THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

EBC 2317: PHYSICS FOR ENGINEERS

SPECIAL/SUPPLEMENTARY EXAMINATON

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Mathematical Table & Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY)

Question 1

a) Define the following terms:- (10 marks)

i) Density
ii) Hook's law
iii) Bulk Modulus
iv) Conduction
v) Convection

b) Using a well labeled stress-strain graph, define the elastic deformation and the plastic deformation (10 marks)

c) A balloon of constant volume 5000m^3 and mass of 4750kg rises to an altitude where upthrust is 400g Newton's, where g is the acceleration due to gravity at this height. Determine the density of air at this height. (3 marks)

d) In the circuit shown in fig 1, what is the p.d across each capacitor? What is the total charge stored? What is the capacitance of the single capacitor which would store the same charge as the two capacitors together? (7 marks)

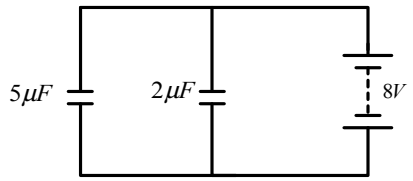

Fig. 1

SECTION B (Answer *any TWO questions from this section*)

Question 2

a) Define the following terms (3 marks)

i) Stress
ii) Strain
iii) Elastic modulus

b) A length of copper of square cross-section measuring 1.0mm by 1.0mm is stretched by a tension of 40N. What is the tensile stress in Pa? (3 marks)

c) A wire originally 2m long suffers a 0.1% strain. What is its stretched length? (2 marks)

d) Define capillarity and give three factors affecting capillarity (4 marks)

e) Calculate the height of a column of water in a very clean glass tube of radius 0.50 x 10^{-3}m. Take density of water to be 1.0g cm^{-3} and surface tension of water to be 7.3 x $10^{-2}Nm^{-1}$ (4 marks)

f) The internal diameter of the tube of a mercury barometer is 3.00 mm. Find the corrected reading of the barometer after allowing for the error due to surface tension. If the observed reading is 76.56cm. (Surface tension of mercury is 4.80 x 10^{-1} Nm^{-1}; angle of contact of mercury with glass is 140^o and density of mercury is 13.6 x 103 kg m^{-3} (4 marks)

Question 3

a) Define the term Kinematics (2 marks)

b) A ball is thrown straight up with an initial velocity of 40m/s. What is the velocity and height after 2 seconds? Take g = 10m/s (4 marks)

c) Derive the following equations as used in projectile motion. (9 marks)

i) Maximum height attained
ii) Time of flight
iii) Range

d) A sprint cyclist starts from rest and accelerates at 1m/s^2 for 20 seconds. He then travels at a constant speed for 1 minute and finally decelerates at 2m/s^2 until he stops. Find his maximum speed in km/h and the total distance covered in meters. (5 marks)

Question 4

a) Define the following terms: (3 marks)

(i) Linear expansivity
(ii) Area expansivity
(iii) Volume expansivity

b) Calculate the change in length of a copper rod 2m long after raising its temperature from 15oc to $\propto = 1.7 \times 10^{-5^o} C^{-1}$
25^oc. Take (3 marks)

c) If the temperature of 100cm3 of mercury in a glass vessel is raised from 10^oC to 100^oC and γreal for mercury is 1.82 x 10^{-4} ^{o} C^{-1} and $\propto$ glass is 8.00 x 10^{-6} $^o c^{-1}$, Calculate γapp. (6 marks)

d) Define the following terms: (2 marks)

(i) Centripetal force
(ii) Angular velocity

e) Turn table of $\propto$ record player makes 45 revolutions per minute. Calculate; (6 marks)

i) Its angular velocity in rad/s
ii) The linear velocity of a point 0.12m from the centre

Question 5

a) Define the following terms as used in electricity. (3 marks)
   i) Potential difference
   ii) Resistance
   iii) Capacitor

b) Derive the equations used to determine the combined capacitance of capacitors in: (8 marks)

   i) Parallel
   ii) Series

c) In the circuit shown in fig.2, what is the p.d across each capacitor? What is the total charge stored? What is the capacitance of two single capacitor which would store the same charge as the two capacitors together? (4 marks)

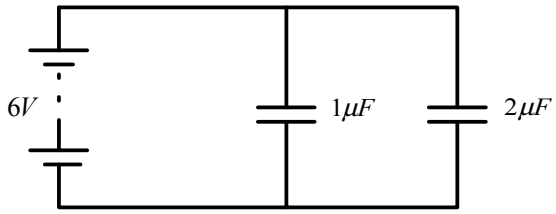

Fig. 2

d) Calculate the combined resistance of the network of resistors shown in fig 3. (3 marks)

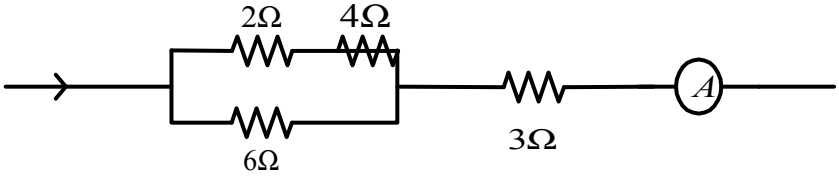

Fig. 3