Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (AE) (2018 Batch) (Sem.–3)

ENGINEERING THERMODYNAMICS

Subject Code : BTAE-302-18

M.Code : 76400

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Write briefly :

1. What are the differences between supersaturated flow and isentropic flow through steam nozzles?
2. What do you understand by thermal equilibrium?
3. Define air standard cycle efficiency.
4. Define available energy and unavailable energy.
5. What is Rankine cycle? What are the limitations of Rankine cycle?
6. Define latent heat of evaporation or Enthalpy of evaporation.
7. What is the function of the throttling valve in vapour compression refrigeration system?
8. What is humidification and dehumidification?
9. What are the factors that affect the volumetric efficiency of a reciprocating compressor?
10. What is meant by Dry Bulb Temperature (DBT)?

SECTION-B

11. Describe steady flow energy equation and apply the equation to a nozzle and derive an equation for velocity at exit.

12. a) What are the conditions for reversibility?

    b) Heat exchanger circulates 5000 kg/hr of water to cool oil from 150°C to 50°C The rate of flow of oil is 2.5 kJ/kgK. the water enters the heat exchanger at 21°C. Determine the net change in entropy due to heat exchange process, and the amount of work obtained if cooling of oil is done by using the heat to run a Carnot engine with sink temperature of 21°C.

13. Draw p-T diagram and label various phases and transitions. Explain the process of isobaric heating above triple point pressure with the help of p-T diagram.

14. Explain the working of 4-stroke cycle Diesel engine. Draw the theoretical and actual valve- timing diagram for the engine.

15. What is sensible heat? How is the sensible heat loss from a human body affected by :

    a) Skin temperature

    b) Environment temperature, and

    c) Air motion.

SECTION-C

16. An air conditioning system is to take in outdoor air at 263 K and 30 percent relative humidity at a steady rate of 45 m^3/min and to condition it to 298 K and 60 percent relative humidity. The outdoor air is first heated to 295 K in the heating section and then humidified by the injection of hot steam in the humidifying section. Assuming the entire process takes place at a pressure of 100 kPa.

    Determine :

    a) The rate of heat supply in the heating section.

    b) The mass flow rate of the steam required in the humidifying section.

17. An Engine-working on Otto cycle has a volume of 0.45 m^3, pressure 1 bar and temperature 30°C at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar and 210 KJ of heat is added at constant volume.

Determine :

a) Pressure, temperature and volumes at salient points in the cycle.

b) Efficiency.

18. Air contained in the cylinder and piston arrangement comprises the system. A cycle is completed by four process 1-2, 2-3, 3-4 and 4-1. The energy transfers are listed below. Complete the table and determine the network in kJ. Also check the validity of the first law of thermodynamics.

Process	Q (kJ)	W (kJ)	ΔU (kJ)
1-2	40	?	25
2-3	20	–10	?
3-4	–20	?	?
4-1	0	+8	?

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.