SUBJECT: Basic Mechanical Engineering

Part-I

Q1 Answer the following questions:
(2 x 10)

a) Differentiate between microscopic and macroscopic view point of thermodynamics.

b) State Zeroth law of thermodynamics with example.

c) State the first law of thermodynamics.

d) What is PMM2?

e) What is the relation between the COP of refrigerator and heat-pump?

f) Define dryness fraction.

g) Write different types of power transmission system.

h) What is Robot Anatomy?

i) What is entropy principle?

j) Explain the purpose of compressor in a refrigeration system.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

a) Show that energy is a property of a system.

b) Define enthalpy. Why does the enthalpy of an ideal gas depend only on temperature?

c) When a stationary mass of gas was compressed without friction at constant pressure, itsinitial state of 0.4 m3 and 0.105 MPa was found to change to final state of 0.20 m3 and 0.105 MPa. There was a transfer of 42.5 kJ of heat from the gas during the process. What was the change in internal energy of the gas?

d) Derive the steady flow energy equation (SFEE) for a single stream entering and a single stream leaving a control volume.

e) An inventor claims to have developed an engine that takes in 105 MJ at a temperature of 400 K, rejects 42 MJ at a temperature 200 K and delivers 15 kWh of mechanical work. Would you advise investing money to put this engine in the market?

f) Show that for an ideal gas, the slope of the constant volume line on the T-s Diagram is more than that of the constant pressure line.

g) Which is more effective way to increase the efficiency of a Carnot engine: to increase T1, keeping T2 constant; or to decrease T2, keeping T1 constant?h) Explain the different types of coupling.

i) Explain the principle and working of vapour compression refrigerator system.

j) Explain briefly about different types of brakes.

k) Explain working of pitot tube with neat sketch.

l) Explain different types of Robot Configuration.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)
(16)

Q3 A large insulated vessel is divided into two chambers, one containing 5 kg of dry saturated steam at 0.2 MPa and the other 10 kg of steam, 0.8 quality at 0.6 MPa. If the partition between the chambers is removed and the steam is mixed thoroughly and allowed to settle, find the final pressure, steam quality, and entropy change in the process.

Q4 A reversible polytropic process begins with a fluid at pressure of 10 bar, temperature of 200°C and ends at pressure of 1 bar. The exponent n has the value 1.15. Find the final specific volume, the final temperature and the heat transfer per kg of fluid if (a) the fluid is air, and (b) the fluid is steam.
(16)

Q5 (a) Explain the working of steam power plant and give its layout.
(8x2)

(b) Explain the working of four stroke petrol engine with neat sketch.

Q6 (a) Explain the principle of single stage reciprocating air compressor and heat pump with sketch.
(8x2)(b) Explain the principle of force and torque measuring methodology with sketch.