No. of Printed Pages : 4

BME-052

01682

DIPLOMA IN MECHANICAL ENGINEERING/ ADVANCED LEVEL CERTIFICATE IN MECHANICAL ENGINEERING (DMEVI/ACMEVI)

Term-End Examination

December, 2011

BME-052 : BASICS OF THERMAL ENGINEERING

Time : 2 hours *Maximum Marks : 70*

Note : *All questions are **compulsory**.*
*Use of **scientific** calculator is **permitted**.*
Use of steam table, Mollier diagram are permitted.

1. Answer *any two* of the following :

(a) Derive an expression for workdone by adiabatic process. **2x7 =14**

(b) Define the following terms :

(i) System (ii) Surroundings

(iii) Property (iv) Process

(v) Workdone (vi) Specific heat

(vii) Heat.

(c) State the following laws / equation (only write) :

(i) Zeroth law of thermodynamics

(ii) First law of thermodynamics

(iii) Second law of thermodynamics

(iv) Charlie's law

(v) Boyle's law

(vi) Characteristic gas equation

(vii) Universal gas constant.

2. Answer *any two* of the following : **2x7 = 14**

(a) Determine the state/quality of steam (ie) whether the steam is wet, dry or super heated in the following cases.

(i) Steam has a pressure of 10 bar and specific volume 0.185 m^3/kg.

(ii) Steam has a pressure of 15 bar and temperature of 215°C.

(b) Steam is generated at 8 bar from water at 32°C. Find the heat required to produce 1 kg of steam.

(i) When the dryness fraction is 0.8

(ii) When the steam is dry and saturated.

(c) Calculate the rate of heat required in the boiler which produces 8000 kg of steam in 5 Hours from feed water at 120°C, the pressure of steam being 10 bar absolute. Assume that the steam is dry and saturated.

3. Answer *any two* of the following : **2x7 =14**

(a) A surface condenser receives 16.5 kg of steam per minute. The temperature of steam entering the condenser is 35°C and it's dryness fraction is 0.85. The temperature the cooling water as it enters is found to be 20°C and the same at the exit is found to be 30°C. Calculate the quantity of cooling water required in kg /minute, if the condensate leaves the condenser at 35°C.

(b) Explain *any two* of the following.

(i) Heat conduction

(ii) Convection

(iii) Radiation

(c) Explain the working principle of cooling tower with a neat sketch.

4. Answer *any two* of the following : **2x7 =14**

(a) A 30 cm thick wall of a reactor is made up of an inner layer of fire brick (K = 0.85W/mK) covered with a layer of insulation (K = 0.15w/mK). The reactor operates at a temperature of 1600 K. While

the ambient temperature is 295 K. Calculate the thickness of fire brick and insulation which gives minimum heat loss.

(b) Forced air flows over a convective heat exchanger in a room heater, resulting in a convective heat transfer coefficient of 1.136 kW/m^2 K. The surface temperature of heat exchanger may be considered constant at 65°C and the air is at 20°C. Determine the heat exchanger surface area required for 8.8 kW of heating.

(c) Describe with a line diagram the circulating cooling water circuit of a steam power plant.

5. Write short notes on ***any two*** of the following. **2x7 =14**

(a) Tidal energy

(b) Nuclear energy

(c) Geothermal energy.