TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MARINE ENGINEERING

EME 2110: ENGINEERING SCIENCE I

SPECIAL/SUPPLEMENTARY EXAMINATION
JULY 2013 SERIES
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

- Answer booklet
- A non-programmable Calculator

This paper consists of **FIVE** questions
Attempt any THREE questions provided All questions carry equal marks. Maximum marks for each part of a question are as shown.

This paper consists of 5 printed Pages

Question ONE

(a) (i) Magnesium has three isotopes with masses 24, 25 and 26 which occur naturally in the proportion 78.7%, 10.13 % and 11.17% respectively. Calculate the relative atomic masses of Magnesium. (2marks)

(ii) Write the electronic configuration of the element with atomic number 33, stating its group number and period in the periodic table. (3marks)

(iii) A compound with moleculer mass 216 contains 33.37% carbon, 0.93% hydrogen and 65.7% chlorine. Determine the molecular formular of the compound. (RAM of C= 12, H=1, Cl = 35.5) (4marks)

(iv) Explain in terms of bonding why the melting point and boiling point of metals increase across the period. (1mark)

(b) A balloon of volume 2000m^3 is filled with hydrogen of density 0.09Kg/M^3. If the mass of the fabric is 100Kg and that of the pilot 75Kg

(i) What will be the greatest mass of equipment that can be carried when operating in air of density 1.25Kg/m^3?

(ii) How would this figure change if helium which has twice the density of hydrogen under the same conditions were to be used? (10marks)

Question TWO

a) (i) Distinguish between the following terms as used in calorimetry

I. Latest heat of fusion and specific latent heat of fusion

II. Heat capacity and specific heat capacity. (4marks)

(ii) Using a well-labelled diagram, describe how you can determine the specific latent heat of fusion using the method of mixtures (10marks)

b) The following data applies to a 500g of dry ice at -20˚C melted till the temperatures of water formed was found to be 30˚C.

- Specific heat capacity of ice = 2100J/KgK
- Specific heat capacity of water = 4200 J/KgK

It was found that the total heat energy required during the process was 252KJ. Calculate the specific latent heat of fusion (Assuming adiabatic process) (6marks)

Question THREE

a) A point moving with simple harmonic motion has a velocity of 6m/s when it is 1m from the mid position and 2m/s when 3m from the mid position. Calculate:
   i) It's angular velocity
   ii) It's periodic time
   iii) Its maximum acceleration
   (10marks)

b) The cutting stroke of a shaping machine is 500mm and is achieved in 1 second. The cutter accelerates uniformly during the first 125mm of the stroke, the velocity remains constant during the next 250mm and finally decelerates uniformly for the lost part of the stroke until it stops:

   i) Sketch a velocity-time curve for this motion.
   ii) Calculate the maximum speed of the cutter. (10marks)

Question FOUR

a) Define the following terms

   i) Work
   ii) Energy
   iii) Power output (3marks)

b) i. A pump ejects 6800Kg of water at a speed of 3.5m/s in 50seconds. Find the power of the pump. (3marks)

   ii. Show that the kinetic energy of a body is given by
   $K.E = \frac{1}{2} mV^2$ (4marks)

   iii. A particle moves between two points A and B 6cm a part such that it passes A at 8m/s and B at 5m/s. If the particle is 0.5Kg and moves along a vertical plane. Calculate the gain in potential energy. (3marks)

Question FIVE

a) Define the following terms as used in machine

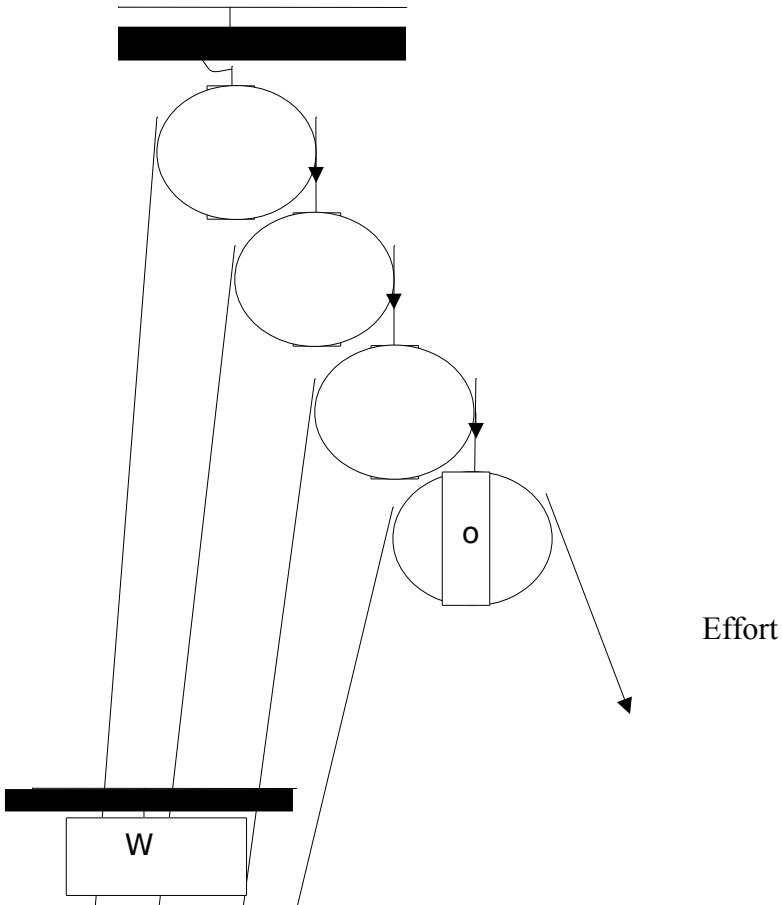
   i) Mechanical Advantage
   ii) Velocity Ratio (2marks)

b) (i) Show that the efficiency of a machine μ , 15 given by:

$$\mu = \frac{\text{Mechanical Advantage}}{\text{Velocity Ratio}}$$

(4marks)

(iii) The following system of pulley was used to lift a load of mass 400Kg. It was found that an effort of 430N was used to lift the load.



Calculate the efficiency of the system. (4marks)

c) The velocity Ration of a machine is 20 and its efficiency is 65%. If an effort of 15N is applied to the Machine.

i) Find the amount of load that will be lifted.
ii) If the machine has a constant frictions resistance, determine the law of the machine.
iii) Find the effort required to run the machine at
   I. No load
   II. A load of 560N (10marks)