency of 70% when tested, the discharge state being 500 kPa, 150°C and inlet state 100 kPa, 15°C. If the clearance is 4%, predict the new volumetric efficiency, when the discharge pressure is increased to 700 kPa. Assume that the ratio of real to ideal volumetric efficiency and the exponent n remains constant. *10*

9. (a) What do you understand about energy management ? Describe the role of energy manager. *5*

(b) Describe the following concepts : *5*

(i) Principle of energy conservation

(ii) Scope of energy audit

10. Write short notes on any ***four*** of the following : $4 \times 2\frac{1}{2} = 10$

(a) Heat Exchangers

(b) Energy Resources

(c) Heat Pump

(d) Dryness Fraction

(e) Kelvin-Planck Statement

(f) Constant-Volume Processes