



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2014/2015 ACADEMIC YEAR**

FIRST YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DIPLOMA
IN
CIVIL AND STRUCTURAL ENGINEERING**

COURSE CODE: DCE 051

COURSE TITLE: PHYSICS

DATE: 8TH DECEMBER 2014

TIME: 11.00AM – 1.00PM

INSTRUCTIONS:

1. Answer Question **ONE** and any other **TWO** questions
2. Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION ONE (46 MARKS)

a) State the following terms;

i). Radioactivity (1mk).

ii). Binding energy (1mk)

iii). Show that I). $N = N_0 e^{-\lambda t}$, where N is the number of decayed atoms, N_0 is the number of radioactive atoms at time $t = 0$ and λ is the decay constant. (4mks)

$$\text{II.) } T_{\frac{1}{2}} = \frac{0.693}{\lambda} \quad (2\text{mks})$$

b) Define

i). Stress (1mk)

ii). Strain (1mk)

iii). Modulus of elasticity (1mk)

iv). Yield point (1mk)

v). Elastic point, describe the behavior of a wire that is gradually loaded to breaking point. (3mks)

c). Differentiate the following the following terms;

i). units and measurements (1mk)

ii). Systematic and random errors (1mk)

iii). SI base units and derived units (1mk)

d). State and derive Bernoullis theorem (6mks)

e). i). What is Youngs modulus of elasticity for a wire of diameter 0.5 mm which is stretched by 0.1 percent of its initial length by a load of 0.4 kg?. (2mks)

ii). What load attached to the end of 2m length of steel wire of diameter 1mm will produce an extension of 2mm if youngs modulus for steel is $2.0 \times 10^{11} \text{ NM}^2$? calculate the amount of stain energy stored in the loaded wire. ($g = 9.8 \text{ ms}^{-2}$) (3mks)

f). i) Show that the oscillations of a simple pendulum is SHM for small amplitudes, hence obtain an expression for its period of oscillations. (4mks)

ii) compare the value of acceleration due to gravity on the surface of mercury with its value on the earth's surface given that, radius of mercury = $0.38 \times$ radius of the earth, mean density of mercury = $0.68 \times$ mean density of earth. (3mks)

g). What is meant by ;

i) Centre of mass (1mk)

ii) centre of gravity of a body (1mk)

iii) To the edge of a square sheet of metal with side 6cm is attached the base of an isosceles triangular piece of the same material. If this triangle has a base of 6cm and a vertical height of 6cm, calculate the position centre of gravity of the composite sheet. (3mks)

h) i) Explain what is meant by black body radiation (1mk)

ii) Give any two examples of good absorbers of radiation and any two examples of poor absorbers of radiation. (2mks)

iii) Describe the factors that would affect the rate of heat radiation from a body. (3mks)

QUESTION TWO

a) Describe the basic composition of an atom. (3mks)

b) What is electric current? If the current through a lamp is 5A, what charge passes it in 5 minutes? (2mks)

c) Calculate the p.d across a 10Ω resistor carrying a current of 2A. (3mks)

d) Four 5Ω resistors are connected in parallel. What is the effective total resistance? (2mks)

QUESTION THREE

a) Explain why a metal lid on a glass jar can be unscrewed easily if the jar is inverted for a few seconds with the lid in very hot water. (2mks)

b) Explain the phenomenon of greenhouse effect. (2mks)

c) Outline a simple method for finding the thermal conductivity of a material. (3mks)

d) Estimate the rate of heat loss from a room through a glass window of area 2m^2 and thickness 3mm when the temperature of the room is 20°C and that of the air outside is 5°C . (3mks)

QUESTION FOUR

a) An R-L circuit of a 20mH inductor, 5Ω resistor and a 6V battery. The switch is closed at $t = 0$.

i). Find the time constant of the circuit (1mk)

- ii). Calculate the current in the circuit at $t = 1.6\text{ms}$. (1mk)
- b) By considering electron energy levels in a solid, distinguish conductors, insulators, and semi-conductors. (2mks)
- c) Explain the action of a centrifuge when used to hasten the decomposition of sediment from a liquid. (1mk)
- d) A pendulum bob of mass 1kg is attached to a string 1m long and made to revolve in a horizontal circle of radius 0.6m. Find the period of the motion and tension of the string. (3mks).

QUESTION FIVE

- a) i) Explain how sound is transmitted through air (3mks)
ii) If the speed of sound is 340m/s, what is the wavelength of a note of frequency 170Hz?
- b) Two trains emit sounds of same frequency of 277Hz. If one train is at rest and the other is travelling at 40km/hr away from an observer at rest, find the difference in frequencies that the observer would detect. (2mks)
- c) A soap bubble in a vacuum has a radius of 3cm and another soap bubble in a vacuum has a radius of 6cm. If the two bubbles coalesce under isothermal conditions, calculate the radius of the bubble formed. (5mks)