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Total No. of Questions : 09] [Total No. of Pages : 03

B.Tech. (Sem. - 1st/2nd)

ELEMENTS OF MECHANICAL ENGINEERING

SUBJECT CODE : ME - 101 (2K4 & Onwards)

Paper ID : [A0114]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Five** questions from Section - B & C.
3) Select atleast **Two** questions from Section - B & C.

Section - A

Q1) *(Marks : 2 Each)*

a) Define enthalpy of the system. How it is related to internal energy?

b) Define compression ratio.

c) Is it possible that $W \neq 0$ even if $dv = 0$? If so give an example.

d) What is entropy principal?

e) Draw P-V and T-S diagrams for brayton cycle.

f) What is PMM1?

g) Give the relation between COP of heat pump and refrigerator.

h) Differentiate between machine and mechanism.

i) State the uses of Oldham coupling.

j) Define temperature stresses and strains.

Section - B

(Marks : 8 Each)

Q2) (a) Differentiate between temperature, heat and internal energy.

(b) A non-flow reversible process occurs for which pressure and volume are correlated by the expression $P = (V^2 + 5/V)$, where P is in bar and V is in m^3. What amount of work will be done when volume changes from 3 to 6 m^3?

Q3) (a) What is throttling process? Point out its salient aspects.

(b) The centrifugal pump delivers 50kg of water per second. The inlet and outlet pressures are 1 bar and 4.2bar respectively. The suction is 2.2m below the center of the pump and delivery is 8.5m above the center of the pump. The suction and delivery pipe diameters are 20cm and 10cm respectively.

Determine the capacity of the electric motor to run the pump.

Q4) (a) Draw P-V diagram for isobaric, isochoric and isothermal process.

(b) $0.2m^3$ of an ideal gas at a pressure of 2MPa and 600 K is expanded isothermally to 5 times the initial volume. It is then cooled to 300K at constant volume and then compressed back polytropically to its initial state. Determine the network done and heat transfer during the cycle.

Q5) State Kelvin-Planck and Clausius statements of second law of thermodynamics. Explain the equivalence of Kelvin-Planck and Clausius statements.

Section - C

(Marks : 8 Each)

Q6) Explain the working principle of dual cycle with the help of P-V and T-S diagrams. Derive an expression for the air standard efficiency of the dual cycle in terms of the compression ratio, pressure ratio, cut off ratio and the adiabatic index.

Q7) (a) Explain the working of elliptical trammel.

(b) A machine raised a load of 300N through a distance of 300mm. The effort of 50N moved 2.7m during the process. Determine

(i) Mechanical advantage.

(ii) Velocity Ratio.

(iii) Efficiency.

(iv) Effect of friction.

Q8) (a) Derive the relation between Bulk modulus (K), Young's modulus (E) and Poisson's ratio (1/m).

(b) In order to evaluate various mechanical properties, a steel specimen of 20mm diameter and 20cm length was tested in a standard tension test and data collected are : yield load = 150kN; maximum load = 225kN; fracture load = 175kN; gauge length at fracture = 25cm; extension at load of 30kN = 0.08mm, Determine

(i) Yield point stress.

(ii) Ultimate tensile stress.

(iii) Percentage elongation.

(iv) Modulus of elasticity.

(v) Breaking strength.

Q9) Write short notes on the following :

(a) Reversible processes.

(b) Carnot cycle.

(c) Creep.

(d) Working of four stroke diesel engine.

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