

Roll No.

OLE-24046

B. Tech. 3rd Semester (MAE) Examination – April, 2021

THERMODYNAMICS

Paper : ME-201-F

Time : Three Hours]

[Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** is *compulsory*. All questions carry equal marks.

1. Explain following :

- (a) Describe the concept of control volume.
- (b) Explain carnot heat engine.
- (c) Explain avogadro's law and universal gas constant.
- (d) Discuss ericson cycle. 5 × 4 = 20

SECTION – I

2. (a) Explain actual and quasiequilibrium processes. 7
- (b) What is thermal equilibrium ? Discuss Kelvin and Celsius scales. 7
- (c) Discuss perpetual-motion machine that violates the second law of Thermodynamics. 6
3. A gas in a piston-cylinder assembly undergoes an expansion process for which the relationship between pressure and volume is given by

$$pV^n = \text{Constant}$$

The initial pressure is 3 bar, the initial volume is 0.1 m^3 and the final volume is 0.2 m^3 . Determine the work for the process, in kJ, if (a) $n = 1.5$, (b) $n = 1.0$ and (c) $n = 0$.

20

SECTION – II

4. (a) A heat pump receives energy by heat transfer from the outside air at 0°C and discharges energy by heat transfer to a dwelling at 20°C . Is this in

violation of the Clausius statement of the second law of thermodynamics ? Explain. 12

(b) Explain Clausius Inequality. 8

5. A cylinder of an internal combustion engine contains 2450 cm³ of gaseous combustion products at a pressure of 7 bar and a temperature of 867°C just before the exhaust valve opens. Determine the specific energy of the gas, in kJ/kg. Ignore the effects of motion and gravity and model the combustion products as air as an ideal gas. Take $T_0 = 300$ K (27°C) and $P_0 = 1.013$ bar. 20

SECTION – III

6. (a) Explain the process of steam formation from with suitable p-v and T-s diagrams. 12

(b) What is dryness fraction of steam ? How will you measure it ? 8

7. (a) Discuss Vander Waal's Equation of state. 10

(b) Describe enthalpy changes of real gases. 10

SECTION – IV

8. (a) Explain Clapeyron equation. 10
- (b) Show that the Joule-Thomson coefficient of an ideal gas is zero. 10
9. Derive an expression for efficiency of dual cycle. 20
-