Roll No. | | | | | | | | | | | | Total No. of Pages: 02

Total No. of Questions: 09

B.Tech (Sem. – 1,2)

# ELEMENTS OF MECHANICALENGINEERING

Subject Code: BTME-101

M Code: 54101

Date of Examination : 21-01-23

Time: 3 Hrs. Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each, carrying EIGHT marks each.
3. Attempt any FIVE questions from SECTION B & C, selecting atleast TWO questions from each of these SECTIONS B & C.

## SECTION-A

**1. Write short notes on:**

a) What is a quasi-static process?

b) What is a pure substance?

c) Explain the term latent heat of steam.

d) Explain the term dryness fraction of steam.

e) What do you mean by PMM of the second kind?

f) Explain the first law of thermodynamics with respect to close systems.

g) Define the term availability.

h) Define the term true stress.

i) Draw (only) and list stress stain diagram of ductile materials.

j) How the composites are different from conventional materials.

## SECTION-B

2. A fluid at a pressure of 3bar, and with specific volume of $0.18m^3/kg$, contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to law, $p = C/V^2$, where C is constant. Calculate the work done by the fluid on the piston.

3. $0.15m^3$ of an ideal gas at a pressure of 15 bar and 550K is expanded isothermally to 4 times the initial volume. It is then cooled at 290K at constant volume and then compressed back polytropically to its initial state. Calculate the net work done and heat transferred during the cycle.

4. Write down the general energy equations for steady flow system and simplify when applied to the following:

   a) Reciprocating air compressor

   b) Steam turbine

5. The heat capacity of a system at constant volume is given by $Cv = ZT^2$, where $Z = 0.045J/K^3$. A system is originally at 250K, and a thermal reservoir at 125K is available.Determine the maximum amount of work that can be recovered as the system is cooled down to the temperature of the reservoir.

## SECTION-C

6. An engine working on otto-cycle has a volume of $0.45m^3$, pressure 1 bar and temperature 30°C at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar. 210kJ of heat is added at constant volume. Determine:

   a) Pressure, temperature and volume at a salient point in the cycle

   b) Percentage clearance

   c) Efficiency

   d) Network per cycle

   e) Mean effective pressure

   f) Ideal power developed by the engine if the number of working cycles per minute is 210. Assume the cycle id reversible.

7. Derive the expression for the efficiency of the following cycles:

   a) Diesel cycle  b) Duel Cycle

8. Discuss the following properties of the materials:

   a) Elasticity  b) Toughness  c) Machinability  d) Brittleness

9. Locate the centroid of a trapezium with the base b and the parallel side's h1 and h2.

**NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.**