Uva Wellassa University, Sri Lanka
End Semester Examination – July 2010
SCT 254-1 Thermodynamics

Time: One (01) hour

Total 05 Questions

Answer **four (04)** questions only

$R = 8.31$ J/ mol. K^{-1}

1 atm = 101, 325 Pa

Specific heat of water = 4.186 Joule /gram

01) I. State 1st law of thermodynamics. (04 marks)

II. Explain three processes of thermodynamics. (06 marks)

III. For an adiabatic expansion of a perfect gas, show that $PV^{\gamma} = K$, where γ and K are constants. (10 marks)

IV. A quantity of air at 27 ^{0}C and atmospheric pressure is suddenly compressed to half of its original volume. Find the final pressure. Take γ is 1.4 for air. (05 marks)

02) I. Give Kelvin-Plank statement for the second law of thermodynamics. (04 marks)

II. What are heat engines ? Give a schematic diagram of a steam engine and describe its operation. (08 marks)

III. Derive an expression for the efficiency of a heat engine. (04 marks)

IV. A 100 KW engine is operating between 217 ^{0}C and 17 ^{0}C. Calculate

(a) The amount of heat absorbed,

(b) The amount of heat rejected and

(c) The efficiency of the engine. (09 marks)

03) I. Explain why P-V diagrams are important ?

(05 marks

II. When a system is taken from the state A to the state B along the path ACB, 80 Joules of hea flows into the system, and the system does 30 Joules of work. (see Fig. 01)

(a). How much heat flows into the system along the path ADB, if the work done is 10 Joules.

(07 marks

(b). The system is returned from the state B to the state A along the curved path. Th work done on the system is 20 Joules. Does the system absorb or liberate heat an how much ?

(07 marks

(c). If $U_A = 0$, $U_D = 40$ Joules, find the heat absorbed in the process AD and DB. Here U and U_B are internal energies of the state A and state B respectively.

(07 marks)

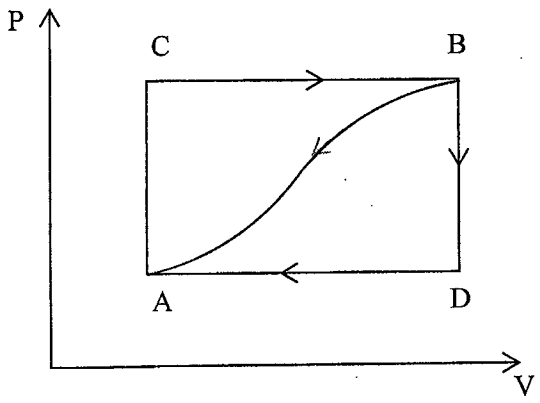

Figure 01

04) I. What do you mean by entropy in a system ?

(04 mark

II. Give T-S diagrams for an isothermal process and a reversible adiabatic process. Acceptab explanations should be given for the shapes of the diagrams in two separate processes.

(06 mark

II. 1 kg of water at 273 K is brought in contact with a heat reservoir at 373 K. Then

(a) What is the change in entropy of water when its temperature reaches 373 K ?

(b) What is the change in entropy of the reservoir and the universe.

(15 mark

05) An adiabatic cylinder, closed at both ends, is fitted with a frictionless adiabatic piston that divides the cylinder into two parts. Initially the pressure, volume, and temperature are the same on both sides of the piston (P_0, V_0, and T_0). The gas is ideal with Cv independent of temperature and $\gamma = 1.5$. By means of a heating coil in the gas on the left side, heat is slowly supplied to the gas on the left until the pressure reaches $27P_0/8$. In terms of n,R ,V_0 and T_0;

(a) Calculate the final volume and the temperature on the right side.

(b) What is the final temperature on the left side ?

(c) How much heat must be supplied to the gas on the left side ?

(d) How much work is done on the gas on the right side ?

(e) Calculate the entropy change of the gas on the left side, right side and the universe.

(25 marks)