



# 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 EXAMINATION**

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

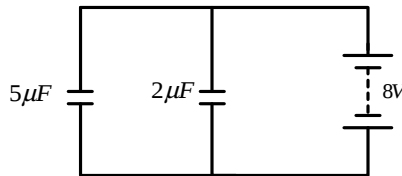
Maximum marks for each part of a question are as shown

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  $5000\text{m}^3$  and mass of  $4750\text{kg}$  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  $1.0\text{mm}$  by  $1.0\text{mm}$  is stretched by a tension of  $40\text{N}$ . What is the tensile stress in Pa? (3 marks)
- c) A wire originally  $2\text{m}$  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  $0.50 \times 10^{-3}\text{m}$ . Take density of water to be  $1.0\text{g cm}^{-3}$  and surface tension of water to be  $7.3 \times 10^{-2}\text{Nm}^{-1}$  (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  $4.80 \times 10^{-1}\text{Nm}^{-1}$ ; angle of contact of mercury with glass is  $140^\circ$  and density of mercury is  $13.6 \times 10^3 \text{kg m}^{-3}$ ) (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  $g = 10\text{m/s}^2$  (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  $1\text{m/s}^2$  for 20 seconds. He then travels at a constant speed for 1 minute and finally decelerates at  $2\text{m/s}^2$  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  $15^\circ\text{C}$  to  $25^\circ\text{C}$ . Take  $\alpha = 1.7 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$  (3 marks)
- c) If the temperature of  $100\text{cm}^3$  of mercury in a glass vessel is raised from  $10^\circ\text{C}$  to  $100^\circ\text{C}$  and  $\alpha_{\text{real}}$  for mercury is  $1.82 \times 10^{-4} \text{ }^\circ\text{C}^{-1}$  and  $\alpha_{\text{glass}}$  is  $8.00 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$ , Calculate  $\alpha_{\text{app}}$ . (6 marks)
- d) Define the following terms: (2 marks)
- (i) Centripetal force
  - (ii) Angular velocity
- e) Turn table of  $\alpha$  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**

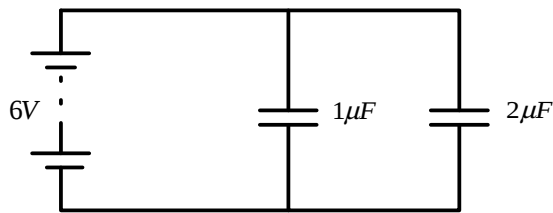
a) Define the following terms as used in electricity. (3 marks)

- i) Potential difference
- ii) Resistance
- iii) Capacitor

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

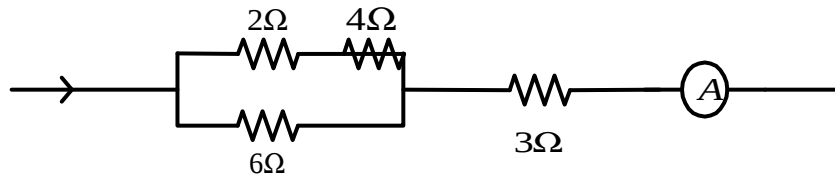
- i) Parallel
- ii) Series

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**