PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 3   Date: 27/05/2019
Subject Code: 03101202   Time: 02:00 pm to 04:30 pm
Subject Name: Basic Engineering 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) Objective Type Questions: **(15)**
   1. Which of the following is not an extensive property?
      (a) Volume   (b) Pressure   (c) Energy   (d) Entropy
   2. A process, which is a locus of all equilibrium points is called as,
      (a) Poly-tropic   (b) Irreversible   (c) Quasi-static   (d) none of these

   3. In a gas turbine cycle with regeneration,
      (a) Pressure ratio increases   (b) Work output decreases
      (c) Thermal efficiency increases   (d) Heat input increase

   4. The real gas starts behaving like an ideal gas when,
      (a) P is very large & T is very small   (b) T is very large & P is very small
      (c) P & T both are very large   (d) P & T both are very small

   5. If $\Delta S_{uni} < 0$, then the process is
      (a) Reversible   (b) Irreversible   (c) Impossible   (d) None

(B) Fill in the blanks:
1. Specific Volume is an _____ property
2. All properties are _____ function (path, point)
3. System and surrounding together constitute _____.
4. The work done by a closed system in a reversible process is always ___ that done in an irreversible process.
5. Efficiency of a heat engine is defined as_____
(C) True or False:
1. Cyclic integration of all the property is always zero. (**True or False**).
2. According to Clausius inequality, for irreversible cycle $\frac{\oint dQ}{T} > 0$. (**True or False**).
3. System, in which energy transfer takes place but mass remains constant, is known as open system. (**True or False**).
4. First law of thermodynamics refers to conservation of mass. (**True or False**).
5. For the same compression ratio and heat rejection, $\eta_{otto} > \eta_{dual} > \eta_{diesel}$. (**True or False**).

Q.2 Answer the following questions. (Attempt any three)   **(15)**
   A) Explain Quasi-static process.
   B) Derive the steady flow energy equation.
   C) Prove that internal energy is a point function.
   D) Explain Clausius theorem.

Q.3 A) Prove that Equivalence of Kelvin-Plank and Clausius statements of second law of   **(07)**
   thermodynamics.
   B) In an air standard Diesel cycle the compression ratio is 16, and at the beginning of isentropic   **(08)**
   compression, the temperature is 15 ^{o}C and the pressure is 0.1 MPa, heat is added until the
   temperature at the end of constant pressure process is 1480 ^{o}C. Calculate (a) cut off ratio (b) the
   heat supplied per kg of air. (c) the cycle efficiency and (d) the mean effective pressure.
                                              OR
   B) Explain the working principle of closed Brayton cycle and hence derive the ideal thermal   **(08)**
   efficiency of Brayton cycle in terms of pressure ratio.

Q.4 A) An engine working on Otto cycle is supplied with air at 0.1 MPa, 35 ^{o}C. The compression ratio is
   8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the   **(07)**
   cycle efficiency and the mean effective pressure. (for air, $C_P = 1.005$, $C_V = 0.718$ and $R = 0.287$
   kJ/kgK)
                                              OR

A) Explain in brief Clausius-Clapeyron equation and Joule- Thomson coefficient **(07)**

B) One kg of ice at -5 $^{\circ}$C is exposed to the atmosphere which is at 20 $^{\circ}$C. The ice melts and comes into thermal equilibrium with the atmosphere. (a) Determine the increase in entropy of universe. (b) find out the change in entropy of surrounding and system. Given that C_P of ice = 2.093 kJ/kg K, C_P of water = 4.187 kJ/kg K and latent heat of fusion of ice is 333.3 kJ/kg. **(08)**