

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-IV Examination-Nov/Dec-2011

Subject code: 141903

Date: 25/11/2011

Subject Name: Engineering Thermodynamics

Time: 02.30 pm -5.00 pm

Total marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of molier chart and steam table is permitted.

- Q-1**
- | | | |
|-----|--|-----------|
| (a) | State the purpose served by each thermodynamic law | 07 |
| (b) | What the meaning of word "Entropy"? | 03 |
| (c) | Carnot cycle is not practical. Justify. | 04 |

- Q.2**
- | | | |
|-----|--|-----------|
| (a) | What is the difference between Otto cycle and diesel cycle? Explain why the higher efficiency of the Otto cycle compared to diesel cycle for the same compression ratio is not a result of practical importance. | 07 |
| (b) | An air standard Otto cycle is required to operate between the temperature limits of 300k and 1800k. Estimate the optimum compression ratio and the corresponding thermal efficiency. | 07 |

OR

- (b) In an air standard diesel cycle the compression ratio is 16. At the beginning of isentropic compression the temperature is 15° c and pressure is 0.1 MPa. Heat is added until the temperature at the end of constant pressure process is 1480° c . Calculate
- | | |
|----------------------|-----------|
| (1) cut off ratio. | 07 |
| (2) cycle efficiency | |
| (3) M. E. P. | |
- Take, $\gamma = 1.4$, $R = 287 \text{ NM/Kg K}$,
 $C_v = 0.718 \text{ KJ/Kg K}$, $C_p = 1.005 \text{ KJ/Kg K}$
Assume Mass of air = 1 Kg

- Q.3**
- | | | |
|-----|--|-----------|
| (a) | Explain the concept of available energy, unavailable energy. | 07 |
| (b) | What is the law of degradation of energy? | 04 |
| (c) | State the Clausius Clapeyron equation. | 03 |

OR

- Q.3**
- | | | |
|-----|--|-----------|
| (a) | Using Maxwell relations derive the Clausius clapeyron equation. | 07 |
| (b) | What is dead state and why it is referred in the concept of availability? | 03 |
| (c) | The same amount of heat loss at higher temperature is more harmful than that at a lower temperature discuss. | 04 |

- Q.4 (a)** Why the Carnot engines is the most efficient engine for a given source and sink temperature? Explain. **07**
- (b)** A Carnot engine receives 4000 KJ as heat addition at 337°C and rejects energy at triple point of water. Calculate **07**
- (1) thermal efficiency
- (2) The net work output in KJ
- If the efficiency of an irreversible engine is 70 % of Carnot engine. Find the % change in heat rejected for the same input and fluid temperature.

OR

- Q.4 (a)** Differentiate between internal energy of reaction and enthalpy of reaction. **04**
- (b)** Discuss the method for determining the calorific value of solid and liquid fuels. **07**
- (c)** Define: (1) exothermic reaction **03**
(2) endothermic reaction
- Q.5 (a)** Explain Binary vapour cycle with P-V and T-S diagram. **07**
- (b)** A steam turbine of a power plant operating on ideal rankine cycle receives steam at 20 bar, 300°C at the rate of 3 Kg/s and it exhausts at 0.1 bar. Determine the following **07**

- (1) Net power output
- (2) Rankine cycle efficiency

OR

- Q.5 (a)** Why Carnot cycle is not practical for steam power plants? Explain in brief. **05**
- (b)** Derive Vander wall's equation. **05**
- (c)** Explain **04**
1. Isothermal compressibility
 2. Adiabatic compressibility
