

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Winter 2022 - 23 Examination

Semester: 3
Subject Code: 203109211
Subject Name: Thermodynamics

Date: 08/10/2022
Time: 2:00pm to 4.30pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (All are compulsory) (Each of one mark)**(15)**

1. Which of the following is the unit of entropy
 - a) J/kg K
 - b) J/K
 - c) N m/kg Sec
 - d) J/kg
2. Triple point of a pure substance on P-V diagram is represented by a
 - a) Point
 - b) Line
 - c) Curve
 - d) Triangle
3. PMM2 is the machine which violates _____
 - a) Kelvin Plank Statement
 - b) Clausius Statement
 - c) Both a & b
 - d) None of the above
4. A cyclic heat engine operates between a source temperature of 927 °C and a sink temperature of 27°C. What will be the maximum efficiency of the heat engine?
 - a) 100%
 - b) 80%
 - c) 75%
 - d) 70%
5. Dryness Fraction of Dry Saturated Steam is
 - a) <1
 - b) >1
 - c) 0
 - d) None of the above
6. Heat flow into a system is ____, and heat flow out of the system is _____
 - a) Positive, Positive
 - b) Negative, Positive
 - c) Positive, Negative
 - d) Positive, Negative
7. What are the intensive and extensive properties? Give suitable examples.
8. What are the causes of irreversibility?
9. For a constant volume process, work done is _____.
10. What do you mean by Exergy of a system? How it is differ from Energy?
11. The value of specific heat of water is _____ kJ/KgK

12. According to entropy principal, entropy of the universe is always _____
13. A 2 kW electric resistance heater in a room is turned on and kept on for 30 min. The amount of energy transferred to the room by the heater is _____. (1800 KJ, 3600 KJ)
14. During throttling process enthalpy of a system will _____. (Increases, Decreases, Not change)
15. Arrangement of Components in Rankine Cycle is
- Condenser, Turbine, Pump, Boiler
 - Turbine, Pump, Condenser, Boiler
 - Pump, Boiler, Turbine, Condenser
 - Boiler, Pump, Turbine, Condenser

Q.2 Answer the following questions. (Attempt any three) (15)

- What are the limitations of 1st Law of thermodynamics? How 2nd law address them all.
- Draw the P-V-T surface diagram of pure substance. Explain critical point of pure substance.
- Draw only diagrams of showing equivalence between Kelvin Planck statement & Clausius statement & vice versa.
- Explain Quasi Static Process in detail.

Q.3 A) A refrigerator operates on reversed Carnot cycle. Determine the power required to drive refrigerator between temperatures of 42°C and 4°C if heat at the rate of 2 kJ/s is extracted from the low temperature region. (07)

B) What is SFEE equation? Derive the expression with suitable diagram. (08)

OR

B) Define entropy. With usual notation prove that $\oint \delta Q/T \leq 0$. (08)

Q.4 A) In a nozzle air at 627°C and twice atmospheric pressure enters with negligible velocity and leaves at a temperature of 27°C. Determine velocity of air at exit, assuming no heat loss and nozzle being horizontal. Take $C_p = 1.005 \text{ kJ/kg.K}$ for air. (07)

OR

A) Determine the COP of Refrigerator and Heat Pump with appropriate diagrams. (07)

B) Derive the efficiency equation for Brayton Cycle. Explain its working too. (08)