NATIONAL OPEN UNVERSITY OF NIGERIA

14/15 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS

SCHOOL OF SCIENCE AND TECHNOLOGY
PHYSICS UNIT

SEMESTER 2013 EXAMINATION

COURSE CODE: PHY 320

COURSE TITLE: Physics Laboratory II

CREDIT UNIT: 2

INSTTRUCTION: Answer any four questions.

TIME: 3 Hours

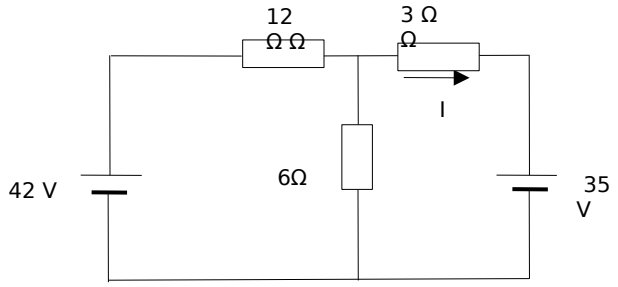
DATE: FRIDAY 25TH JANUARY, 2013

PHYSICAL CONSTANTS:

1. (a) (i) Distinguish between an active and a passive network
4 marks

(ii) State the reciprocity theorem of electrical network and draw suitable circuit diagrams to illustrate it.

6 marks



Circuit Diagram for Question 1b

(b) (i) Using Thevenin's theorem, determine the current in the 3Ω resistance.
13 marks

(ii) In an experiment to study the application of Thevenin's theorem using the circuit shown, you were supplied with two power supplies, multimeter, and resistors (with nominal values) and Connecting wires.

State two precautions you would take to ensure accurate results.
2 marks

2. (a) (i) Define the terms 'ripple factor' and 'root mean square RMS value of an alternating

current AC'.
6 marks

(ii) With a suitable circuit diagram, explain the working of a full wave rectifier constructed with a centre-tapped transformer and two diodes, indicating the input waveform and output waveform across the load resistance.
8 marks

(b)(i) Draw a suitable circuit diagram each of a capacitor and an inductor filter which you could use to reduce the ripple factor of the output of your full wave rectifier and briefly

explain their working.
9 marks

(ii) State two precautions you would take in an experiment to characterize rectifiers and filters. **2 marks**

3. (a) (i) State three characteristics of an ideal operational amplifier.
3 marks

(ii) With suitable circuit diagrams, explain the operation of the opamp in the inverting and non-inverting mode and write down expressions for the gain when used as inverting and

non-inverting amplifiers.
10 marks

(b)(i) Define the term ‘common mode rejection ratio (CMRR).
3 marks

(ii) Draw a circuit diagram to illustrate how an opamp may be used as a summing circuit for two voltage signals and write down an expression for its gain.
9 marks

4. (a)Briefly explain with basic circuit how an opamp can be used as

(i) differentiator
7 marks

(ii) integrator.
7 marks

(b) (i) Outline the principle of the measurement of magnetic flux density using the opamp. **9 marks**

(ii) State the precautions you would take in an experiment to measure electric charge

using an opamp.
2 marks

5. (a)(i) Distinguish between a positive and negative lens.
4 marks

(ii) With suitable ray diagrams, explain the terms *focus* and *focal length* of a converging and

diverging lens.
6 marks

(b) (i) Describe an experiment you would perform to determine the focal length of a converging lens by the image coincidence method.
8 marks

(ii) In an experiment to determine the focal length of a converging lens, $\frac{1}{u}$ was plotted on the horizontal axis and $\frac{1}{v}$ on the vertical axis (u and v are the object and image distances respectively). Explain, with suitable equations, how you would use this graph to obtain the power, focal length and linear magnification of the lens.
7 marks

6.(a) (i) With a suitable ray diagram, explain the principle of Young's double slit experiment. **8 marks**

(ii) State two precautions you would take to ensure accurate results in

Young's double-slit experiment.
2 marks

(b) (i) In a particular double-slit experiment, yellow light from a sodium arc was used. If the distance of the screen from the plane of the double-slit is 100 cm, the position of the second-order bright fringe from the centre of the screen is 0.50 cm and the slit separation is 0.023 cm, find the wavelength

of the sodium light.
8 marks

(ii) If the mercury blue line (λ = 436 nm) and the mercury green line (λ = 546 nm) are used in the experiment in (i), what will be the separation of the blue and green first-order fringes? **7 marks**