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SF-6569

B. E. - II (Sem. IV) (Mechanical) Examination

May / June – 2011

Thermodynamics - I

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - II (Sem. IV) (Mechanical)**

Name of the Subject :

☛ **Thermodynamics - I**

☛ Subject Code No. : **6 5 6 9** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Answer all questions.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of steam table, molier diagram, refrigeration charts are permitted.

1 (a) Distinguish between extensive and intensive properties and give example of each. **4**

(b) State zeroth law of thermodynamics and show how it is useful in measurement of temperature. **6**

(c) Distinguish between heat and work. **6**

OR

1 (a) Explain the terms critical point and triple point. **6**

(b) Determine the amont of heat which should be supplied to 2 kg of water at 25°C to convert it in to steam at 5 bar and 0.9 dry. **10**

2 (a) Define "internal energy" and prove that it a property of a system. **6**

(b) A container is divided in to compartments by partition. The container is completely insulated so that there is no heat transfer. One portion contains gas at temperature T_1 and pressure P_1 while the other portion also has the same gas but at the temperature T_2 and pressure P_2. If the partition is removed, what will be the change of internal energy and work done due to mixing of two gas? **10**

OR

2 A cylinder contains $0.45m^3$ of gas at 1 bar and $80°C$. The gas is compressed to a volume of $0.13m^3$, the final pressure being 5 bar, determine **16**

(i) The mass of gas

(ii) the value of index 'n' for compression

(iii) The increase in internal energy of gas

(iv) The heat exchanged by the gas during compression.

3 (a) Write down the general energy equation for steady flow system and simplify when applied to (i) centrifugal water pump (ii) steam nozzle. **9**

(b) In a gas turbine unit, the gas flows through the turbine is 15 kg/s and the power developed by the turbine is 12 MW. The enthalpies of gas at inlet and outlet are 1260 kJ/kg and 400 kJ/kg respectively and the velocities of the gas at inlet and outlet are 50 m/s and 110 m/s respectively. Calculate the rate at which heat is rejected from the turbine. **9**

4 Attempt the following : **18**

(a) Define partial pressure, partial volume, Dalton's law and Amagat's law.

(b) Differentiate between dry air and moist air ? Can we treat water vapour in moist air as perfect gas ? Justify your answer.

(c) Define following :
COP, Heat pump, Kelvin Plank statement,
Clausius statement.

(d) A domestic food freezer maintains a temperature of $-15°C$. The ambient temperature is $30°C$. The heat leaks into the freezer at 1.75 kJ/sec. What is the minimum power necessary to pump out heat.

5 (a) State and prove Clausius inequality. **16**

(b) A reversible heat engine operates between two reserviors at $600°C$ and $40°C$. The engine drives a reversible refrigerator which operates between the same $40°C$ reservior and a reserviour at $-18°C$. The heat transfer to the heat engine is 2100 kJ and there is a net output of 370 kJ from combined plant. Evaluate the heat transfer to the refrigerator and net heat transfer to the $40°C$ reservior.

OR

5 (a) Explain concept of Entropy in detail. **16**

(b) 4 kg of water at $27°C$ is mixed with 1 kg of ice at $0°C$. Assuming adiabatic mixing determine the temperature of the mixture of water and ice. Calculate the net change of entropy. Assume enthalpy of fussion of ice as 335 kJ/kg.

6 Attempt any **two :** **16**

(a) Explain following terms :
fire point, pour point, flash point, cloud point.

(b) How are fuels classified ? Compare chemical and physical properties of any two fuels.

(c) State and explain thermodynamic temperature scale.

(d) Prove that $\eta_{Carnot\,cycle} = \frac{T_1 - T_2}{T_1}$ where T_1 is source temperature and T_2 is sink temperature.