Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech. Winter 2018 - 19 Examination

Semester: 1 **Date: 10/12/2018**
Subject Code: 203210101 **Time: 10:30 am to 1:00 pm**
Subject Name: Advanced Thermodynamics **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) State & explain Zeroth Law of thermodynamic and triple point of water. **(05)**
B) Give the expression for the entropy generation in an open system. **(05)**
C) A mass of gas at 0.1MPa is compressed at constant pressure from an initial state of 0.5 m^3 to a final state of 0.2 m^3. During this 30KJ heat is transferred from the gas to the surroundings. Calculate the change in internal energy of the gas. **(05)**

Q.2 **Answer the following questions**. (Attempt any three) (Each five mark) **(15)**
A) State and prove Clausius' theorem.
B) What is concept of continuum? How will you define density and pressure using this concept?
C) A small metallic object of mass 2 kg having specific heat of 0.5 KJ/Kg K is heated to a temperature of 227 ºC. The object is then thrown into the sea which is at 17 ºC. Calculate the change in entropy of the universe.
D) Explain the terms: Reversibility, Irreversibility, Second Law Efficiency.

Q.3 A) Show that maximum work obtainable from a finite heat capacity body and thermal reservoir is given as **(07)**

$$W_{max} = C_p\,[(T - T_0) - T_0 \log\frac{T}{T_0}]$$

B) What is the condition for exact differential? Derive Maxwell's equations. **(08)**

OR

B) Explain in detail Exergy Balance and Exergy Destruction. **(08)**

Q.4 A) Write down Vander Waals equation and obtain its constant a,b and R in terms of critical parameters P_c, V_c and T_c. **(07)**

OR

A) Define coefficient of expansions (ß) and coefficient of compressibility (K) and show that **(07)**

$$\frac{\beta}{K} = \left(\frac{\partial P}{\partial T}\right)_V$$

Find β and K for a perfect gas.

B) Compare Fermi-Dirac, Bose Einstein and Maxwell-Boltzman statistics when four particles are arranged in two energy levels. Two particles are at energy level ε_1 having a degeneracy of g_1=4 and other two particles at energy level ε_2 having a degeneracy of g_2=2. **(08)**