

**Thermal Engineering (313310)**

MSBTE Diploma · K-Scheme · Model Question Paper — Set C

**Time: 3 Hours****Max. Marks: 70****Instructions:**

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Use of non-programmable electronic pocket calculator is permissible.
7. Use of steam tables, logarithmic tables and Mollier chart is permitted.
8. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

**Q.1 Attempt any FIVE of the following:****10**

- a) Define heat and work. State their SI units.
- b) Define: i) Dry saturated steam ii) Wet steam.
- c) State Dalton's law of partial pressures.
- d) State the function of a steam nozzle and name its types.
- e) Define thermal conductivity and state its SI unit.
- f) Define: i) Transmissivity ii) Emissivity.
- g) Define: i) Cut-off ratio ii) Clearance volume.

**Q.2 Attempt any THREE of the following:****12**

- a) Differentiate between heat engine and refrigerator. (Any four points)
- b) State Boyle's law and Charles' law. Derive the characteristic gas equation.
- c) Represent the isentropic and polytropic processes on P–V and T–S diagrams.
- d) 0.3 kg of a gas at 1.8 bar and 120 °C is cooled at constant pressure until its volume becomes half. Find the initial volume, work done, change in internal energy and heat rejected. Take  $C_p = 1.0 \text{ kJ/kg K}$  and  $C_v = 0.71 \text{ kJ/kg K}$ .

**Q.3 Attempt any THREE of the following:****12**

- a) Represent the generation of steam at constant pressure on the T–S diagram and explain it.
- b) Explain the construction and working of an induced draught cooling tower with a neat sketch.
- c) Classify steam condensers. Explain the working of a surface condenser with a neat sketch.

- d) Explain regenerative feed heating and bleeding of steam with a neat sketch.

**Q.4 Attempt any THREE of the following:**

12

- Differentiate between natural convection and forced convection. (Any four points)
- A furnace wall consists of 225 mm fire brick ( $k = 1.4 \text{ W/m K}$ ) and 115 mm insulating brick ( $k = 0.2 \text{ W/m K}$ ). The inside surface temperature is  $1000^\circ\text{C}$  and the outside surface temperature is  $80^\circ\text{C}$ . Find the heat loss per  $\text{m}^2$  and the temperature at the interface.
- Represent the Carnot cycle on P–V and T–S diagrams. State its limitations.
- Compare Otto cycle and Diesel cycle on the basis of: i) P–V and T–S diagrams ii) heat addition iii) compression ratio iv) application.
- 0.2 kg of air at 1 bar and  $27^\circ\text{C}$  is compressed adiabatically to 8 bar. Find the final temperature, initial and final volumes, work done and change in internal energy. Take  $\gamma = 1.4$ ,  $R = 0.287 \text{ kJ/kg K}$  and  $C_v = 0.718 \text{ kJ/kg K}$ .

**Q.5 Attempt any TWO of the following:**

12

- Write the steady flow energy equation per unit mass and state the significance of each term. Apply it to: i) steam turbine ii) steam condenser.
- 2.5 kg of steam at 9 bar occupies a volume of  $0.45 \text{ m}^3$ . Using the steam table extract, find: i) dryness fraction ii) total enthalpy iii) internal energy iv) heat required to make it dry saturated at the same pressure.

| p (bar) | $t_s$ ( $^\circ\text{C}$ ) | $v_g$ ( $\text{m}^3/\text{kg}$ ) | $h_f$ (kJ/kg) | $h_{fg}$ (kJ/kg) | $h_g$ (kJ/kg) |
|---------|----------------------------|----------------------------------|---------------|------------------|---------------|
| 9       | 175.4                      | 0.2149                           | 742.7         | 2030.3           | 2773.0        |

- Explain the working of a simple impulse steam turbine with a neat sketch. Show the variation of pressure and velocity of steam along the turbine.

**Q.6 Attempt any TWO of the following:**

12

- Define a boiler as per IBR. Explain the construction and working of the Lamont boiler with a neat sketch.
- Classify heat exchangers. Explain the construction and working of a plate type heat exchanger with a neat sketch and state its applications.
- Explain the construction and working of a two stroke petrol engine with neat sketches.

**Note:** This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — [anandatechnologies.in](http://anandatechnologies.in)