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

Total No. of Questions : 09

B.Tech. (2011 to 2017) (Sem.–1,2)

ELEMENTS OF MECHANICAL ENGINEERING

Subject Code : BTME-101

Paper ID : [A1107]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**
5. **Assume any missing data suitably.**

SECTION–A

1. Answer briefly :

(a) What do you understand by the term phase as applied to a system?

(b) State the conditions for a process to be reversible.

(c) Define zeroth law of thermodynamics.

(d) What is mechanical equivalent of heat?

(e) What is a heat pump? How is it different from a refrigerator?

(f) Name the four processes that make up the ideal Diesel cycle.

(g) What do you understand by resilience of a material?

(h) What is ceramics?

(i) Define radius of gyration.

(j) State the perpendicular axes theorem.

SECTION–B

2. A non-flow reversible process occurs for which pressure and volume are correlated by the expression $pV = 150$, where V is the volume in m^3 and p is the pressure in bar. Calculate the work done on or by the system as pressure increases from 10 bar to 100 bar. Indicate the nature of process, whether expansion or compression.

3. It is desired to compress 10 Kg of gas from 1.5 m^3 to 0.3 m^3 at a constant pressure of 15 bar. During this compression process, the temperature rises from 20°C to 150°C and the increase in internal energy is 3250 kJ. Calculate the work done, heat interaction and change in enthalpy during the process. Also find out the average value of specific heat at constant pressure.

4. Air enters an adiabatic nozzle steadily at 500 kPa, 200°C and 30 m/sec and leaves at 100 kPa and 180 m/sec. If the inlet area is 0.012 m^2, find the mass flow rate through the nozzle, exit temperature of air and exit area of the nozzle. Take R = 0.287 kJ/KgK and $\gamma = 1.4$.

5. Explain the carnot cycle. What are the main conclusions that can be drawn from the efficiency of carnot cycle.

SECTION–C

6. Derive an expression for the air standard thermal efficiency of Otto cycle.

7. Explain the working of a two-stroke petrol engine with the help of neat sketches. What are the demerits of two-stroke engines?

8. What are smart materials? Explain the theory behind shape memory alloys and give the composition and applications of some commercially available shape memory alloys.

9. Find the moment of inertia about the centroid axis XX for the lamina shown below.