TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE IN BACHELOR OF TECHNOLOGY IN ELECTRICAL ENGINEERING

TMC 4256 : THERMODYNAMICS

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2017

TIME: 2 HOURS

DATE: Pick Date Aug 2017

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of Choose No questions. Attempt Choose instruction.

Do not write on the question paper.

Question ONE

a) Describe the following thermodynamic systems

   i. Open system

   ii. Isolated system

   iii. Adiabatic system

   iv. Heterogeneous system (8 marks)

b) State Zeroth Law (2marks)

c) Describe a mercury in class thermometer (4 marks)

d) Two Celsius thermometers A and B agree at Ice point (0^oC) and steam point (100^oC) and the related equation is $t_A = L + mt_B + nt_B^2$, where t_A and t_B are thermometer readings and L , M and n are constant. When both thermometers are immersed in an Oil both, thermometer A indicates 51^oC and B registers 50^oC. Calculate the reading A, where B reads 30^oC (6 marks)

Question TWO

a) Define the following terms
   i. Heat pump
   ii. Heat engine
   iii. Thermal reservoir (6marks)

b) State Kelvin-plank and clausius statements of second law of thermodynamics (4marks)

c) Derive the efficiency equation of heat engine (4marks)

d) A heat engine working at the rate of 105kw has an efficiency of 22%. Determine the quality of heat received and transferred from the working fluid (6marks)

Question THREE

a) State the first law of the thermodynamics (2marks)

b) 0.012m3 gas at constant pressure of $2600kN/m^2$ expands to a pressure of 210 KN/m2 by following the law $PV^{1.35} = C$. determine the work done by the gas during expansion process (6marks)

c) State the assumption made in the analysis of steady flow energy equation (5marks)

d) In a steady flow device, the work done by each kg of fluid is 150kj at the entry the fluid properties are $V_1=0.40m^3/kg$, P_1 =550kps and C_1 = 15m/s and V_2= 0.65m3/kg, P_2 = 105kps and C_2=275m/s are the fluid properties at the exit section is at the floor. The heat loss from the fluid is 10 x 103 J/kg. calculate change in internal energy through the device (7marks)

Question FOUR

a) What is an Ideal gas (2 marks)

b) State and explain the following

i. Charle's Law

ii. Boyle's Law

iii. Avogadro's Law (9marks)

c) A gas occupies a volume of $0.1m^3$ at a temperature of 20^0C and a pressure of 1.5 bar. Find the final temperature of the gas, if is compressed to a pressure of 7.5 bar and occupies a volume of 0.04 m^3. (3 marks)

d) A quantity of gas has a pressure of 350 KN/m^2 when its volume is 0.03m3 and its temperature is 35^Oc.If the value of R=0.29 KJ/kg K.

i. Calculate the mass of the gas .

ii. If the gas pressure is increased to 1.05 MN/m^2 while the volume remains constant ,Calculate new temperature. (6 marks)

Question Five

a) Define the following terms:

i. Internal Energy

ii. Enthalpy (3marks)

b) Derive the equation for work done for the following process:

i. Constant volume process

ii. Constant temperature process (6 marks)

c) Define the following terms

i. Wet steam

ii. Dry saturated steam

iii. Dryness fraction

iv. Super heated steam (6marks)

d) State the properties of steam which make it a preferred working fluid (5marks)