****I Mid Term examination**

**Session: 2018-19**

**B.Tech II Year (III-Semester)**

**Subject with code: 3ME4-05**

**SET-A**

Time: 2 hrs. M.M.:30

**Instruction for students:**

1. No provision for supplementary answer book.
2. Question paper contains three sections. Sec A includes 5 Short answers type questions (upto 25 words) Sec B- contains 06 Questions out of which any 04 questions to be attempt by the student (Analytical/Problem solving questions.). Sec C- contains 03 Questions out of which any 02 questions to be attempt by the student (Descriptive /Design questions.)

**Sec-A** (5\*1=5 Marks)

Q.1 Define a thermodynamics system, surrounding and boundary.

Q.2 Define to Clausius statement for II low of thermodynamic.

Q.3 Explain to Extensive and intensive properties.

Q.4 Explain to Path Function and Point Function

Q.5 briefly explains steady state processes.

**Sec-B** (4\*2.5=10 Marks)

Q.1 Give the expression for steady flow energy equation.

Q.2 Carnot refrigerator removes 20,000 KJ/min from a cold storage at -20 0C. Heat is rejected to atmosphere at 250C. Determine the power required.

Q.3 In a steam power station, steam flows steadily through a 0.2 m diameter pipeline from the boiler to the turbine. At the boiler end the steam conditions are found to be: p = 4 MPa, t = 4000C, h = 3213.6 kJ/kg and v = 0.073 m3/kg. At the turbine end, the conditions are found to be: p = 3.5 MPa, y = 3920C, h = 3202.6Kj/kg. There is a heat loss of 8.5kJ/kg from the pipe line. Calculate the steam flow rate.

Q.4 A heat engine develops 10 kw power when receiving heat at the of 2250 KJ/min. Evaluate the corresponding rate of heat rejection from the engine and its thermal efficiency.

Q.5 Explain the Carnot cycle and Carnot engine.

Q.6 what is a thermal energy reservoir? Define in terms of heat source and sink.

**Sec-C** (2\*7.5=15 Marks)

Q.1 An engine working on the Otto cycle is supplied with air at 0.1Mpa, 350C. The compression ratio is 8

Heat supplied is 2100 kj/kg. Calculate the maximum pressure and temperature of the cycle, the cycle Efficiency and the mean effective pressure. ( Cp=1.005, Cv = 0.718, and R = 0.287 KJ/kg K)

Q.2 Explain briefly the diesel cycle with p-v & T-S diagram and derive expression for efficiency.

Q.3 Write down general energy equations for steady flow systems.

(i) Steam Nozzle

(ii) Turbine

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**Sec-A** (5\*1=5 Marks)

Q.1 Explain the reversibility and irreversibility.

Q.2 Give the Kelvin-Plank statement.

Q.3 What is a thermal energy reservoir? Define in terms of heat source and sink.

Q.4 Explain to Zero law of thermodynamics.

Q.5 Drive the mathematical form of I low of thermodynamic.

**Sec-B** (4\*2.5=10 Marks)

**Q.1** Draw the p-v and t-s diagram for Otto, diesel and dual cycle.

**Q.2** A perfect gas flows through a nozzle where it expands in a reversible adiabatic manner. The

Inlet conditions are 22 bars. Determine the exit velocity and exit area if flow rate is 4 kg/s. take R = 190 J/Kg K, Cp=733J/Kg K, γ=1.35.

Q.3 Carnot refrigerator removes 20,000 KJ/min from a cold storage at -20 0C. Heat is rejected to atmosphere at 250C. Determine the power required.

Q.4 A reversible heat engine delivers 0.6 KW power and rejects heat energy to a reservoir at 300 k at the rate of 24 KJ/min. Make calculation for the engine efficiency and the temperature of the thermal reservoir supplying heat to the engine.

Q.5 A heat source of 800K loses 2000KJ of heat to sink at (i) 500K and (ii) 750K. Determine which heat transfer is more irreversible.

Q.6 Show that the COP of a heat pump is greater than the COP of refrigerator by unity.

**Sec-C** (2\*7.5=15 Marks)

Q.1 In an Otto cycle, air at 0.5 bar and 250 k is compressed isentropic ally until the pressure is 15 bar. The heat is added at const. volume until the pressure rises to 40 bar. Calculate air standard efficiency and the mean effective pressure for cycle. Take Cv = 0.717 KJ/kgk & R = 8.317 KJ/kg mole k.

Q.2 Explain briefly the diesel cycle with p-v & T-S diagram and derive expression for efficiency.

Q.3 Explain the Carnot cycle and Carnot engine.