Roll No ....

MMTP - 102

M.E./M. Tech., I Semester

Examination, June 2014

Thermodynamics And Combustion

Time : Three Hours

Max. Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Air tank has three manometers connected to it, the fluids in them are oil (sp. gravity = 0.8), water and mercury (sp. gravity = 13.6). If the absolute pressure in the tank is 1.2 bar and the manometer reads 760mm of Hg. Estimate the height of fluid in each manometer.

   b) Explain with simple sketches, thermodynamic systems-Closed, open, adiabatic, isolated.

2. a) Compare the first law of thermodynamics with second law with examples.

   b) A domestic food freezer maintains a temperature of 15°C. The ambient air temperature is 30°C. If heat leaks into the freezer at the continuous rate of 1.75 KJ/s, what is the minimum power required to pump this heat out continuously?

3. Two kg of air at 6.86 bar absolute and 90°C pass through a reversible non-flow polytrophic process represented by

$$pv^{1.1} = constant$$

till the pressure falls to 1.37 bar.

Calculate:

   a) The final temperature, specific volume and change in entropy.

   b) Work and heat transfer.

   c) What will be the answers if process was irreversible and adiabatic between the same end states?

4. a) State Vander walls equation for real gases. Determine the constants of Vander walls equation. Also state its limitations.

   b) Steam enters a steam condenser at the rate of 3600 kg per hour. The inlet and exit specific enthalpies of steam and condensate are respectively 605 kJ/kg and 32.2 kJ/kg. If 264.6 m^3 of cooling water at a specific enthalpy of 21.1 kJ/kg is passed through the condenser, find the specific enthalpy of the cooling water.

5. Define and explain the following:

   a) Triple point   b) Critical point

   c) Clapeyron's equation

6. a) Determine the flue gas analysis and air-fuel ratio by weight when a medium viscosity fuel oil with 84.9% Carbon, 11.4% hydrogen, 3.2% sulphur, 0.4% oxygen and 0.1% ash is burned with 20% excess air. Assume complete combustion.

   b) Explain laminar and turbulent flames.

7. a) Discuss types of combustion processes.

   b) Calculate the limits of inflammability of a gas containing 25.0% CH_4, 45% H_2, 10% CO, 10% CO_2 and 10% N_2.

8. a) Discuss properties and structures of pre-mixed and diffusion flames.

   b) Classify Gas burners. Discuss Fluidised Bed Combustion (FBC).

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