

Total No. of Questions : 4]

SEAT No. :

**PE588**

[Total No. of Pages : 2

**[6578]-61**

**S.E. (Automobile & Mechanical /Mechanical S.W.)(Insem)**

**ENGINEERING THERMODYNAMICS**

**(2019 Pattern) (Semester - III) (202043)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Solve two questions; Q.1 or Q.2, Q.3 or Q.4.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1) a)** Derive steady flow energy equation for following devices. **[9]**

- i) Nozzles
- ii) Hydraulic Turbines
- iii) Compressors

b) State zeroth law of thermodynamics and first law of thermodynamics. Explain concept of heat and work with sign convention. **[6]**

OR

**Q2) a)** Define. **[8]**

- i) State
- ii) Process
- iii) Cycle
- iv) Quasi static Process

b) Define Internal Energy with SI unit. In an internal combustion engine during compression stroke heat rejected to the coolant is 100 kJ and Work done on the system is 300 kJ. Find change in internal energy of working fluid and comment on answer. **[7]**

**P.T.O.**

**Q3) a)** Derive an expression for reversible adiabatic process for an ideal gas undergoing a cycle: [9]

- i) Work done
- ii) Heat transfer
- iii) PVT Relation

b) Derive the expression for relation between the properties, work (W), heat (Q), and change in entropy ( $\Delta S$ ) for a adiabatic process with P-V & T-S diagram. [6]

OR

**Q4) a)** State Kelvin Planck's statement and Clausius statement. Explain the equivalence of Clausius statement with Kelvin Planck's statement. [6]

b) Explain heat engine, Heat pump and refrigerator. [9]

A carnot refrigerator cycle absorbs heat at  $-3^{\circ}\text{C}$  and rejects it at  $27^{\circ}\text{C}$ ;

- i) Calculate the COP of this refrigeration cycle.
- ii) If the cycle is absorbing 1130 kJ/min at  $-3^{\circ}\text{C}$ , how much work is required per second?
- iii) If the carnot heat pump operated between the same temperature limit then what is its COP?

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