PVP 20

Code: 20ES1304

II B.Tech - I Semester – Regular Examinations - FEBRUARY 2022

BASIC THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Define the following thermodynamic terms
i) State ii) path iii) System. 7 M
b) Define thermodynamic process? Explain quasi-static process and its characteristic features. 7 M

OR

2. a) What is Joule's Law in thermodynamics? Explain Joules experiment with neat sketch. 7 M
b) Write minimum 3 major differences of following
(i) Macroscopic and Microscopic approaches
(ii) Heat and Work in thermodynamics 7 M

UNIT – II

3. a) Discuss the first law of thermodynamics applied to a non-flow system undergoing cycle and change of state. 7 M
b) Prove the equivalence of Kelvin Planck and Clausius Statements of second law of thermodynamics. 7 M

OR

4. a) Explain the concept of irreversibility and its significance. 7 M

b) Apply steady flow energy equation to a nozzle, turbine, compressor, and a boiler. 7 M

UNIT-III

5. a) Explain entropy and disorder. Prove that entropy is a property of a system. 7 M

b) An inventor claims that his petrol engine operating between the temperatures 2500°C and 600°C will produce 1 H.P/hr consuming 0.13kg of petrol of 45, 732 kJ/kg calorific value. Check the validity of his claim. 7 M

OR

6. a) Why Carnot cycle cannot be realized in practice? 7 M

b) One kg of water at 273K is brought into contact with a heat reservoir at 373K. When the water has reached 373K, find the entropy change of water, the heat reservoir, and the universe. If water is heated from 273K to 373K by first bringing it in contact with a reservoir at 323K and then with a reservoir at 373K, what will be the entropy change of universe? 7 M

UNIT – IV

7. a) Draw the p v diagram of a pure substance and explain how it is formed. 7 M

b) A steam pressure of holding capacity $4m^3$ contains a mixture of saturated water and saturated steam at 250°C. The mass of the liquid present is 1 ton. Determine
(i) Quality
(ii) Specific Volume
(iii) Specific Enthalpy
(iv) Specific Entropy and
(v) Specific Internal Energy of steam. 7 M

OR

8. a) What do you understand by triple point? Give the pressure and temperature of water at its triple point. 7 M

b) Determine the internal energy of 1kg of steam at 1 bar and 0.9 dry. If this steam is compressed to 10bar according to law $pv^{1.1}$ = constant, calculate the final dryness of steam and change in internal energy, stating the latter is an increase or decrease. 7 M

UNIT – V

9. a) Explain the working of otto cycle and derive the expression for thermal efficiency. 7 M

b) An engine operates on the theoretical Diesel cycle with the compression ratio of 12:1 and fuel is injected of 10% of the stroke. The pressure of the air entering the cylinder is 0.98 bar and its temperature is 15°C. Calculate
(i) cut-off ratio
(ii) the temperature at the end of compression process
(iii) the heat input 7 M

OR

10. a) Mention the merits and demerits of the Stirling and Ericsson cycles. 7 M

b) In a gas turbine plant working on the Brayton cycle the air at the inlet is at 27°C, 0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800°C. The turbine and compressor efficiencies are each 80%. Find
(i) the compressor work per kg of air,
(ii) the turbine work per kg of air,
(iii) the heat supplied per kg of air,
(iv) the cycle efficiency, and
(v) the turbine exhaust temperature. 7 M