

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2015

Subject code: 2131905

Date: 04/06/2015

Subject Name: Engineering Thermodynamics

Time: 02.30pm-05.00pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. ~~Tables for properties of air and water, Steam tables, Psychometric chart is permitted.~~

Q.1 (a) Define property. What is meant by intensive and extensive property? State the differences between Microscopic approach and macroscopic approach. **07**

(b) State the Steady Flow Energy Equation and explain how this equation can be applied for (i) Nozzle, (ii) Boiler, and (iii) Steam Turbine. **07**

Q.2 (a) The mass flow rate of steam into a steam turbine is 1.5 Kg/s and heat loss from the turbine is 8.5 KW. The steam is entering the turbine at the pressure of 2MPa, temperature 350°C, Velocity 50 m/s, elevation 6 m/s and is leaving the turbine at a pressure of 0.1 MPa, quality of 100%, velocity of 200 m/s, elevation of 3 m/s. Determine power output of turbine. **07**

(b) State Kelvin-Planck Statement of Second Law of thermodynamics and show that violation of Kelvin-Planck statement leading to violation of Clausius statement. **07**

OR

(b) A heat pump is used to heat the house in winter. A house requires 50 KJ/s heat for heating in winter which is delivered by heat pump from outside air. Work required to operate the heat pump is 8 KW. Calculate the Co-efficient of Performance of heat pump and heat abstracted from outside. **07**

Q.3 (a) Explain principle of increase of entropy for an isolated system. **07**

(b) What is irreversibility? State various types of irreversibilities and explain them. **07**

OR

Q.3 (a) Explain the concept of decrease in available energy when heat is transferred through a finite temperature difference with the aid of T-S diagram. **07**

(b) 5 kg of water at 0°C is exposed to reservoir at 98°C. Calculate the change of entropy of water, reservoir and universe. Assume that specific heat of water is 4.187 KJ/Kg-K. **07**

Q.4 (a) Draw Rankine cycle on P-v, T-s and h-s diagrams and derive an expression for its thermal efficiency with and without pump work. **07**

(b) An engine working on Diesel cycle has cylinder bore of 190 mm and piston stroke of 230 mm. The clearance volume is 290 cm³. The fuel injection takes place at constant pressure for 6% of the stroke. Determine the air standard cycle efficiency. **07**

OR

Q.4 (a) Compare Otto, Diesel and Dual cycle for **07**
i) Same compression ratio and heat supplied
ii) Same Max. Pressure and temperature.

- (b) Dry and saturated steam at pressure of 10.5 bar is supplied to a turbine and expanded isentropically to a pressure 0.075 bar. Calculate Thermal efficiency of Rankine cycle. **07**
- Q.5** (a) What is regeneration in gas turbine plant? How it improves thermal efficiency of simple open cycle Gas Turbine Plant. Explain it with the help of schematic diagram and T-S Diagram of the cycle. **07**
- (b) State the statements of Dalton's Law and Gibbs-Dalton Law. Explain in detail Dalton's law of partial pressures. **07**
- OR**
- Q.5** (a) How actual Brayton cycle differs from the theoretical cycle? Explain with the help of T-S diagram. **07**
- (b) What is the Vander waal's equation of state? State its importance and derive it. **07**
