MURANG'A UNIVERSITY COLLEGE
2014/2015 ACADEMIC YEAR
JULY 2015
SUPPLEMENTARY/SPECIAL EXAMINATION

FOR DIPLOMA
IN
MECHANICAL ENGINEERING,
ELECTRICAL ENGINEERING
BUILDING CIVIL ENGINEERING

SEB 1160 PHYSICS 1

DATE: 6TH AUGUST 2015 **TIME: 2HOURS**

INTRUCTIONS:
The paper contains **FOUR** questions each having **20** marks. Answer any **THREE** questions

Some useful constants
Specific heat capacity of water = 4200 J/kg.^{o}C
Specific heat capacity of ice = 2100J/kg.^{0}C
Specific heat capacity of copper = 390J/kg.^{0}C
Specific heat capacity of aluminium = 900 J/kgK
Latent heat of fusion of ice = 3.6 x 10^{5}J/kg
Latent heat of vaporization of steam = 2.26 x 10^{6}J/kg
g = 10 m/s^{2}

QUESTION 1 (20mks)

a) Define 4marks
   i. Heat
   ii. Heat capacity
   iii. Latent heat of fusion L_f
   iv. Latent heat of vaporization L_V

b) (i) A 0.05kg block of metal is heated to 200°C and then dropped into a beaker containing 0.4kg of water initially at 20.0°C. If the final equilibrium temperature of the mixed system is 22.4°C, find the specific heat of the metal. 3marks

(ii) An aluminum calorimeter with a mass of 100 g contains 250 g of water. The calorimeter and water are in thermal equilibrium at 10.0°C. Two metallic blocks are placed into the water. One is a 50.0-g piece of copper at 80.0°C; the other block has a mass of 70.0 g and is originally at a temperature of 100°C. The entire system stabilizes at a final temperature of 20.0°C. Determine the specific heat of the unknown sample. 4marks

c) How much heat is required to convert 200g of ice at -10^0C to steam at 100°C assuming no heat is lost to the surrounding. The ice is in a 100g copper calorimeter. 5marks

d) A person wants to have a bath in water at 60^0C. How much water at 70^oC should he add to 50kg of water at 20^oC to achieve the desired temperature? 4marks

Question 2 (20mks)

a) State the Kinematic equations of motion in a straight line with constant acceleration. 3mks

b) An automobile travels on a straight road for 50 km at 40km/h. It then continues in the same direction for another 60km at 50km/h. What is the average velocity of the car during this trip? 3marks

c) An indestructible bullet 3 cm long is fired straight through a board that is 15 cm thick. The bullet strikes the board with a speed of 320 m/s and leaves with a speed of 260 m/s.

(i) What is the average acceleration of the bullet as it passes through the board? 3marks

(ii) What is the total time that the bullet is in contact with the board? 3marks

(iii) What thickness of board (calculated to 0.1 cm) would it take to stop the bullet, assuming the bullet's acceleration through all parts of the board is the same? 3marks

d) A man, driving at 30m/s, enters a one-lane tunnel. He then observes a slow-moving van 145 m ahead traveling at 5m/s. He applies his brakes but can accelerate only at -2.00 m/s^2 because the road is wet. Will there be a collision? If so, determine how far into the tunnel and at what time the collision occurs. If not, determine the distance of closest approach between his car and the van. 5marks

QUESTION 3 (20mks)

a) Define the following terms as used in projectile motion: 3marks
   (i) Range
   (ii) Trajectory
   (iii) Time of flight

b) A student climbs a 50.0-m cliff that overhangs a calm pool of water. He throws two stones vertically downward, 1s apart, and observes that they cause a single splash. The first stone has an initial speed of 2.00 m/s.
   (i) How long after release of the first stone do the two stones hit the water? 4marks
   (ii) What was the initial velocity of the second stone? 3marks
   (iii) What is the velocity of each stone at the instant the two hit the water? 4marks

c) A soccer ball is kicked from the ground with an initial speed of $19.5 m/s$ at an angle of 45^0 . A player $55m$ away in the direction of the kick starts running to meet the ball at that instant. What must be his average speed if he is to meet the ball just before it hits the ground? Neglect air resistance. 6marks

QUESTION 4 (20mks)

a) Use Kirchhoff's laws to determine the currents flowing in each branch of the network shown in the figure below. 6marks

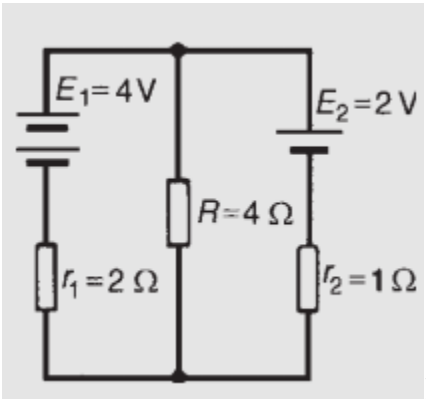

Fig 1

b) State three advantages of connecting electric bulbs in parallel. 3marks

c) For the circuit shown in the figure below, find

(I) The supply current 3marks

(II) The current flowing through each resistor 4marks

(III) the p.d. across each resistor. 4marks

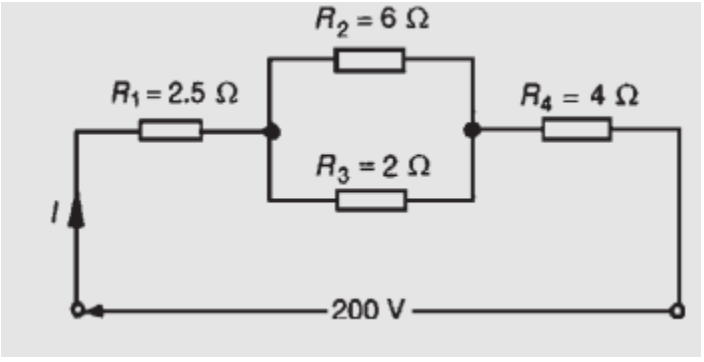

fig 2