NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PHYSICS
2023_1 POP EXAMINATION

COURSE CODE: **PHY 492**
COURSE TITLE: **LABORATORY PHYSICS III**
CREDIT UNIT: **3**
TIME ALLOWED: **(3 HRS)**

INSTRUCTION: ***Answer question 1 and any other three questions***

QUESTION 1

In an optics experiment, a student obtained the following readings:

Distance of object from lens U(cm)	**Distance of image from the object X(cm)**
14.0	64.0
18.0	50.0
26.0	46.0
40.0	56.0
55.0	68.0

(a) (i) Prepare a composite table containing V the image distance from the lens, $U+V$ and UV for each reading above. **(6marks)**

(ii) Plot a graph of UV against $U+V$ **(6marks)**

(iii) Obtain the slope **K** from the graph **(3marks)**

(iv) What is the physical meaning of **K ?** **(2marks)**

(Hint: V = X – U)

(b) Draw and label a ray diagram showing how a virtual image of an object is formed by a converging lens **(4marks)**

(c) An object is placed on the principal axis of a converging lens of focal length 12cm. If the magnification of the real image formed by the lens is 3, calculate the distance of the object from the lens. **(4marks)**

QUESTION 2

In an experiment to verify Hooke's law a NOUN student obtained the following readings:

m(kg)	Load F(N)	Position of the lowest point of spring L(cm)
0.00	0.00	55.0
0.10	0.98	57.6
0.20	1.96	61.3
0.30	2.94	64.9
0.40	3.92	68.4
0.50	4.91	72.0

a(i) Prepare a composite table including extension **e**(cm) produced by the load **(4marks)**
ii Plot the graph of F against e (**3marks**)
iii Obtain the slope **s** from the graph (**2marks**)
iv What is the physical meaning of **s** **(1mark)**
(b) Mention three apparatus needed in carrying out these experiment in the laboratory (**3marks**)
(c) State Hooke's law and write its mathematical expression (**2marks**)

QUESTION 3

A student carried out an experiment to investigate how the diameter d of the path of a beam of electron varied with accelerating voltage V when a magnetic field B was applied at right angle to the electron beam. The results obtained were as follow:

V/v	d $x10^{-2}$m
500	2.1
1000	2.8
1500	3.4
2000	3.9
2500	4.3
3000	4.7

(a) Prepare a complete table showing V, d, d^2 **(3marks)**

(b) Plot a graph of d^2 on y axis and V on the x-axis **(5marks)**

(c) It is suggested that V and d are related by the formula:

$$\frac{e}{m} = \frac{8V}{B^2 d^2}$$

i) Write an expression for the gradient of the graph **(2marks)**

ii) Obtain the slope of the graph **(2marks)**

(d) Giving that the magnetic flux density is $7.9x10^{-3}$ T. using the value of s, determine $\frac{e}{m}$ **(3marks)**

QUESTION 4

An experiment was carried out to determine the resistance of a lamp filament, the result obtained were as given below.

V	I	R
2.2	0.36	
4.1	0.62	
6.0	0.86	
7.9	0.98	
9.8	1.20	
10.0	20.0	

(a) Calculate the resistance R of the lamp filament and complete the table above **(4marks)**

(b) State factors which affect the resistance of a wire and write an expression for the resistivity of a wire. **(5marks)**

(c) The bulb is switched on for 7 minutes. The current is 1.5 A and the potential difference is 11.6 V.

i) Show that the rate of electrical energy transfer is about 21.5W **(3marks)**

ii) Show that the electrical work done is about 9009J **(3marks)**

QUESTION 5

In an experiment to determine the magnification of a lens, **ho (**object height) is placed a distance u from the lens and $\mathbf{h_i}$ (image height) formed on a screen at distance **x** from **F** with the scale 1 = 10cm

ho =2.0cm **ho** converted = **1mk**

x (cm)	$\mathbf{h_i}$ **(cm)**	**x converted(cm)**	$\mathbf{h_i}$ **converted (cm)**	$m = \frac{h_i}{h_o}$	m^{-1}	x^{-1}
4.2	4.0	42.0	40.0			
2.8	2.7	28.0	27.0			
2.1	2.0	21.0	20.0			
1.7	1.6	17.0	16.0			
1.4	1.4	14.0	14.0			

a) Complete the table as shown above (9**marks**)

b) Plot the graph of m^{-1} on the vertical axis and $\mathbf{x}^{-1}$ on the horizontal axis. **(3marks)**

c) Obtain the magnification at **x** = 25 cm (**2marks**)

QUESTION6

a) Give two important conditions for resonance frequency to occur in an R-L-C a.c circuit. **(4marks)**

b(i) If $X_C = \frac{1}{2\pi fc}$, $X_L = 2\pi fL$, obtain an expression for resonance frequency **(3marks)**

(ii) Show a sketch of current against frequency indicating resonance frequency $\mathbf{f_o}$ **(4marks)**

c) The washing machine is connected to a 230 V supply. What current is drawn from the supply by the heater if it's power rating is 2500W **(4marks)**