THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

FORM SIX SPECIAL SCHOOLS SYNDICATE JOINT EXAMINATION

131/1 **PHYSICS 1**

Time: 3:00 Hrs **Tuesday 14-March-2023 PM**

INSTRUCTIONS:

i. This paper consists of sections A and B with a total of ten (10) questions.
ii. Answer all questions in section A and any two questions from section B
iii. Section A carries seventy (70) marks and section B carries thirty (30) marks
iv. Marks allocation has been indicated on each section
v. Cellular phones and any other unauthorized materials are not allowed in an examination room
vi. Mathematical tables and non-programmable calculators may be used
vii. Write your examination number on every page of your answer sheet
viii. The following information may be useful.
ix. Acceleration due to gravity $g = 9.8 m/s^2$
x. Radius of the earth, $R = 6370 km$
xi. Pie, $\pi = 3.14$
xii. Density of water $\rho = 1000 kg/m^3$
xiii. Stefan-Boltzman constant, $\sigma = 5.67 \times 10^{-8} w/m^2 k^{-4}$

1. (a) (i) Applying a formula where it does not hold is a mistake or error? Explain by giving difference between the two key terms **(02 marks)**

(ii) Estimate the precision to which the young's modulus Y of the wire can be determined from the formula Y given that. $Y = \frac{4FL}{\pi\ d^2 e}$

F- (500± 0.5)
L= (3000±2) mm
d= (1±0.01)
e= (5±0.1) mm **(04 marks)**

(b)(i) State principle of homogeneity of dimension and hence state on what principle it is based upon? **(01 mark)**

(ii) If the speed of Transverse wave V along a wire of tension, T and mass M is given By $V = \frac{\sqrt{T}}{M}$ Apply dimensional analysis to check whether the given expression is correct or not. (03 **marks)**

2. (a) (i) Give one common difference between physical pendulum and simple pendulum (**02 marks)**

(ii) Why the velocity and acceleration of a body executing simple harmonic motion are out of phase

(02 marks)

(iii) Restoring force is necessary force for a body to execute S.H.M.Why? **(02 marks)**

b) A pan is attached to spring balance that has mass of 1kg. A mass of 2 kg when placed in a pan, stretches the spring by 10cm. what is the frequency which the empty pan will oscillate? **(04 marks)**

3(a) Water in a bucket whirled in a vertical circle do not spill out when whirled fast, but when whirled slowly the water spill out, why is it so **(03 marks)**

(b) A space craft was launched from the earth to the moon .If the mass of the earth was given to be 81 times that of the moon and that the distance from the center of the earth to that of the moon is about 4 $x10^5$ km.

(i) Draw a sketch showing how the gravitational force of a space craft varies with its journey. **(02 marks)**

(ii) Calculate the distance from the center of the earth to the point where resultant gravitational force is zero **(05 marks)**

4. (a) Explain the following phenomenon as used in rotation dynamics.

(i) A diver rotates very fast with his arms and legs folded in. **(01½ marks)**

(ii) An ice skater spins at relatively low speed with her arms and legs out-stretche **(01½ marks)**

(b) (i) Explain why moment of Inertia is not unique? **(01 mark)**

(ii) State the law of conservation of angular momentum **(01 mark)**

(iii) Find the resultant linear acceleration of a car, given that the car was moving with speed of 30m/s on a circular track of radius 500m whose speed was increasing at rate of $2m/s^2$ **(4 marks)**

5 (a) (i) State the laws of black body radiation **(3 marks)**

(ii) The temperature of a furnace is 2324°c and the intensity in its radiation spectrum maximum nearly at 1200 Å. Calculate the surface temperature of the star that emits radiation of wavelength of nearly 4800 Å

(03 marks)

(iii) What does one require in order to establish a temperature scale? **(02 marks)**

(b) Explain the following phenomenon

(i) Steam pipes are wrapped with insulating material **(01 mark)**

(ii) Stainless steel cooking pain fitted with extra copper at the bottom are preferred (1 mark)

6. (a) (i) Give common example of adiabatic expansion **(01 mark)**

(ii) State what happens to the internal energy of a gas during adiabatic expansion? **(02 marks)**

(iii) The resistance thermometer and gas thermometer may show different values in measuring the temperature of the surrounding. Explain the reason behind. **(01 mark)**

(b) A mass of an ideal gas of volume 400cm' at 288k expands adiabatically where its temperature falls to 273k. Find

(i) The new volume of the gas **(03 marks)**

(ii) Final volume of the gas, if the gas finally compressed isothermally until its pressure returns to its original value ($\gamma = 1.4$)

(03 marks)

7. (a)(i)State the consequences of earthquake(any four) **(04marks)**

(ii) What are the precautions to be taken by engineers when constructing a building to overcome the effect of an earthquake? **(02 marks)**

(b) Explain how geothermal energy is extracted for generation of electricity **(04 Marks)**

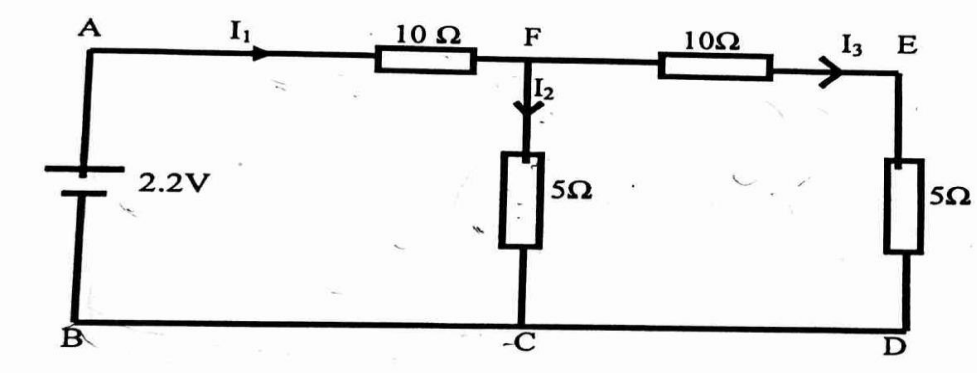
8. (a)(i)Upon which principle is the Kirchhoff's current law (junction rule) is based? **(01 mark)**

(ii) What are advantages of measuring unknown resistance with a wheat stone bridge?

Give three points **(03 marks)**

(b) A battery of negligible internal resistance is connected to the combination of resistor as

Shown



Find

(i) the effective value of the resistance across the terminals of the cell **(02marks)**

(ii) the value of the current I_1, I_2 and I_3? **(03 marks)**

(iii) p.d between B and F? **(02 marks)**

(c) An alternating current I is given by I= 141.1 sin 314t.

Find (i) Maximum value of current **(01 mark)**

(ii) Frequency **(01 mark)**

(d) Show that the SI unit of capacitive reactance (Xc) is ohm **(02 marks**

9. (a) (i) What is the level of doping in a semiconductor? **(02Marks)**

(ii) Briefly explain, why are rectifier diodes not operated in the breakdown region? **(02 Marks)**

(b) A n-p-n transistor is connected in common emitter configuration in which collector supply is 8 V and the voltage drop across the load resistance of 800 Ω connected in the collector circuit is 0.8 V. if the current amplification factor is 25, determine:

(i) The collector-emitter voltage and base current. **(03 Marks)**

(ii) Voltage gain and power gain. **(02 Marks)**

(c) (i) Describe two advantages and two disadvantages of semiconductor devices. **(04 Marks)**

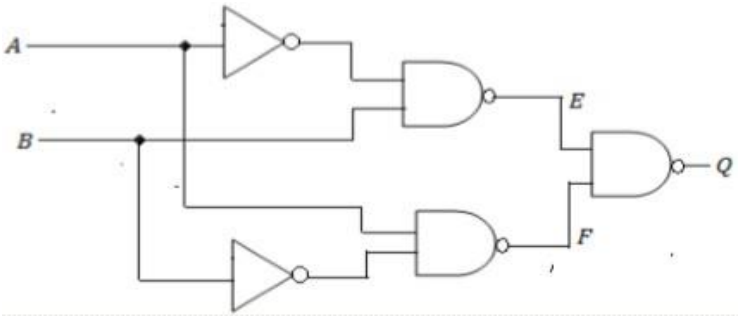
(ii) Under what conditions a transistor acts as an oscillator ? **(02 marks)**

10. (a) (i) What is voltage follower. **(01 Mark)**

(ii) Explain three uses of a voltage follower. **(03 Marks)**

(b) (i) If any component of integrated circuits (IC) goes out of order, explain what will you do? **(02 Marks)**

(ii) From the following circuit, use a truth table to determine the type of single gate represented and hence draw its symbol. **(04 Marks)**



(c) (i) What are the limitations of amplitude modulation? **(02 Marks)**

(ii) The load current in the transmitting antenna of an unmodulated AM transmitteris 8 A. What will be the antenna current when modulation is 40%? **(03 Marks)**