Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: 141903 **Date: 22-12-2014**

Subject Name: Engineering Thermodynamics

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define 'System', 'Surroundings' and 'Boundary'. Explain types of system with suitable example. **07**

(b) What is thermodynamic equilibrium? Describe complete thermodynamic equilibrium in detail. **07**

Q.2 **(a)** State the Carnot theorem and explain PMM-II (Perpetual Motion Machine of second kind). **07**

(b) Calculate the final temperature, pressure, work done and heat transfer if the fluid is compressed reversibly from volume of 6 m^3 to 1 m^3 when the initial temperature and pressure of fluid as 20^0C and 1 bar respectively. Assume the index of compression as 1 and 1.4, C_p = 1.005 and C_v = 0.718 and R =0.287KJ/kgk. **07**

OR

(b) An inventor claims that his engine has the following specifications: **07**

1.Temperarue limits	750^0C and 25^0C
2. Power developed	75 KW
3. Fuel burned per hour	3.9 kg
4. Heating value of the fuel	74500 KJ/kg

State weather his claim is valid or not.

Q.3 **(a)** State Clausius statement. Explain equivalence of Kelvin and Clausius statement. **07**

(b) State the Steady flow energy equation. List the engineering application of it and deduce the SFEE for any two applications. **07**

OR

Q.3 **(a)** Prove that "No heat engine working in a cycle between two constant temperature reservoirs can be more efficient than a reversible engine working between the same two reservoirs." **07**

(b) A container is divided into two compartments by a partition wall. The container is completely insulated so that there is no heat transfer. One portion contains gas at temperature 25^0C and pressure 5 bar while the other portion also has the same gas but at temperature 40^0C and pressure 10 bar. Calculate the amount of work done, heat transferred and change in internal energy if the partition wall is removed from the container. **07**

Q.4 **(a)** Define 'Exergy', 'Anergy' and 'Dead state'. Explain the concept of available and unavailable energy with neat sketch. **07**

(b) Derive Vander Waal's equation. **07**

OR

Q.4 **(a)** State and explain Gibbs and Helmholtz functions. **07**

(b) Describe throttling process. Explain Joule Thomson porous plug experiment. **07**

Q.5 **(a)** Derive expression for air standard efficiency with usual notations for Constant Volume cycle. **07**

(b) Explain briefly Dalton's law and Gibbs-Dalton law applied to mixture of perfect gases. **07**

OR

Q.5 **(a)** Compare Otto, Diesel and Dual cycle for **07**

(1) Efficiency Versus Compression Ratio.

(2) Same Compression Ratio and same heat supplied.

(b) What is LCV and HCV? Describe the method of determination of heating value of solid and liquid fuel. **07**

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