

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**M.Tech., Winter 2017 - 18 Examination**

**Semester: 1****Subject Code: 03210103****Subject Name: Advanced Thermodynamics****Date: 30/12/2017****Time: 02:00PM to 04:30PM****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) What is concept of continuum? How will you define density and pressure using this concept? (05)  
B) Explain the terms: Reversibility, Irreversibility, Second Law Efficiency. (05)  
C) Give the expression for the entropy generation rate for a control volume of steady flow system. (05)
- Q.2 Answer the following questions.** (Attempt any three) (Each five mark) (15)
- A) Discuss the Fermi-Dirac (F - D) statistics. Compare the Fermi-Dirac, Bose-Einstein and Maxwell-Boltzmann statistics when 4 particles are arranged in two energy levels. Two particles are at energy level  $\epsilon_1$  having a degeneracy  $g_1 = 4$  and other two particle at energy level  $\epsilon_2$  having a degeneracy  $g_2 = 2$ .
- B) Define exergy balance. Explain exergy balance for a steady flow system.
- C) State the third law of thermodynamics. Discuss the Physical and chemical facts of the third law.
- D) Discuss the principle of Equipartition of energy.
- Q.3** A) Explain the Gouy-Stodola theorem. Write equation for heat transfer through a finite temperature difference. (07)  
B) What is the condition for exact differential? Derive Maxwell's equations. (08)
- OR**
- B) Derive the expression for the irreversibility and second law efficiency of (08)  
(A) Steam turbine  
(B) compressor  
(C) heat exchanger  
(E) Mixing of Two Fluids
- Q.4** A) Write down the Vander Waals equation of state. How does it differ from the ideal gas equation of state? (07)
- OR**
- A) State application of statistics to gases-mono-atomic ideal gas. (07)  
B) Explain the principle of operation of a hydrogen-oxygen fuel cell. What is the maximum work obtainable in the cell? (08)