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

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B. Tech Winter 2019 - 20 Examination

Semester: 3 **Date: 27/11/2019**
Subject Code: 203101203 / 03101202 **Time: 2.00 pm to 4.30 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 - (All are compulsory) (Each of one mark) **(05)**

1. A quasi-static process has main characteristics as it is
   (a) a stationary process
   (b) an infinitely slow process
   (c) a random process
   (d) a spontaneous process
2. A cyclic heat engine operates between a source temperature of 927 ^{o}C and a sink temperature of 27 ^{o}C. What will be the maximum efficiency of the heat engine?
   (a) 100%
   (b) 80%
   (c) 75%
   (d) 70%
3. PMM2 is the machine which violates _____
   (a) Kelvin-Planck statement
   (b) Clausius statement
   (c) Both a & b.
   (d) none of the above
4. What is the equation for entropy of a system if two parts 1 and 2 having entropies S1 and S2 are considered in equilibrium?
   (a) $S = S_1 – S_2$
   (b) $S = S_1 + S_2$
   (c) $S = (S_1 + S_2) / 2$
   (d) $S = \sqrt{S_1}\ S_2$
5. People use electric energy to heat and light homes. What does it indicate?
   (a) People are destroying energy
   (b) People are creating energy
   (c) People are converting energy from more exergy value to less exergy value
   (d) People are converting energy from less exergy value to more exergy value

B) Short Questions – (All are compulsory) (Each of two mark) **(10)**

1. Define intensive and extensive properties.
2. Define following terms: 1) dead state 2) high grade energy 3) irreversibility.
3. Explain the term exergy. Give suitable example.
4. State Avogadro’s law. Where we can use it?
5. Draw the brayton cycle diagram with ideal reheating and intercooling.

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Explain the Clausius inequality.
B) What is entropy? Prove that it is a point function and hence property of the system.
C) Prove the equivalency of Kelvin Plank and Clausius statements of second law of thermodynamics.
D) Explain Vander Waal's equation of state.

Q.3 A) Derive the general energy equation and deduce it for steady flow energy equation. Apply the same to nozzle. **(07)**

B) Air at 1 bar pressure, 290 K temperature flows steadily at the rate of 120 m^3/hr into a compressor where its pressure and temperature are respectively raised to 15 bar and 390 K. During the compression process, the heat transfer from the compressor is 10 percent of work transfer from the machine. Neglecting changes in kinetic energy and potential energy, evaluate the work and heat interactions. Presumes that air behaves as a perfect gas. **(08)**

OR

B) An engine mounted on a ship has a thermal efficiency 80% of that corresponding Carnot cycle. The engine receives heat from the sea at 300 K and rejects heat to the atmosphere at 280 K. The work output from the engine is dissipated through an agitator to heat 500 kg of sea water to 355 K. What quantity of heat must be extracted from the sea water to provide the required heating effect? Take specific heat of sea water Cp = 4.187 kJ/kgK **(08)**

Q.4 A) Explain p-V-T surface for a pure substance by defining i) Triple point, ii) Critical point and iii) Vapor dome. **(07)**

OR

A) State various methods to improve efficiency of Brayton cycle. With suitable diagrams, explain any two of them. **(07)**

B) In an air standard diesel cycle, the compression ratio is 15 and fluid properties at the beginning of compression are 100 kPa and 300 K. For a peak temperature of 1600 K, calculate (a) the percentage of stroke at which cut off occurs (b) the cycle efficiency and (c) the work output per kg of air. **(08)**