Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

Term Evaluation (Odd) Semester Examination September 2025

Roll no.............................

Name of the Course: **B.TECH** (ME)
Semester: **3rd**
Name of the Paper: **Thermal Engineering**
Paper Code: **TME 308**
Time: 1.5 hour **Maximum Marks: 50**

Note:

(i) Answer all the questions by choosing any one of the sub-questions
(ii) Each question carries 10 marks.

Q1. **(10 Marks)**

a. Define thermodynamic state, equilibrium, state postulate, and quasi-equilibrium process with one practical example. **CO 1**

OR

b. Derive the First Law of Thermodynamics for a closed system undergoing a cyclic process. **CO 4**

Q2. **(10 Marks)**

a. With neat diagrams, explain the phase changes of a pure substance during heating of ice at constant pressure. Also define the terms: saturation temperature, saturation pressure, latent heat, triple point, and critical point. **CO 2**

OR

b. A gas undergoes a polytropic process with n = 1.3, initial pressure = 1 bar, initial volume = 0.2 m^3, and final pressure = 5 bar. Calculate: (i) Final volume, (ii) Work done, (iii) Heat transfer. **CO 1**

Q3. **(10 Marks)**

a. Derive the expression for thermal efficiency of Carnot Vapour Power Cycle and explain its limitations. **CO 3**

OR

b. Hot gases at 500 K flow through a heat exchanger, transferring 200 kW of heat to water entering at 25°C at the rate of 2 kg/s. Determine the exit temperature of water (Cp = 4.18 kJ/kgK) **CO 3**

Q4. **(10 Marks)**

a. Derive an expression for the work done in a steam turbine using SFEE. Define isentropic efficiency of turbine **CO 3**

OR

b. A compressor handles 2 kg/s of air at 1 bar and 300 K, delivering at 6 bar. Assuming isentropic compression with $\gamma = 1.4$, calculate: (i) Work input, (ii) Exit temperature, (iii) Power required. **CO 3**

Q5. **(10 Marks)**

a. State and explain the Clausius statement of the second law of thermodynamics. Prove that both statements are equivalent **CO 4**

OR

b. A reversible heat engine receives 3000 kJ/min of heat from a reservoir at 500 K and rejects heat to a reservoir at 300 K . Calculate (i) thermal efficiency, (ii) work output. **CO 4**