Total No. of Questions : 8] *[Total No. of Printed Pages : 2*

Roll No .....

ME-3005-CBGS

B.E. III Semester

Examination, December 2020

Choice Based Grading System (CBGS)

Thermodynamics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Draw neat sketch if required.

1. a) What is thermodynamic equilibrium? Discuss its aspects. Explain the significance of quasi static process.
   b) 3 kg of air at 2.5 bar and 77°C is compressed polytropically to 7.5 bar, n = 1.2. It is then cooled isothermally to its original state. Find out the net work and heat transferred.

2. a) Establish the equivalence of Kelvin-Planck and Clausius statements.
   b) A refrigerator plant for a food store operates as a reversed carnot heat engine cycle. The store is to be maintained at a temperature of –5 °C and heat transfer from the store to the cycle is at the rate of 5 kW. If heat is transferred from the cycle to the atmosphere at a temperature of 25 °C. Calculate the power required to drive the plant.

3. a) Find an expression for work done during a polytropic process in terms of initial and final process and volumes.

b) $0.25m^3$ of a gas at a pressure of 20 bar and temperature of 200°C is cooled to a temperature of 50°C at constant volume. Find out final pressure, change in internal energy, heat extracted and change of entropy. Take $C_v = 0.78$ and $C_p = 1.005$ kJ/kg.

4. a) Define dryness fraction of steam. How do you measure it.
   b) Steam at 8 bar has enthalpy $h = 2360$kJ/kg. Find its state and internal energy.

5. a) Derive an expression for the air standard efficiency of the diesel cycle.
   b) A certain gas has $C_p = 1.968$ and $C_v = 1.507$ kJ/kg-K. Find its molecular weight and the gas constant. A constant volume chamber of 0.3 m^3 capacity contains 2 kg of this gas at 5ºC. Heat is transferred to the gas until the temperature is 100ºC. Find the work done, the heat transferred and the change in internal energy, enthalpy and entropy.

6. In a constant volume 'Otto cycle', the pressure at the end of compression is 15 times that at the start, the temperature of air at the beginning of compression is 38ºC and maximum temperature attained in the cycle is 1950ºC. Determine
   i) Compression ratio
   ii) Thermal efficiency of the cycle
   iii) Work done
   Take y for air = 1.4.

7. a) Derive an expression for the efficiency of the Carnot engine.
   b) Explain P-V-T surface for water.

8. a) Define the steady flow process. Explain flow energy equation.
   b) Discuss the properties of mixture of ideal gases.

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