DEC-2007

2007-CALICUT UNIVERSITY

B.TECH IV SEMESTER DEGREE EXAMINATION

THERMODYNAMICS

(MECHANICAL ENGINEERING)

TIME-3HOUR
MARKS-100

ANSWER FULL QUESTIONS

SECTION A 8*5=40 MARKS

I. (a) List out two modes in which energy crosses the boundary of a system. Mention the similarities between them.

(b) What is a PMM 1 ? Why is it impossible ?

(c) A heat engine receives 1000 kJ of heat from high temperature source at 800° C during a cycle. The work developed by this engine is 300 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 carnot theorem.

(d) Unit mass of air has an initial pressure and temperature of 140 kPa, and 25° C respectively. It is compressed to a pressure of 1.4 MPa and temperature of200° C. Determine the change in entropy.

(e) Using the clapeyron equation, estimate the enthalpy of vaporization of steam at 200 kPa, and compare it to the tabulated value.

(f) Draw the phase equilibrium diagram for a pure substance on p-T coordinates. Why does the fusion line for water have negative slope ?

(g) Discuss about combustion and air-fuel ratio.

(h) What is meant by enthalpy of reaction ?

SECTION B 4*15=60 MARKS

II. (a) (i) A mass of 1.2 kg. of air at 150 kPa and 12° C is contained in a gas tight, frictionless piston-cylinder device. The air is now compressed to a final pressure of 600 kPa by keeping the temperature inside the cylinder constant. Calculate the work done during the process.

(ii) A stationary mass of gas is compressed without friction from an initial state of 0.3 in.3 and 0.105 MPa to a final state of 0.15 m.3 and pressure remain constant. The heat transferred from the gas during this process is 40 kJ.Find out the change in internal energy and indicate whether it is positive or negative.

Or

(b) (i) Write SFEE for a single stream entering and leaving a control volume and explain various terms in it. Derive the steady flow energy equation for a adiabatic compressor.

(ii) The mass flow rate into a steam turbine is 1.5 kg/s, and the heat transfer from the turbine is 8 kW. The inlet condition of steam is 2 MPa and 350°C. 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 100 m/s respectively. Determine the power output of the turbine.

III. (a) State and prove Clausius inequality.

Or

(b) What is meant by availability ? Get expressions for availabilities of a closed system and a steady flow open system.

IV. (a) (i) What is the condition for exact differential ?

(ii) Derive Maxwell's equations.

Or

(b) (i) Show that for an ideal gas Cp-Cv = R.

(ii) What is meant by compressibility factor ? Explain generalized compressibility chart,

V. (a) Explain first law analysis of steady flow reacting systems.

Or

(b) Explain how the calorific value of a solid fuel is determined by Bomb Calorimeter.