



## MURANG'A UNIVERSITY COLLEGE

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

### SECOND YEAR EXAMINATION FOR THE CERTIFICATE IN SCIENCE LABOLATORY TECHNOLOGY

#### ASLT 0204: PHYSICS TECHNIQUES EXAM

14C

DATE:13<sup>th</sup> NOVEMBER 2015

TIME 2 HOURS

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Answer all questions in this paper

#### Some useful constants

Speed of light  $c = 3.0 \times 10^8 \text{m/s}$

Mass of an electron  $= 9.1 \times 10^{-31} \text{kg}$

Charge of an electron  $= 1.6 \times 10^{-19} \text{C}$

1. A solid of relative density 1.2 and a volume of  $5\text{cm}^3$  is completely immersed in water. Determine;
  - a) Weight of solid in air [ 2mks]
  - b) Upthrust on the solid (density of water is  $1000\text{kgm}^{-3}$ ) [ 2mks]
2. Define the following as used in light waves
  - a) Diffraction [ 1mk]
  - b) Refraction [ 1mk]
  - c) Sketch a diagram to demonstrate diffraction [2mks]
3. A moving coil galvanometer has a resistance of  $10 \Omega$  and gives a full scale deflection (f.s.d) when a current of  $0.0075 \text{A}$  flows through it.
  - a. Calculate the potential difference at f.s.d [ 2mks]
  - b. Sketch a set-up of resistance and galvanometer coil for it to convert to an ammeter reading up to  $1.5\text{A}$ . [2mks]
  - c. Determine the value of the resistor in (b) above. [ 3mks]
4. State two applications of cathode ray oscilloscope. [ 2mks]
5. A virtual image of height  $4\text{cm}$  is produced by a convex lens of focal length  $20\text{cm}$ . If the size of the object is  $1 \text{cm}$ , find the position of the object. [ 4mks]

6. A cell supplies a current of 800mA through a  $2\Omega$  resistor and a current of 200A through a  $8\Omega$  resistor. Find the internal resistance of the cell. [4mks]
7. Find the time it takes a 240V, 1200W electric immersion heater to raise the temperature of 360 litres of water in a well lagged copper tank of mass 12 kg from  $15^{\circ}\text{C}$  to  $65^{\circ}\text{C}$ . (specific heat capacity of water and copper are  $4200\text{JKg}^{-1}\text{K}^{-1}$  and  $400\text{JKg}^{-1}\text{K}^{-1}$  respectively, density of water  $1000\text{kgm}^{-3}$ ) [4mks]
8. The angle of incidence of a ray of light in air is  $60^{\circ}$ . Find the angle of refraction in a material whose critical angle is  $45^{\circ}$ . [4mks]
9. State Archimede's principle. [2mks]
10. A solid of mass 4kg weighs 36N when wholly immersed in water. If density of water is  $1000\text{kgm}^{-3}$ , find:
- Upthrust on solid [3mks]
  - Volume of solid [3mks]
  - Relative density of solid [3mks]
11. Two capacitors of capacitance  $0.1\ \mu\text{F}$  and  $0.4\ \mu\text{F}$  were connected in series and the combination connected across a battery of 3 V. The battery was then removed and the free terminals joined together. Calculate the final charge which was stored in the  $0.1\ \mu\text{F}$  capacitor. [4mks]
12. The velocity of light in water is  $2.2 \times 10^8\text{m/s}$ , while in glass the velocity is  $2.0 \times 10^8\text{m/s}$ . find;
- Refractive index for light passing from water to glass. [4mks]
  - Angle of incidence in water in which would produce an angle of refraction of  $30^{\circ}$  in glass. [3mks]
13. A beaker contains 300g of water at  $21^{\circ}\text{C}$ . 3.5grams of ice at  $0^{\circ}\text{C}$  is added to the water which is then stirred until all the ice melts. Taking latent heat of fusion of ice to be  $334000\text{J/Kg}$ , determine;
- Amount of heat needed to melt the ice [3mks]
  - The lowest temperature of the mixture assuming that no heat enters or leaves the system and that the heat capacity of the beaker is negligible. [4mks]
14. An ammeter gives a full scale deflection for a current of 0.3 A and its coil resistance is  $0.4\Omega$ . Show how it can be adapted to give a full scale deflection of 2A. [4mk]
15. The frequency of a colour of light was recorded as 50kHz. Determine the wavelength
16. of the light.  
4mks
17. The diameter of a wire is 4mm and its resistivity is  $2.0 \times 10^{-6}\Omega\text{m}$ . Determine the:
- Length of wire that would make a resistance of  $50\ \Omega$  [3mks]
  - Diameter of a wire with equal length that would have a resistance of  $150\ \Omega$ . [2mks]
18. Distinguish between a mechanical wave and an electromagnetic wave giving an example of each. [4mks]