



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

SCU 100: PHYSICS

DATE: 3/8/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks)
- Answer any **two** questions from section **B** (each 20 marks).

Required data and constants:

$$g = 9.81 \text{ m s}^{-2}$$

$$\text{Density of water} = 1000 \text{ kg m}^{-3}$$

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

- a) Define relative density. (3 marks)
- b) An empty 60 liters petrol tank has a mass of 10 kg. Calculate its mass when full of fuel of relative density 0.72. (3 marks)
- c) Distinguish between speed and velocity. (2 marks)
- d) A body starts with an initial velocity of 26 ms^{-1} and moves with a constant acceleration of 7 ms^{-2} for 25 seconds. Calculate the distance moved in meters. (2 marks)
- e) Derive the equation for the greatest height in a projectile motion. (4 marks)
- f) An object is fired with a velocity of 200 ms^{-1} at an angle of 30° to the horizontal. Calculate its greatest height. (3 marks)
- g) Definition Young's modulus and deduce its quantitative expression. (4 marks)
- h) A Metallic wire of cross-sectional area 0.2 mm^2 is stretched through 0.2mm by a 4 kg mass. If its original length is 20cm, find
 - i Tensile strain
 - ii tensile Stress
 - iii Young's Modulus of the wire (9 marks)

SECTION B: ANSWER ANY OTHER TWO QUESTIONS

QUESTION TWO (20 MARKS)

- a) Distinguish between elastic and plastic deformations. (3 marks)
- b) A length of a copper wire of square cross-section $1 \text{ mm} \times 1 \text{ mm}$ is stretched by a tension of 40 N. Calculate the tensile stress. (3 marks)
- c) Define the term breaking stress for a non-brittle wire stretched by some forces attached from one end. (2 marks)
- d) Sketch a graph of stress against strain for a non-brittle wire in (b) above. On the sketch, label the elastic and plastic regions. (6 marks)
- e) Using kinetic theory of matter, explain the change of state from solid to liquid state. (3 marks)
- f) A wire originally 2 m long suffers 0.1% strain. Calculate its stretched length. (3 marks)

QUESTION THREE (20 MARKS)

- a) Distinguish between distance and displacement. (4 marks)
- b) Derive the second equation of linear motion. (4 marks)
- c) A body changes its velocity from 20ms^{-1} to 30ms^{-1} in 5 second, Calculate the acceleration. (3 marks)
- d) A body runs at a constant speed of 10ms^{-1} in 300 seconds and then accelerates uniformly to a speed of 20ms^{-1} over 20 seconds. This speed is maintained for 300 seconds before it decelerates uniformly to rest in 30 seconds.
 - i Sketch a velocity – time graph for the journey. (5 marks)
 - ii From the graph, determine the average speed (4 marks)

QUESTION FOUR (20 MARKS)

- a) Using kinetic theory, explain the existence of the three states of matter. (2mark)
- b) Define the following terms
 - i Molar heat capacity
 - ii Specific heat capacity
 - iii Specific latent heat of fusion. (6 marks)
- c) The temperature of 500g of a certain solid is raised to 120°C and then placed in 300g of water at 20°C . If the final steady temperature rises to 25°C , calculate the specific heat capacity of the solid. (4 marks)
- d) An electric heater which produces energy at a rate of 3000W contains 0.5 kg of water. It takes 100 seconds to heat the water from 10°C to 100°C
Calculate the difference in the heat produced by the kettle and heat taken in by water.
Suggest two reasons for the difference. (8 marks)

QUESTION FIVE (30 MARKS)

- a) State Ohm's Law. (2 marks)
- b) Give three factors which the resistivity of a wire depends upon. (3 marks)
- c) Two resistors, $2\ \Omega$ and $3\ \Omega$ are connected in series to a battery. When a voltmeter is connected to a $2\ \Omega$ resistor it reads 4 V.

- i Draw the diagram for the circuit.
 - ii Calculate:
 - 1. Current in the two resistors
 - 2. Reading of the voltmeter connected to $3\ \Omega$ resistor.
 - 3. EMF of the battery. (10 marks)
- d)
- i Define Coulomb of charge.
 - ii In an external circuit connected a current of 5 A passes through the circuit in 20 minutes. Calculate the number of coulombs. (5 marks)