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Roll No

MMTP-102**M.E./M.Tech., I Semester**

Examination, December 2013

Thermodynamics and Combustion*Time : Three Hours**Maximum Marks : 70**Note:* Attempt any five questions. All questions carry equal marks.

1. a) Give the thermodynamic definition of work. State and explain Zeroth Law of thermodynamics. Why it is called so?
b) A barometer reads 76 cm of Hg. What would be the absolute pressure of
 - i) A pressure gauge connected to a steam main line leading to inlet of steam turbine reads 28 bar and
 - ii) A vacuum gauge connected to exhaust line of the same turbine reads equivalent to 910 cm of water column. Express the absolute pressure in both cases in Kpa.
2. a) A refrigerator uses 2 kwh of electrical energy in cooling the food inside and the internal energy of the system decreases by 10,000 KJ as the temperature drops. Find the amount of heat transferred during the process.
b) State the limitations of the first law of thermodynamics. Also, state statements of second law with examples.
3. a) Explain with examples and PV-diagram, reversible and irreversible processes.
b) State clausius theorem and discuss clausius inequality.

4. a) Two carnot engines combined in series operates between temperatures of 906K and 586K. What should be the intermediate temperatures so that the engines produce equal work.
b) Draw and discuss the significance of P-V-T surface for real substances.
5. 10 kg of air at 100°C is stored in a rigid cylinder of volume 0.05 cubic meters. Calculate the pressure using vander waals equation of state. The properties of air at critical point are $P_c = 38.467$ bar, $T_c = 137.24$ K and $V_c = 0.093$ m³/kg mole.
6. a) Draw and discuss triple point and critical point.
b) State "law of corresponding states" and "Gibbs phase rule".
7. a) Compare combustion of solid, liquid and gaseous fuels.
b) Discuss about
 - i) Combustion stoichiometry.
 - ii) Spontaneous ignition temperature (SIT).
8. a) State and discuss theories of flame propagation.
b) Compute the inflammability limits for a fuel of composition.

CH₄ – 90%
C₂H₆ – 4%
C₂H₄ – 2%
CO₂ – 2%
N₂ – 2%
