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**ME 131303**

Roll No. of candidate

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**2019**

**B.Tech. (ME) 3rd Semester End-Term Examination**

**BASIC THERMODYNAMICS**

**(New Regulation)**

**(w.e.f. 2017 – 2018)**

Full Marks – 70

Time – Three hours

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The figures in the margin indicate full marks  
for the questions.

Answer Question No. 1 and any *four* from the rest.

1. Fill up the gaps : (10 × 1 = 10)

(i) 1 bar is equal to \_\_\_\_\_ Pascal.

(ii) The property introduced by Zeroth law of thermodynamics is \_\_\_\_\_.

(iii) The property introduced by first law of thermodynamics is \_\_\_\_\_.

(iv) The property introduced by second law of thermodynamics is \_\_\_\_\_.

[Turn over

- (v) A reversible adiabatic process is known as \_\_\_\_\_.
- (vi) A process in which temperature remains constant is called \_\_\_\_\_.
- (vii) Properties of substances like pressure, temperature and density in thermodynamics coordinates are \_\_\_\_\_ function.
- (viii) Properties which are independent of mass is called \_\_\_\_\_.
- (ix) According to Clausius's inequality, a cycle is reversible when \_\_\_\_\_.
- (x) Amount of oxygen required for complete combustion of 5 kg of Carbon is \_\_\_\_\_ kg.
2. (a) Define (i) Isolated system (ii) Closed System (iii) Open system.
- (b) What do you mean by Thermodynamics equilibrium?
- (c) Differentiate between Intensive property and Extensive property. (5 + 5 + 5 = 15)
3. (a) State Zeroth law of thermodynamics.
- (b) Name any three thermometers along with their thermometric properties.
- (c) A Platinum resistance thermometer has a resistance of 2.8 ohm at 0°C and 3.8 ohm at 100°C. Calculate the temperature when the resistance indicated is 5.8 ohm. (3 + 5 + 7 = 15)

4. (a) State the First law of thermodynamics.
- (b) Prove that energy is a property of a thermodynamic system.
- (c) A stationary mass of gas is compressed without friction from an initial state of  $0.3 \text{ m}^3$  and  $0.105 \text{ MPa}$  to a final state of  $0.15 \text{ m}^3$  and  $0.105 \text{ MPa}$ , the pressure remaining constant during the process. How much does the internal energy of the gas change?  $(3 + 5 + 7 = 15)$
5. (a) Give the following statements of second law of Thermodynamics
- (i) Clausius Statement
- (ii) Kelvin Plank Statement.
- (b) Show that no heat engine working between the fixed temperatures can have efficiency greater than that of a reversible engine working between the same temperatures.
- (c) Show that  $(\text{COP})_{\text{Heat Pump}} = (\text{COP})_{\text{Refrigerator}} + 1$   
 $(5 + 5 + 5 = 15)$
6. (a) Define the following terms: Degree of superheat, calorific value, stoichiometric air, HCV, LCV, proximate analysis and ultimate analysis
- (b) A cyclic heat engine operates between a source temperature of  $800 \text{ }^\circ\text{C}$  and a sink temperature of  $30 \text{ }^\circ\text{C}$ . What is the least rejection per kW net output of the engine?  $(7 + 8 = 15)$

7. (a) Draw the P-V and T-S diagram for an Otto cycle and Diesel cycle.
- (b) What do you mean by critical point and triple point of water? Draw the phase diagram for water with P-T coordinates.
- (c) What do you mean by saturated liquid and compressed liquid? Explain the Rankine cycle in brief with a schematic diagram.

(5 + 5 + 5 = 15)

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