Thermal Engineering (313310)

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

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) State the zeroth law of thermodynamics.

b) Define: i) Sensible heat ii) Latent heat.

c) List any two assumptions made for an ideal (perfect) gas.

d) State Dalton's law of partial pressures. Write its relation for a condenser.

e) Classify boilers according to: i) relative position of water and hot gases ii) position of furnace.

f) State any four applications of heat exchangers.

g) Define mean effective pressure of an I.C. engine.

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

a) Prove that $(COP)_{heat\ pump} = (COP)_{refrigerator} + 1$.

b) Define thermodynamic system. Classify the systems with one example each.

c) Represent the isobaric and isochoric processes on P–V and T–S diagrams.

d) 0.2 m^3 of air at 4 bar and 150 °C expands at constant pressure until its volume becomes 0.45 m^3. Find the work done, change in internal energy and heat supplied. Take C_p = 1.005 kJ/kg K and C_v = 0.718 kJ/kg K.

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

a) Draw the simple Rankine cycle on P–V and T–S diagrams (steam dry saturated at turbine inlet) and name the processes.

b) Draw a neat layout of a steam power plant and label: boiler, turbine, generator, condenser, cooling tower, chimney, feed pump and coal circuit.

c) Explain the working of a natural draught cooling tower with a neat sketch.

d) Draw a neat labelled sketch of a surface condenser. State the sources of air leakage in a condenser.

Q.4 Attempt any THREE of the following: **12**

a) Explain the three modes of heat transfer with one practical example each.

b) State the Stefan–Boltzmann law. Define emissivity and gray body.

c) Explain the Diesel cycle with P–V and T–S diagrams.

d) Classify I.C. engines on the basis of: i) working cycle ii) number of strokes iii) method of ignition iv) method of cooling.

e) Steam at 8 bar has i) specific volume 0.20 m^3/kg ii) enthalpy 2900 kJ/kg. Determine in each case whether the steam is wet or superheated, and find the dryness fraction or the temperature of superheat. Take C_{ps} = 2.1 kJ/kg K.

p (bar)	t_s (°C)	v_g (m^3/kg)	h_f (kJ/kg)	h_{fg} (kJ/kg)	h_g (kJ/kg)
8	170.4	0.2403	721.0	2047.3	2768.3

Q.5 Attempt any TWO of the following: **12**

a) Write the steady flow energy equation and apply it to: i) steam boiler ii) steam nozzle iii) steam condenser.

b) Describe the formation of steam at constant pressure with the help of temperature–enthalpy diagram. Show sensible heat, latent heat and superheat on it.

c) What is the need of compounding of steam turbines? Explain velocity compounding of an impulse turbine with pressure and velocity variation diagram.

Q.6 Attempt any TWO of the following: **12**

a) Explain the construction and working of the Benson boiler with a neat sketch. How does it differ from the Lamont boiler?

b) The wall of a cold storage, 4 m × 2.5 m, consists of 115 mm brick (k = 0.7 W/m K) on the outside, 75 mm cork (k = 0.045 W/m K) in the middle and 20 mm wood (k = 0.18 W/m K) on the inside. The outer surface temperature is 30 °C and the inner surface temperature is −8 °C. Find the heat transfer through the wall per hour and the interface temperatures.

c) Compare S.I. and C.I. engines on the basis of: i) fuel used ii) working cycle iii) air–fuel ratio iv) method of ignition v) compression ratio vi) noise and vibration.

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