



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

**SECOND YEAR FIRST SEMESTER EXAMINATION FOR
DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING
DIPLOMA IN CIVIL ENGINEERING**

SCU 100: PHYSICS

DATE:11/12/2017

TIME:8.30-10.30 AM

Instructions: Answer Question ONE and Any Other TWO questions

Take 'g' = 9.8 ms^{-2}

1. (a) Define the following terms:
 - (i) Fusion
 - (ii) Vaporization
 - (iii) Sublimation(3 marks)

- (b) Outline the meaning of the following phrases in relation to mechanical properties of matter:
 - (i) Elastic limit
 - (ii) Proportional limit
 - (iii) Plastic deformation(3 marks)

- (c) A length of steel wire of square dimensions $2.0 \times 10^{-3} \text{ m}$ by $3.0 \times 10^{-3} \text{ m}$ is stretched by a load whose mass is 2.0 Kg .
 - (i) Determine the stress experienced by the steel wire.(2 marks)

- (ii) If the breaking stress of the steel wire in No C (i) above is $1.2 \times 10^9 \text{Nm}^{-2}$, determine if the wire will break when a load of mass 5.0Kg is hung on it. (3 marks)
- (d) (i) Derive the three linear equations of motion for the uniformly accelerated object where the terms and symbols take their usual meanings. (8 marks)
- (ii) A rocket ship in a free space moves with a constant acceleration of 10.0ms^{-2} . If the rocket starts from rest, calculate the time duration taken to attain a speed of $1/10^{\text{th}}$ the speed of light. (2 marks)
- (iii) Calculate the distance it will travel in order to attain that above speed. (3 marks)
- (e) Three resistors, 3.0Ω , 4.0Ω , 5.0Ω are connected in parallel and a total current of 2.0 A passes through each of them for unspecified period of time.
- (i) Calculate the combined resistance of the three resistors. (3 marks)
- (ii) Determine the current through each resistor (3 marks)
2. (a) Distinguish the following terms: Circular motion, Angular displacement and Centripetal acceleration (3 marks)
- (b) For an object moving in a in a uniform circular path of direction, show that the angular velocity, $\omega=2\pi f$ (10 marks)
- (c) A mass of 2.0kg is attached to a string of length 60cm. It is whirled in a circle in a vertical string at 5 revolutions per second about a horizontal axis. Calculate the Tensional force in the string when the mass is at the:
- (i) Highest point in the circle
- (ii) Lowest point in the circle (7 marks)
3. (a) Show that the maximum height reached by a projectile is: $Y_{\text{max}} = (V_o \sin \Theta)^2 / 2g$. (8 marks)
- (b) A shell is fired horizontally from a gun located 50m above a plane with a muzzle at a velocity of 250ms^{-1}
- (i) How long does the shell remain in air (3 marks)
- (ii) Calculate its range in the air (3 marks)

- (iii) Calculate the vertical component of velocity as it hit the target (3 marks)
- (iv) What is the velocity on hitting the target (3 marks)
4. (a) State the Ohms law and give its mathematical expression. (3 marks)
- (b) Show that the electrical resistivity of a conductor is given by $\rho = \frac{AR}{L}$; where A is the area of the cross-section of the conductor, L is the length of the conductor and R is its resistance. (5 marks)
- (c) A constantan wire of resistivity $49 \times 10^{-8} \Omega \text{m}$ and cross-sectional area of $2.0 \times 10^{-2} \text{ cm}^2$ has a length of 1.5m. Calculate the resistance of the wire. (4 marks)
- (d) A cell supplies a current of 0.8A through a 3.0Ω resistor and a current of 0.5A through a 6.0Ω resistor. Calculate:
- (i) The internal resistor, r, of the cell (5 marks)
- (ii) The emf, E, of the cell (3 marks)
5. (a) Differentiate between Heat capacity and Specific Heat Capacity. (2 marks)
- (b) Using a well labeled diagram, describe in details how the thermal conductivity of copper bar metal can be measured accurately. (18 marks)