INFORMATION AND COMMUNICATIONS UNIVERSITY

SCHOOL OF ENGINEERING

ICE0325– ENVIRONMENTAL CHEMISTRY

SYLLABUS AND DETAILED COURSE GUIDE

Part 1: Course Description and Resources

Lecturer/Tutor: Kaela Kamweneshe

Office: 16th Floor, Findeco House, Lusaka

Office Hours: 08.00 – 17:00 Hrs. Monday-Friday

Office Telephone: +260211221662

Lecturer's E-mail: kamweneshek@gmail.com

Assistant Lecturer/Tutor: Ms Annie Ayombe

Office: 16th Floor, Findeco House, Lusaka

Office Hours: 08.00 – 17:00 Hrs. Monday-Friday

Office Telephone: +260211221662

Lecturer's E-mail: ayiwombe@yahoo.com

Course Description

The course address the environmental chemistry of the hydrosphere, discusses the fundamental properties of water, properties of bodies of water, and basic aquatic chemistry, including acid base behavior, phase interactions, oxidation-reduction, chelation. Moreover it introduces the atmosphere and atmospheric chemistry, including the key concept of photochemistry. Inorganic air pollutants, including nitrogen and sulfur oxides, carbon monoxide, and carbon dioxide. The course deals with soil and discuss anthrospheric aspects of environmental chemistry.

Rationale:

Aim:

Course Objectives:

On completion of this course, the successful student should be:

1) Able to understand the meaning of environmental chemistry;
2) Define atmospheric pollution,
3) list reasons for global warming. Green- house effect and acid rain;
4) Identify causes for ozone layer depletion and its effects;
5) Give reasons for water pollution and know about international standards for drinking water;
6) Describe causes of soil pollution;
7) Suggest and adopt strategies for control of environmental pollution;
8) Appreciate the importance of green chemistry in day to day life.

Prerequisites

Grades C/C+ in Mathematics, English, and Science or equivalent

Required Text Books

Key Texts:

(i) Andrews J.E., et al. (eds.). (2004). An introduction to Environmental Chemistry 2ed., Blackwell, United Kingdom (UK)

(ii) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press.

(iii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd ISBN 0-632-05905-2

(iv) Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK
ISBN-13: 978-0-85404-371-2

Supplementary Reading:

1. Jorge G. Ibanez, Margarita Hemandez-Esparza, Carmen Doria-Serrano, Arturo. Fregoso-Infante and Mono Mohan Singh. 2007. Environmental Chemistry Fundementals. Springer.
2. Ronald A. Hites 2007. Elements of Environmental Chemistry. WILEYINTERSCIENCE A JOHN WILEY & SONS, INC., PUBLICATION.
3. Roy M. Harrison. Understanding Our Environment An Introduction to Environmental Chemistry and Pollution. ISBN 0-85404-584-8. The Royal Society of Chemistry 1999
4. John Wright . 2005. Environmental Chemistry. Taylor & Francis e-Library, 2005.

5. Eric Lichtfouse, Jan Schwarzbauer and Didier Robert (Editors). Green Chemistry and Pollutants in Ecosystems. ISBN 3-540-22860-8. Springer Berlin Heidelberg New York.

Online Resources

https://www.youtube.com/watch?v=oIbjhdnKogU

https://www.youtube.com/watch?v=4kMtlcih4x8

https://www.youtube.com/watch?v=5ZxggMWYiH0

https://www.youtube.com/watch?v=hp3LS7pIeHQ

https://www.youtube.com/watch?v=1_bz4Mmo1Jo

Course Delivery

Teaching Hours & Methods:

Approximately 60 hours class contact time or equivalent;

90 hours of independent student study.

Directed and undirected reading plus centre based tutor support.

Part 2: Student Learning Outcomes

General Learning Outcomes:

1. Design object- oriented programs to address loosely-defined problems
2. Implement object- oriented programs that reflect established programming and software engineering practice
3. Develop design documentation for use in program maintenance and end user documentation

Specific Learning Outcomes:

On completion of this module the student should be able to:

1. Implement object- oriented programs from well-defined specification

PART 3: WEEKLY TOPICS AND ASSIGNMENTS

WEEK 1:

TOPIC 1: CHAPTER 1: INTRODUCTION TO ENVIRONMENTAL CHEMISTRY

1 Chemistry and Environmental Chemistry

2 The Building Blocks of Matter

3 Chemical Bonds, Compound Formation and Octet Rule

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

FREE ONLINE VIDEOS:

https://www.youtube.com/watch?v=oIbjhdnKogU

https://www.youtube.com/watch?v=4goTeFVD89w

https://www.youtube.com/watch?v=gsvR4AZGRSk

https://www.youtube.com/watch?v=a8LF7JEb0IA

PROBLEM SETS FOR WEEK 1:

1) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

WEEK 2:

TOPIC 2: CHAPTER 2: ACIDS, BASES, AND SALTS

1 The Importance and nature of Acids, Bases, and Salts

2 Dissociation of Acids and Bases in Water

3 pH and the Relationship Between Hydrogen Ion and Hydroxide Ion Concentrations

4 Preparation of Acids, Bases and Salts

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

FREE ONLINE VIDEOS:

https://www.youtube.com/watch?v=KwSmlODnUd0

https://www.youtube.com/watch?v=ZNo6gfCAgWE

https://www.youtube.com/watch?v=LS67vS10O5Y

https://www.youtube.com/watch?v=Xeuyc55LqiY

https://www.youtube.com/watch?v=OEW4-Sfyvik

https://www.youtube.com/watch?v=tr6FYv-Rl3s

PROBLEM SETS FOR WEEK 2:

2) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

WEEK 3:

TOPIC 3: CHAPTER 3: SOLUTIONS

1 The Solution Process, Solubility and Concentration

2 Standard Solutions and Titrations

3 Solution Equilibria

4 Colloidal Suspensions Onlines Sources

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

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https://www.youtube.com/watch?v=cHBlDVg9nR8

https://www.youtube.com/watch?v=JCAsOJYkn-s

https://www.youtube.com/watch?v=W5dBo18jtWw

https://www.youtube.com/watch?v=g5wNg_dKsYY

https://www.youtube.com/watch?v=3ROWXs3jtQU

https://www.youtube.com/watch?v=1a9e9Ta4A7c

PROBLEM SETS FOR WEEK 3:

3) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

WEEK 4:

TOPIC: 4) CHAPTER 4: ENVIRONMENTAL CHEMISTRY OF WATER

1 Aquatic Chemistry

2 Metal Ions and Calcium in Water

3 Oxidation-Reduction - Complexation and Chelation and Water Interactions with Other Phases

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

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https://www.youtube.com/watch?v=F8IyInlTe2U

https://www.youtube.com/watch?v=K1_V4XtrajU

https://www.youtube.com/watch?v=giNNqilj4HI

https://www.youtube.com/watch?v=Wj4-nQmW28s

https://www.youtube.com/watch?v=IIu16dy3ThI

https://www.youtube.com/watch?v=r7gTH_5XfOI

PROBLEM SETS FOR WEEK 4:

4) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

WEEK 5:

TOPIC 5: CHAPTER 5: WATER POLLUTION

1 Nature and Types of Water Pollutants

2 Elemental Pollutants, Heavy Metal, Metalloid

3 Organically Bound Metals and Metalloids

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

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https://www.youtube.com/watch?v=lBfupv8dXg8

https://www.youtube.com/watch?v=VLockNALdd8

https://www.youtube.com/watch?v=X4y_MlX3oXM

https://www.youtube.com/watch?v=_H-lneTs5XM

https://www.youtube.com/watch?v=fWL75-19cx4

https://www.youtube.com/watch?v=YlgU-qdNlas

PROBLEM SETS FOR WEEK 5:

5) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press.

WEEK 6:

TOPIC 6: CHAPTER 5: WATER POLLUTION

4 Inorganic Species

5 Oxygen, Oxidants, and Reductants

6 Organic Pollutants, Pesticides in Water and Polychlorinated Biphenyls

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

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https://www.youtube.com/watch?v=RKXYxTOMpuA

https://www.youtube.com/watch?v=rKmMY7gCXtM

https://www.youtube.com/watch?v=kEJUYDHhuCg

https://www.youtube.com/watch?v=RKwrBXuBzig

https://www.youtube.com/watch?v=npuiOyYebwE

https://www.youtube.com/watch?v=uBNm17DpVuw

https://www.youtube.com/watch?v=U5ibm-e-07Y

https://www.youtube.com/watch?v=DbpWI7IcJ8I

https://www.youtube.com/watch?v=dSczkas_-W0

PROBLEM SETS FOR WEEK 6:

1) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

WEEK 7:

TOPIC 6: CHAPTER 6: THE ATMOSPHERE AND ATMOSPHERIC CHEMISTRY

1 The Atmosphere and Atmospheric Chemistry

2 Physical Characteristics of the Atmosphere

3 Energy Transfer in the Atmosphere

4 Atmospheric Mass Transfer, Meteorology, and Weather

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK

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https://www.youtube.com/watch?v=yRtdPgzYDr4

https://www.youtube.com/watch?v=L70wBqhxf94

https://www.youtube.com/watch?v=6LkmD6B2ncs

https://www.youtube.com/watch?v=pXiQICwBQ0Q

https://www.youtube.com/watch?v=Y3kZVX6ZCsY

https://www.youtube.com/watch?v=V6I8lnFoiMQ

https://www.youtube.com/watch?v=BC0yx7_ZmiU

https://www.youtube.com/watch?v=JDKWYv0XZC8

PROBLEM SETS FOR WEEK 7:

2) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

WEEK 8

TOPIC 6: CHAPTER 6: THE ATMOSPHERE AND ATMOSPHERIC CHEMISTRY

5 Inversions and Air Pollution

6 Chemical and Photochemical Reactions in the Atmosphere

7 Acid–Base Reactions in the Atmosphere

8 Reactions of Atmospheric Oxygen and Nitrogen

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

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https://www.youtube.com/watch?v=XbHfZwzubUU

https://www.youtube.com/watch?v=ObnWb7yspxA

https://www.youtube.com/watch?v=UBgto3cOXW4

https://www.youtube.com/watch?v=IsxdBD11ulY

https://www.youtube.com/watch?v=ANi709MYnWg

https://www.youtube.com/watch?v=UEVYpZpkLUk

https://www.youtube.com/watch?v=9npHPE6PhSI

https://www.youtube.com/watch?v=x6NhtSWRVNU

PROBLEM SETS FOR WEEK 8:

3) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press.

WEEK 9:

TOPIC: CHAPTER 7: SOIL ENVIRONMENTAL CHEMISTRY

1 Nature and Composition of Soil

2 Acid-Base and Ion Exchange Reactions in Soils

3 Macronutrients and Micronutrients in Soil

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK.

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https://www.youtube.com/watch?v=3j9NBsCYUnA

https://www.youtube.com/watch?v=ec_IzxfHlQc

https://www.youtube.com/watch?v=fSmk9ZZKujo

https://www.youtube.com/watch?v=2T8orRdWBlc

https://www.youtube.com/watch?v=i0Pjflsw3FI

https://www.youtube.com/watch?v=9SotrCwqfHo

PROBLEM SETS FOR WEEK 4:

4) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press.

WEEK 10:

TOPIC: CHAPTER 7: SOIL ENVIRONMENTAL CHEMISTRY

4 Fertilizers

5 Wastes and Pollutants in Soil

6 Soil Loss and Degradation

READINGS:

(i) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

(ii) J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid. 2004. An Introduction to Environmental Chemistry . 2nd ed. Blackwell Science Ltd

(iii)Roy M Harrison .2007. Principles of Environmental Chemistry.The Royal Society of Chemistry. Cambridge CB4 0WF, UK.

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https://www.youtube.com/watch?v=kPfqWr7WQf4

https://www.youtube.com/watch?v=0tNNiEOMgps

https://www.youtube.com/watch?v=TDGX9azhkcs

https://www.youtube.com/watch?v=Cy6W5fHPBLg

https://www.youtube.com/watch?v=-3ygQd9nnE0

https://www.youtube.com/watch?v=eFbHErRPQHg

PROBLEM SETS FOR WEEK 10:

5) Stanley E. Manahan. 2009. Fundamentals of Environmental Chemistry, 3rd ed., Taylor & Francis/CRC Press,

Part 4: Grading Policy

Graded Coursework, assignments and examinations

ASSESSMENT	**COMMENTS**	**% OF FINAL GRADE**
Continuous Assessment (or course project)	Assessment for topics 1, 2, 3, 4	10%
Test (or course project)	Test 1will be given for topics 5, 6,	10%

Test 2 (or course project)	Test 2 will be given for topics 8,9,10	10%
Teamwork		
Labs (or course project)		10%
FINAL EXAM		60%
TOTAL POINTS		100%

Letter Grades

Letter Grade	**Percentage**	**Performance**
A +	90 - 100%	Distinction
A	80 - 89%	Distinction
B+	70 - 79%	Merit
B	60 - 69%	Merit
C+	50 - 59%	Credit
C	40 - 49%	Pass
D	Below 40%	Fail

Part 5: Course Policies

Class Attendance, Participation and Emergencies

1. Attending classes is mandatory for all students.
2. Participation in group work or teamwork is required whenever such work is assigned.
3. In case of any emergency that disenables a student from attending classes or completing work, the student is expected to communicate with the lecturer or dean as soon as possible.
4. Students with disabilities should inform the dean of the faculty of any special needs that they may have.

Late Work and Missing Assessments

1. Each student is responsible for making sure that his or her work is done on time.
2. Any student who misses assessments or misses class should talk to his or her lecturer or professor as soon as possible and seek the lecturer's advice on how to make up for work missed or assessments missed.
3. Students who expect to miss classes or to miss assessments for health reasons or special family reasons should communicate with the lecturer or professor for the course as soon as possible.
4. Students should note that there may be a penalty for late work, and missed assessments. The penalty may include not being allowed to sit for the final examination.
5. Students who are unable to keep up with class work should consult with the course lecturer or faculty dean or dean of students, and seek advice.

Integrity and Zero Tolerance to Plagiarism

1. All students are expected to abide by the university's policy on ethical conduct.
2. Any student involved in cheating in tests, coursework or examinations will be suspended pending investigations, and may be expelled from the University.
3. Any student involved in buying or selling tests or examinations will be suspended from the University pending investigations.
4. Any student involved in using sexual favors in exchange for marks will be suspended pending investigations, and may be expelled from the University.
5. Plagiarism means presenting other people's work from online or from other sources as your own. Plagiarism is a serious offence and will not be tolerated, and offenders will fail that particular course.
6. Students are required to read the University's policy on examinations.

Make up of Missed Classes

1. There will be special make up classes for each class that is missed because the lecturer could not come to class on a particular day.

Students are required to treat make up classes as part of the regular learning program