

**3060**

**B.Tech. 3rd Semester (Mechanical Engg.) (G-Scheme)**

**Examination, November-2023**

**THERMODYNAMICS**

**Paper-PCC-ME-213-G**

*Time allowed : 3 hours]*

*[Maximum marks : 75]*

**Note :** Attempt any five questions in all, selecting one question from each unit. Question no. 1 is compulsory. All questions carries equal marks.

1. Explain the following:  $6 \times 2.5 = 15$
- (a) Reversible and irreversible processes
  - (b) Internal energy and enthalpy
  - (c) Sensible heat and latent heat
  - (d) PMM2
  - (e) Dryness fraction
  - (f) Carnot theorem

**Unit-I**

2. Derive the expression for work done in various non flow processes. 15
3. (a) What is a PMM1 ? Why is it impossible ? 4
- (b) What is first Law of Thermodynamics ? 4
- (c) Show that work is a path functions and not a property. 7

**Unit-II**

4. (a) Draw phase equilibrium diagram for a pure substance on t-s plot with relevant constant property lines.
- (b) What is critical state ? Explain the terms critical pressure, critical temperature and critical volume of water ? 15
5. Find the specific volume, enthalpy and internal energy of wet steam at 18 bar with dryness fraction ( $x$ ) = 0.85, by using Steam Tables and Mollier chart. 15

**Unit-III**

6. 0.8 kg of air flow through compressor under steady state conditions. The properties of air at entry are : pressure 1 bar, velocity 10m/s, specific volume  $0.95 \text{ kg/m}^3$  and internal energy 30 KJ/kg. The corresponding values at exit are : 8 bar, 6m/s,  $0.2\text{kg/m}^3$  and 124KJ/kg. Neglecting the change in potential energy, Calculate the power output and pipe diameter at entry and exit. 15
7. State and discuss the Kelvin-Plank and Clausius statement of Second Law of Thermodynamics. 15

**Unit-IV**

8. Air enters a compressor at 1 bar,  $30^{\circ}\text{C}$ , which is also the state of environment. It leaves at 3.5 bar,  $141^{\circ}$  and 90m/s. Neglecting inlet velocity and P.E. effect, Determine :
- Whether the compression is adiabatic or polytropic
  - If not adiabatic, the polytropic index
  - The isothermal efficiency
  - The minimum work input and irreversibility and
  - Second law efficiency.

Take  $C_p$  of air =  $1.0035 \text{ kJ/kgK}$

15

9. Explain the Carnot cycle. Derive its thermal efficiency relation and draw the p-v and t-s diagram.                    15