

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF MASTERS OF
SCIENCE IN PHYSICS**

PHYS 821: LABORATORY TECHNIQUES I

STREAMS: MSC (PHYSICS)

TIME: 3 HOURS

DAY/DATE: FRIDAY 06/12/2019

2.30 P.M. – 5.30 P.M.

INSTRUCTIONS:

- Answer all Questions
- Do not write anything on the question paper
- This is a closed book exam, No reference materials are allowed in the examination room
- There will be No use of mobile phones or any other unauthorized materials
- Write your answers legibly and use your time wisely

QUESTION ONE

- a. What is X-ray Powder Diffraction (XRD)? **(1 mark)**
- b. Explain the basic Principles of X-ray Powder Diffraction (XRD). **(4 marks)**
- c. Outline the working of an X-ray diffractometer. **(4 marks)**
- d. List the advantages and disadvantages of qualitative XRF analysis. **(6 marks)**

QUESTION TWO

- a. With an aid of Jablonski diagram, explain the basic principles of Fluorescence spectroscopy. Discuss the following in your explanation; **(12 marks)**
 - i. Absorption, emission and stokes shift.
 - ii. Spectroscopic Transition Strengths and Quantum yields
 - iii. Lambert–Beer Law and Absorption Spectroscopy
 - iv. Temperature Effects on Absorption and Emission Spectra

- b. Mention how Förster Resonance Energy Transfer Technique (FRET) can be used. What makes FRET useful in *in vivo* experiments? **(3 marks)**

QUESTION THREE

- a. What do you understand by Hall effect? **(2 marks)**
- b. Derive the Hall Constant relation $R_H = \frac{1}{nq}$. **(5 marks)**
- c. Explain briefly the Basic principle of a Hall Effect Sensor/switch. **(2 marks)**
- d. Discuss applications for Hall Effect IC Switches in portable electronics. Limit your discussion in applications of Unipolar Hall effect IC , Omnipolar Hall effect IC switches, Bipolar, latching Hall ICs, in Open/close detection, Screen Orientation and Function Selection and Control. **(6 marks)**

QUESTION FOUR

- a. What is Ellipsometry? **(2 marks)**
- b. What does Ellipsometry tell us about samples? **(7 marks)**
- c. How do Ellipsometers work? **(6 marks)**
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