

# CBCS Scheme

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15MA33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018

## Thermodynamics

Time: 3 hrs.

Max. Marks: 80

**Note: 1. Answer any FIVE full questions,**

**choosing ONE full question from each module.**

**2. Use of thermodynamic data hand book and steam tables is permitted.**

### Module-1

- 1 a. Distinguish between the following :
- Microscopic and macroscopic point of view
  - Intensive and extensive property
  - Path function and point function
  - Work and heat. (08 Marks)
- b. Explain briefly the following :
- Quasi – static process
  - Thermodynamic equilibrium. (08 Marks)

OR

- 2 a. Define the following with examples :
- Open system
  - closed system
  - isolates system
  - zeroth law of thermodynamics. (08 Marks)
- b. With a neat P –V diagram, drive an expression for work done in each of the following :
- isothermal process
  - polytropic process. (08 Marks)

### Module-2

- 3 a. Show that internal energy is a property of the system. (08 Marks)
- b. Write the statement of first law of thermodynamics for a system undergoing a cycle and prove by Joule's experiment. (08 Marks)

OR

- 4 a. Define the following :
- I – law applied to cyclic process
  - I -- law applied to non – cyclic process
  - Specific heat at constant volume
  - Specific heat at constant pressure. (04 Marks)
- b. Apply steady flow energy equation to boiler and nozzle. (04 Marks)
- c. State and show that Kelvin – Plank statement and clausis statement are equivalent. (08 Marks)

### Module-3

- 5 a. With the help of P–V and T–S diagram, drive an expression for the air –standard efficiency of otto cycle. (08 Marks)
- b. With the help of T–S diagram, compare Carnot and Rankine vapour cycles operating between same boiler and condenser temperature. (08 Marks)

OR

- 6 a. Compare otto, diesel and dual cycles with the help of P – V and T – S diagram on the basis of same compression ratio and the same heat input. (08 Marks)
- b. With the help of P – V, T – S and h – s diagram, explain simple Rankine cycle. (08 Marks)

Module-4

- 7 a. State and prove Clausius inequality. (08 Marks)
- b. Calculate the internal energy per kg of superheated steam at pressure of 10 bar and a temperature of 300°C. Also find the change in internal energy if the steam is expanded to 1.4 bar and dryness fraction 0.8. (08 Marks)

OR

- 8 a. With a neat sketch explain the measurement of dryness fraction of steam by using throttling calorimeter. (08 Marks)
- b. A fluid undergoes a reversible adiabatic compression from 0.5MPa, 0.2m<sup>3</sup> to 0.05m<sup>3</sup> according to the law  $PV^{1.3} = \text{constant}$ . Determine the change in enthalpy, internal energy and entropy, and also heat and work transfer during the process. (08 Marks)

Module-5

- 9 a. With a neat sketch, explain the working of vapour absorption refrigeration system. (08 Marks)
- b. An air (moist) at 35°C has a dew point of 15°C. Calculate its relative humidity, specific humidity and enthalpy. (08 Marks)

OR

- 10 a. Define and explain briefly the following :  
 i) Specific humidity ( $\omega$ )                      ii) dew point temperature  
 iii) degree of saturation ( $\mu$ )                iv) relative humidity. (08 Marks)
- b. A refrigerator uses R – 134a as the working fluid and operates on an ideal vapour compression cycle between 0.14MPa and 0.8MPa. If the mass flow rate of the refrigerant is 0.06 kg/s, determine :  
 i) The rate of heat removal from the refrigerated space  
 ii) The power input to the compressor  
 iii) The heat rejection rate in the condenser  
 iv) The COP. (08 Marks)

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