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 pv1.2 = 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