JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE)

3RD YEAR 2ND SEMESTER 2016/17

MAIN REGULAR

COURSE CODE: SCH 304

COURSE TITLE: GROUP THEORY

EXAM VENUE: **STREAM: (BED SCI)**

DATE: **EXAM SESSION: 2.00 – 4.00 PM**

TIME: 2:00HRS

Instructions:

1. **Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A

QUESTION 1

(a) State the relationship between:

(i) Z –axis and horizontal plane of a molecule
(ii) Principal axis and vertical plane of a molecule.
(iii) Molecular plane and horizontal plane of a molecule
(iv) The of study group theory and its importance to a chemist? 10 Marks.

(b) . Several sets of operations in the study of group theory forms some characteristics of a group. List and describe these characteristics needed to form these

group? 10 Marks

(c).Water belongs to the C_{2v} point group, { C_{2v} [E, C_2, σ (XZ), σ (YZ)}

(i) Define the Molecular Plane as the XZ plane and generate the multiplication table for C_{2v} point group 10 Marks

SECTION B ATTEMPT ANY TWO QUESTIONS

QUESTION 2

(a) Define the following terms as applied to molecules in group theory:

(i) Successive operations
(ii) Symbol h
(iii) Symmetry operation
(iv) Symmetry element
(v) Center of of inversion
(vi) Similarity transformations
(vii) A class

20 Marks

QUESTION 3

(a) Describe all the types of symmetry operations exhibited by a planar $PtCl_4^{2}$ ion

(b) Given the square planar molecule $PtCl_4^{2-}$ with D_{4h} symmetry

(i) Present the molecule in its geometrical form and name its shape.

(ii) What are the symmetry operations (in symbol form) possible for this molecule?

(c) Construct a multiplication table for the point groups of this molecule.

20 Marks

QUESTION 4

(a) What is meant by the term mathematical group as applied in group theory?
(b) State the rules obeyed by members of a mathematical group
(c) Given the molecule NH_3 with C_{3v} symmetry

(i) Present the molecule in its geometrical form and name its shape.

(ii) What are the symmetry operations (in symbol form) possible for this molecule?

(iii) Determine its point group.

(iv) Construct a multiplication table for the point group of this molecule. 20 marks

QUESTION 5

(a). Describe the following character representations

(i) Irreducible representation?

(ii) Reducible representation?

(iii) State the basic rules of direct products of irreducible representation that can easily work out symmetrical?

(b) What do each of the following group theory symbols represent?

(i) E

(ii) i

(iii) S_n 20 Marks