C 15215

(Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2010

ME 04 403—THERMODYNAMIC

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

1. (a) Explain thermodynamic system, property and process.

   (b) Write down the general energy equation for study flow system and explain each term in it. Simplify the equation when applied for pump and steam nozzle.

   (c) State limitations of thermodynamics first law. Mention both the statements II law of thermodynamics.

   (d) A heat engine receives 1000 kJ of heat from high temperature source at 800° C during the cycle. The work develop by this engine is 350 kJ and the remaining energy is rejected as heat to a sink at 30° C. Check the validity of this engine on the basis of the Clausius inequality.

   (e) Define volume expansivity and isothermal compressibility.

   (f) Mention and define any *two* psychrometric properties.

   (g) What is meant by stoichiometric ratio ?

   (h) What is meant by enthalpy of formation ?

2. (a) Unit mass of gas is contained in a cylinder at an initial pressure of 20 bar. The gas is allowed to expand behind a piston according to a law pV^{12} = Constant until the volume is doubled. The gas is then cooled at constant pressure until the volume reduced to its initial value and the piston regains its original position. Then at constant volume heat is added till the pressure rises to the original value of 20 bar. Calculate the network done by the gas. Assume the initial volume of gas as 0.05 m^3.

Or

   (b) (i) The inlet condition of steam for an adiabatic turbine is 2 MPa and 350° C. The mass flow rate is 1.5 kg/s. The condition of leaving steam is 0.1 MPa and 90 % dry. the velocity of steam at inlet and outlet of the turbine are 50 m/s and 110 m/s respectively. Determine the power output of the turbine.

(8 marks)

   (ii) Air enters a centrifugal compressor at 1.05 bar and 15° C and leaves at 2 bar and 97° C. The mass flow rate is 50 kg/min. Find out the power required to drive the compressor. Take C_p of air as 1.005 kJ/kg K.

(7 marks)

Turn over

3. (a) State and prove clausius inequality.

Or

(b) (i) What do you understand by "useful work" ? (7 marks)

(ii) Explain Helmholtz function and Gibbs function. (8 marks)

4. (a) (i) Derive the first and second Tds equations also known as entropy equations. (8 marks)

(ii) Get an expression for entropy change of mixture of gases. (7 marks)

Or

(b) Explain in detail about Law of corresponding states. (15 marks)

5. (a) (i) What are the characteristics of hydrocarbon fuels ? List out few hydrocarbon fuels. (8 marks)

(ii) Explain theoretical and actual combustion process. (7 marks)

Or

(b) Discuss flue gas analysis. How is volumetric analysis converted into weight analysis ?

(4 × 15 = 60 marks)