CBCS SCHEME

USN | | | | | | | | | | |

18AU32

Third Semester B.E. Degree Examination, Aug./Sept. 2020
Engineering Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***

2. Use of Thermodynamics Data Hand Book, Steam tables, Psychrometry chart are allowed.

Module-1

1 a. State and explain Zeroth law of thermodynamics. Thermocouple with a test junction at t°C on a gas thermometer and cold junction at 0°C gives output emf as per the following relation. $e = 0.20t - 5 \times 10^{-4}t^2$, mV.
Where't' is the temperature. The millivoltmeter is calibrated at ice and steam points. What temperature would this thermometer shown when gas thermometer reads 70°C.? **(10 Marks)**

b. Differentiate between :
i) Macroscopic and Microscopic approach
ii) Open and closed system
iii) Path function and point function
iv) Intensive and Extensive properties
v) Thermal and Mechanical equilibrium. **(10 Marks)**

OR

2 a. Explain working of constant volume gas thermometer with neat sketch. **(06 Marks)**

b. Derive an expression for displacement work is a quasistatic process. **(06 Marks)**

c. Define work and heat. Write the similarities and dissimilarities between them. **(08 Marks)**

Module-2

3 a. Explain unsteady flow process namely tank filling and tank emptying process with relation. **(10 Marks)**

b. 50Kg/min enters the control volume of a steady flow system at 2 bars and 100°C and at elevation of 100m above the datum. The same mass leaves the control volume at 150m elevation with a pressure of 10 bars and temperature of 300°C. The entrance velocity is 2400m/min and exit velocity is 1200m/min. During the process 50000 kJ/hr of heat is transferred to the control volume and the rise in enthalpy is 8kJ/kg. Calculate the power developed. Also find the ratio of inlet to outlet diameter of pipe. **(10 Marks)**

OR

4 a. State Kelvin – Planck's and Clausius statement of second law of Thermodynamic and prove that they are equivalent. **(08 Marks)**

b. The minimum power required to drive a heat pump which maintains a house of 20°C is 3kW. If the outside temperature is 3°C, estimate the amount of heat which the house loses per minute. **(08 Marks)**

c. Briefly explain PMM II and PMM I. **(04 Marks)**

Module-3

5 a. Derive Clausius inequality and hence prove that entropy is a property. **(14 Marks)**

b. Explain briefly available and unavailable energies referred to a cyclic heat engine. **(06 Marks)**

OR

6 a. Explain with neat volume sketch, the method of determining the quality of steam by combined separating and throttling calorimeter. **(10 Marks)**

b. A vessel of volume $0.04m^3$ contains a mixture of saturated water and saturated steam at a temperature of 250ºC. The mass of the liquid present is 9kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy. **(10 Marks)**

Module-4

7 a. Explain the working of ammonia vapours absorption refrigeration system with neat sketch. **(10 Marks)**

b. Explain steam jet refrigeration with neat sketch. **(10 Marks)**

OR

8 a. With a neat sketch, explain the working of the air-conditioning system for hot and dry weather. **(08 Marks)**

b. It is required to design an air conditioned hall for the following condition:

Outdoor condition = 32ºC DBT and 65% RH
Indoor condition = 25ºC DBT and 60% RH
Amount of air circulated = $250m^3/min$
Coil dew point temperature = 13 ºC

If the required condition is achieved first by cooling and dehumidifying and then by heating calculate :

i) Cooling coil capacity and its bypass factor
ii) Heating coil capacity and its surface temperature if its bypass factor is 0.3
iii) Mass of water vapour removed per hour. **(12 Marks)**

Module-5

9 a. Derive the expression for the isothermal work done by a single state reciprocating compressor with and without clearance volume. **(12 Marks)**

b. Explain Multi-stage compression with sketch. Mention its advantages. **(08 Marks)**

OR

10 a. Explain with neat sketch, types of gas turbines. **(10 Marks)**

b. Write short notes on :

i) Turbojet engine
ii) Rocket propulsion. **(10 Marks)**

* * * * *