



**KERALA AGRICULTURAL UNIVERSITY**  
**B.Tech.(Food Technology) 2021 Admission**  
**II Semester Final Examination - September 2022**

Pafe.1206

**Food Thermodynamics (2+0)**

**Marks: 50**  
**Time: 2 hours**

- I Fill in the blanks** **(10x1=10)**
1. The maximum useful work that can be obtained in a process in which the system comes to equilibrium with the surroundings or attains the dead state is known as.....
  2. For a frictionless reversible process the entropy change of a system is .....
  3. The properties which are independent on the mass of the system is called.....
  4. For a heat pump and refrigerator working between the same temperature reservoir, the difference between the COP of Heat pump and COP of heat pump is equal to .....
  5. The difference between the dry bulb temperature (DBT) and the wet bulb temperature (WBT) is known as .....
- State True or False**
6. Internal energy of a system is path function.
  7. Triple point of water is used as the fixed point in absolute temperature scale.
- Define the following**
8. Carnot's Theorem
  9. Charle's law
  10. Critical point of pure substance
- II Write short notes on ANY FIVE of the following** **(5x2=10)**
1. Define Zeroth law of thermodynamics. Which property of the system can be defined using the zeroth law of thermodynamics?
  2. List the causes of irreversibility in a thermodynamics process.
  3. What are the various process involved in an ideal Rankine cycle? Explain with P-V diagram of the cycle.
  4. Explain Classius inequality.
  5. Define dew point temperature of a moist air.
  6. Define dryness fraction, what is the value of dryness fraction for saturated steam.
  7. Define available energy and unavailable energy of a system.
- III Answer ANY FIVE of the following** **(5x4=20)**
1. A system receives 200 kJ of heat at constant volume process and rejects 220 kJ at constant pressure during which 40 kJ of work is done on the system. The system is brought to its original state by adiabatic process. Calculate the adiabatic work. If the initial internal energy is 240 kJ, calculate the internal energy all the points.
  2. Calculate the availability of the air when the pressure is 500 kPa and temperature is 200 K, when the atmospheric pressure and temperature are 100 kPa and 300 K respectively.
  3. Explain the steady flow energy equation (SFEE) for an open system. Explain the terms involved in the process and hence deduce the equation for a nozzle.
  4. In a diary, steam power plant works between 40 bar and 0.05 bar. If the steam supplied is dry saturated and the cycle is operated under Rankine cycle find
    - (a) cycle efficiency and
    - (b) steam consumption in that plant per hour

5. Explain how to draw the T-S diagram of pure substance and show the Critical point and triple point of the pure substance.
6. Calculate
  - (a) Partial pressure of water vapour in the air
  - (b) relative humidity of air
  - (c) Dew point temperature of air when the air is at 25° C DBT and specific humidity 6gm/kg of air
7. Derive an expression for the efficiency Carnot's engine working between the heat reservoir of temperature  $T_H$  and  $T_L$

**IV**

**Write an essay on ANY ONE of the following**

**(1x10=10)**

1.
  - (a) Determine the air standard efficiency of the diesel cycle, if the compression ratio is 14 and heat is supplied up to 5% of the stroke. Also find the mean effective pressure.
  - (b) if the cut off is increased from 5% to 8% with the original compression ratio, find the percentage change in the air standard efficiency.
2. A turbine operating under steady flow conditions receives steam at the following state: Pressure 13.8bar; Specific volume 0.143 m<sup>3</sup>/kg and Internal energy 2590 kJ/Kg; Velocity 30m/s. The state of the steam leaving the turbine is: Pressure 0.35bar; Specific Volume 4.37 m<sup>3</sup>/kg and Internal energy 2360 kJ/Kg; Velocity 90m/s. Heat is lost to the surroundings at the rate of 0.25 kJ/s. If the rate of steam flow is 0.38 kg/sec. What is the power developed by the turbine?

\*\*\*\*\*