

6.9.21
Morning

The Assam Royal Global University, Guwahati
Royal School of Engineering & Technology
BTECH Civil Engineering 4th Semester
Semester End Examination, August 2021
Course Title : Mechanical Engineering
Course Code: MEE022C407

Time: 3 Hours

Maximum Marks: 70

Note: Attempt all questions as per instructions given.
The figures in the right-hand margin indicate marks.

Section – A

- 1. Attempt all questions. (Maximum word limit 50) 2 x 8**
- a. Define a thermodynamic system.
 - b. Differentiate between open system, closed system and an isolated system
 - c. How does a homogeneous system differ from a heterogeneous system?
 - d. Explain the First Law of Thermodynamics as referred to closed systems undergoing a cyclic change.
 - e. State the limitations of first law of thermodynamics.
 - f. Define heat engine, refrigerator and heat pump.
 - g. What is a pure substance? Define latent heat of ice.
 - h. Define triple point and critical point for pure substance.
- 2. Attempt any two of the following: 6 x 2**
- a. Define Intensive and Extensive properties. What is meant by thermodynamic work?
 - b. What is meant by Point and Path function? Explain Zeroth Law of thermodynamics.
 - c. Enumerate the conditions which must be fulfilled by a reversible process. Give some examples of ideal reversible processes.
- 3. Attempt any two of the following: 7x2**
- a. State the First Law of Thermodynamics and prove that for a non-flow process, it leads to the energy equation $Q = \Delta U + W$.
 - b. When a stationary mass of gas was compressed without friction at constant pressure its initial state of 0.4 m³ and 0.105 MPa was found to change to final state of 0.20 m³ and 0.105 MPa. There was a transfer of 42.5 kJ of heat from the gas during the process. How much did the internal energy of the gas change.
 - c. A gas having a volume of 0.05 m³ and pressure of 6.9 bar expands reversibly in a cylinder behind a piston according to law $pv^{1.2} = \text{constant}$ until the volume is 0.08 m³. Calculate the work done by the gas.

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Section – B

4. Attempt **any two** of the following: **7x 2**
- a. In an air motor cylinder the compressed air has an internal energy of 450 kJ/kg at the beginning of the expansion and an internal energy of 220 kJ/kg after expansion. If the work done by the air during the expansion is 120 kJ/kg, calculate the heat flow to and from the cylinder.
 - b. Give the following statements of second law of thermodynamics.
 - (i) Clausius statement
 - (ii) Kelvin-Planck statement
 - c. Derive expressions for entropy changes for a closed system in the following cases :
 - (i) General case for change of entropy of a gas
 - (ii) Heating a gas at constant volume
5. Attempt **any two** of the following: **7 x 2**
- a. Explain the following terms relating to steam formation :
 - (i) Sensible heat of water, (ii) Latent heat of steam,
 - (iii) Dryness fraction of steam, (iv) Enthalpy of wet steam, and
 - (v) Superheated steam
 - b. Describe the process of formation of steam and give its graphical representation also.
 - c. What do you mean by the following :
 - (i) Internal latent heat (ii) Internal energy of steam
 - (iii) External work of evaporation (iv) Entropy of evaporation
 - (v) Entropy of wet steam (vi) Entropy of superheated steam