expression PV^n = constant, where n has a constant value of 1.4. If the initial pressure and volume of the gas are 100 kN/m^2 and 2 m^3 respectively and the final volume is 0.5 m^3, determine:

i. The final pressure of the gas
ii. The work done during the process
iii. Sketch the process on P-V diagram

QUESTION 4

(a) State the Second Law of Thermodynamics

(b) A quantity of steam exists in a closed rigid vessel of volume 0.12m^3 and it exerts a pressure of 8bar at 200°C. If the vessel is cooled so that the pressure falls to 2.5bar

(i) find the saturation temperature t_s corresponding to $p_1 = 8bar$

(ii) which temperature is greater, $t_1 = 200$°C or t_s and what does this show of the initial condition of the steam at state 1?

(iii) determine v_1, the specific volume of the steam at state 1, hence determine the mass of the steam in the system

(iv) determine the value of mv_{g2} at state 2, how does this value compare with the free space of the vessel and what will be the condition of the steam in its final state (i.e. state 2)?

(v) find the dryness fraction at state 2

(vi) determine the final temperature, heat transfer and change in entropy of the steam

QUESTION 5

(a) Name the thermodynamic property which arose as a consequence of each of the following:

(i) the First Law

(ii) the Second Law

(b) Under what conditions will a process be reversible?

(c) 1kg of steam at 7bar, entropy 6.5kJ/kgK, is heated reversibly at constant pressure until the temperature is 250°C. Calculate the heat supplied, and show on a $T - s$ diagram the area which represents the heat flow.

QUESTION 6

(a) Explain any two corollaries of the Second Law

(b) 2kg of fluid fills a container of volume 0.14m^3. Determine the specific volume of the fluid

(c) Briefly explain the following terms as used in Thermodynamics:

(i) open system (ii) closed system

(d) Sketch a $p - v$ diagram and show on it: saturated vapour line, saturated liquid line and the critical pressure

(e) Calculate the:

(i) specific volume,

(ii) specific enthalpy and

(iii) specific internal energy of wet steam at 18bar, dryness fraction of 0.9.

Use your steam tables and the following equations: (i) $v = xv_g$ (ii) $h = h_f + xh_{fg}$ (iii) $u = (1 - x)u_f + xu_g$

FEDERAL UNIVERSITY OYE-EKITI
DEPARTMENT OF MECHANICAL ENGINEERING
2017/2018 B.ENG. DEGREE EXAMINATIONS

Course Code: MEE205
Course Title: Thermodynamics I
Units: 2
Instructions: Answer any FOUR (4) Questions from this paper.
Time Allowed: 2 Hours

QUESTION 1

a) Explain the following terms as applied to the study of thermodynamics
   i. System
   ii. State
   iii. Property
   iv. Boundary
   v. Surrounding

b) The pressure of the gas in a constant volume gas thermometer at 0°C was 325 mmHg and at it was 458 mm. The thermometer was then placed in a fluid of unknown temperature and necessary adjustment in the levels of the mercury column, the pressure was found to be 458 Determine the temperature of the fluid

c) State the units of the following quantities

i)Force ii) Pressure iii) Power iv) Electric potential v) Electrical resistance

QUESTION 2

a) What is total stored energy and express it mathematically

b) A 0.5 kg of gas contained in a cylinder-piston combination has an initial energy of 64 kJ. 13 of heat is added while it does 35 kJ of work to the surroundings. Determine the final internal ener of the gas per unit mass.

c) Briefly define the following terms
   i. Reversible process Internal energy
   ii. Translational energy
   iii. Flow process
   iv. Non-flow process

QUESTION 3

a) With the aid of a diagram show that for reversible expansion process $P = \frac{c}{v^n}$

b) A mass of an ideal gas is enclosed in a piston-cylinder arrangement. The gas is compres reversibly in such a manner that the pressure and volume are related to one another by