CBCS SCHEME

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17MA33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of thermodynamic data handbook is permitted.***

Module-1

1 a. With neat sketch, explain constant volume gas thermometer. **(10 Marks)**

b. Obtain the relationship between degree Celsius and Fahrenheit scale. **(10 Marks)**

OR

2 a. Show that work and heat is a path function. **(10 Marks)**

b. A spherical balloon of 1m diameter contains a gas at 1.5 bar. Due to heating the pressure reaches to 4.5 bar. During this process pressure is directly proportional to the diameter cubed of the balloon. Determine the work done. **(10 Marks)**

Module-2

3 a. Show that internal energy is a property of the system. **(10 Marks)**

b. A centrifugal air compressor compresses 5.7 m^3/min of air from 85 kPa to 650 kPa. The initial specific volume is 0.35 m^3/kg and final specific volume is 0.1 m^3/kg. If the suction line diameter is 10 cm and discharge line diameter is 6.25 cm, determine:

i) Change in flow work
ii) Mass flow rate
iii) Change in velocity **(10 Marks)**

OR

4 a. State Kelvin-Planck and Clausius for second law of thermodynamics with TER diagram. **(10 Marks)**

b. A heat engine receives 125 kJ of heat per cycle, from a reservoir at 300°C and rejects heat to a reservoir at 0°C by the following hypothetical amounts (i) 95 kJ/cycle (ii) 59.5 kJ/cycle (iii) 31.25 kJ/cycle, which of these represents reversible, irreversible and impossible cycles? **(10 Marks)**

Module-3

5 a. Derive the expression for mean effective pressure of constant pressure cycle. **(10 Marks)**

b. The minimum pressure and temperature of an Otto cycle are 100 kPa and 27°C, the amount of heat added to air per cycle is 1500 kJ/kg. Determine:

i) The pressure and temperature at all points
ii) The specific work and thermal efficiency if compression ratio is 8. **(10 Marks)**

OR

6 a. With the help of T-S diagram, explain the effect of pressure and temperature in ranking cycle for the following:

i) Effect of superheat
ii) Effect of boiler pressure **(10 Marks)**

b. A steam power station uses the following cycle:
Steam at boiler outlet = 150 bar, 550°C
Condenser at 0.1 bar
Using Mollier chart and assuming ideal processes, find :
i) Quality of steam at turbine exit
ii) Cycle efficiency
iii) Steam rate **(10 Marks)**

Module-4

7 a. Show that entropy is a property of the system. **(10 Marks)**

b. 2 kg of water at 80°C is mixed adiabatically with 3 kg of water at 30°C is a constant pressure process at 1 atm. Find the increase in entropy of total mass of water due to mixing process. **(10 Marks)**

OR

8 a. Define the following:
i) Sensible heat
ii) Latent heat of evaporation
iii) Dryness fraction
iv) Enthalpy of wet steam
v) Enthalpy of superheated steam **(10 Marks)**

b. In a steam engine expansion of steam takes place from 7 bar, 0.98 dry to 0.34 bar by following the law $PV^{1.3} = 6$. Calculate per kg of steam (i) work done (ii) final dryness. **(10 Marks)**

Module-5

9 a. Explain the working principle of vapour compression refrigeration cycle. **(10 Marks)**

b. A cold storage is to be maintained at -5°C while the surroundings are at 35°C. The heat leakage from the surroundings into the cold storage is estimated to be 29 KW. The actual COP is ⅓rd of ideal COP working between the same temperature. Find power in KW. **(10 Marks)**

OR

10 a. Define the following:
i) Specific humidity
ii) Relative humidity
iii) Dry Bulb Temperature (DBT)
iv) Wet Bulb Temperature (WBT) **(10 Marks)**

b. Atmospheric air at 1.0132 bar has DBT of 32°C and WBT of 26°C, compute:
i) Partial pressure of water vapour
ii) Specific humidity
iii) Dew point temperature
iv) Enthalpy of mixture **(10 Marks)**

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