Lead City University, Ibadan
Faculty of Sciences
Department of Biochemistry

COURSE PARTICULARS

Course Title: Chemistry of Lanthanides and Actinides
Course Code: CHM 412
No. of Units: 2
Status: Compulsory

LECTURER DETAILS

Name:	**Prof. Akinlabi Akinola**
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Name:	**Mr. John-Dewole O.O.**
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Area of Specialization:	Environmental Chemical Analysis

Course Description

Chemistry of Aromatics, Heterocyclic Hydrocarbon & Introductory Natural Products is a specialized branch of organic chemistry which studies the chemical composition of various biological products like; alkaloids, terpenoids, steroids and vitamins. These natural products, both from plants and animals, have found uses in industries like; pharmaceutical, food, brewery etc. The course also helps to appreciate the synthesis of these natural products and their various chemical reactions.

Course Objective:

The course is meant to be a link from the general organic compound chemistry to that of drugs, thereby preparing the students for studies in drug related courses. The students were also to appreciate the chemistry of naturally occurring drugs like *quinine* in the bark of cinchona tree and some other plants whose roots have some medicinal importance.

ASSESMENT

Class Attendance	5marks
Test(s) and Assignments	25marks
Final Examination	70marks

LECTURE PLAN

Week	Topic
1	Brief Revision of Organic Compounds Learnt in 100 Level
2	Introduction to Aromatic Chemistry, especially Benzene
3	Substitution Reaction of Benzene and its derivatives.
4	Alkylbenzenes and aromatic alcohols, carbonyl compounds and carboxylic acids, phenols and quinines.
5	Nitro-compounds, amines and other nitrogenous derivatives.
6	: Sulphonic acids and the derivatives.
7	Bi-functional benzene derivatives and compounds linked with benzene rings.
8	Revision and Mid-Semester Test
9	Naphthalene and anthracene chemistry.
10	Aromatic heterocycles exemplified by pyrrole, thiophene and pyridine.
11	Introduction to Natural Products.
12	Alkaloids; sources, uses/importance, types and examples.

READING LIST

1. Abass A Olajire et al. (2009): Introductory Organic Chemistry, University Series B.
2. Murray R.S. (2003): Principles of Organic Chemistry, 2nd Ed., Heinemann Educational Books Ltd London.
3. Templeton, W. (1981): Organic Chemistry, Macdonald & Evans Ltd. Estover, Plymouth PL6 7PZ
4. Vogel's Textbook of Practical Organic Chemistry, Longman (ELBS).

TUTORIAL QUESTIONS

1. a. Name the lanthanide elements and give their electronic configurations.
   b. What are the characteristic precipitation reactions of lanthanide +2, +3, and +4 ions?
   c. Which lanthanide elements show departure from usual +3 oxidation state? Give the electronic configuration of these ions.
2. a. What is characteristic about the coordination numbers of lanthanide ions? Give examples.
   b. Explain how Ce^{IV} ions are extracted?
   c. Explain the position of the lanthanides in the periodic table and their relation to the Al, Ga, In, and Tl group.
3. a. Work out the number of unpaired electrons in the ions of Pr^{3+}, Pm^{3+}, Sm^{2+}, Gd^{3+}, Tb^{4+}, Lu^{2+}.
   b. Explain how lanthanides are separated from other elements in their mineral ores.
   c. Comment briefly on the general properties of lanthanide metals.
4. a. Write briefly on the trivalent state oxides and hydroxides of lanthanides.
   b. What are the most interesting features of lanthanide β – diketonates?
   c. Why are scandium and yttrium usually considered along with the lanthanide elements?

5 a. Name the actinide elements and list their electronic configurations.
   b. List the oxidation states for actinide elements.
   c. Which actinide isotopes can be obtained in macroscopic amounts?

6 a. What are the characteristic reactions of actinide +3 and +4 ions?
   b. Which +3 ion has its *6f* shell half-full? What oxidation states do the preceding and succeeding elements show?
   c. How are actinide metals made? What are their main features?

7 a. Which actinide element corresponds to Lu?
   b. How is actinium made? Which element does it most resemble?
   c. What are the main sources of (a) thorium, and (b) uranium?

8 a. Uranium is usually recovered as uranyl nitrate. How is this converted to the metal?
   b. What are the properties and main use of UF_6?
   c. How is uranium hydride obtained? What are its uses?

9 a. What elements would the unknown elements 105, 107, 112 and 118 be expected to resemble?
   b. Describe the lanthanum fluoride cycle for separation of Np or Pu from U.
   c. Describe the tributylphosphate extraction separation of Np and Pu from U.

10 a. How are the elements Am-Lw usually separated? Why is it first necessary to separate lanthanides as a group from the actinides as a group and how is this done?
   b. Compare and contrast the chemistries of the dioxo ions of U, Np, Pu and Am.
   c. What are the main principles upon which the separations of Np, Pu and Am from U are made?