COURSE COMPACT

Course

Course code: MCB 426
Course title: Biodeterioration (2 Units)
Course status: Elective

Course Duration

Two hours per week for 15 weeks (30 hours)

Lecturer Data

Name of the lecturer: Dr. Abalaka
Qualifications obtained: BSc, MSc, PhD.
Department: Biological Sciences
College: Science and Engineering
E-mail:
Office Location:
Consultation Hours:

Name of the lecturer: Adelani-Akande, T.A. (Mrs.)
Qualifications obtained: BSc, MSc
Department: Biological Sciences
College: Science and Engineering
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Office Location: A141, 1st College Biulding
Consultation Hours: Mondays 2-4pm & Fridays 1 - 2:50pm

Course Content –

The course covers the following areas: principle of microbial deterioration of materials; materials subject to microbial deterioration such as food, jet fuels, paper, paints, textiles and leather, metals and how biodeterioration occurs in them; factors favouring deterioration of materials; biodeterioration by insects in marine and terrestrial environments as well as major microbial groups involved in deterioration.

Course Description –

This course traces factors as well as organisms responsible for various undesirable changes in materials. It takes a looks at various materials including paper, textile- synthetic and natural, fuel, stone, e.t.c. their composition and why and how they are susceptible to deterioration. It exposes

signs of deterioration in these materials and suggests preventive measures to biodeterioration.

Course Justification-

The state of a material (i.e. an form of matter e.g. paper, leather, textile, metal, building materials e.t.c.) can determine the value placed on it. The onset of biodeterioration diminishes the value of materials leading to physically observable changes or biochemical changes. It is thus important to study the organisms responsibly, the factors that predispose materials to biodeterioration as well as how to prevent the biodeterioration.

Course Objectives

Upon completion of the course, students should be able to demonstrate basic knowledge of the following:

- The basic concepts in biodeterioration
- Principles and mechanism of biodeterioration of natural and synthetic materials
- Organism involved in biodeterioration and their roles in the process
- The essence of biodeterioration in relation to preservation of historical materials.

Course Requirement –

To derive maximum benefit from the course students are expected to have a basic knowledge of microbiology as well animal diversity. An understanding of the basic components of selected materials will also be required. The University policy on attendance will strictly apply. Also, students are expected to comport themselves appropriately. seriously.

Method of Grading-

S/N	**Grading**	**Score** (%)
1.	Test/ Quiz	20
2.	Assignment/ Class presentation	10
4.	Final Examination	70
	Total	**100**

Course Delivery Strategies –

Lectures will be made as explicit and practical as possible. Teaching aids will be made available as required.

LECTURE CONTENT

- **Week 1:** General Introduction and basic concepts
- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Define biodeterioration.
  Define other basic terminologies.
  Briefly describe the scope of the course.

- **Description**

The course is unveiled and the term biodeterioration, biodegradation, biofilms, deteriogens will be critically considered.

- **Study Question:**

What differentiates biodeterioration from biodegradation?

- **Reading List –**

Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)

- **Week 2:** Types and consequences of biodeterioration

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Distinguish between the various types of biodeterioration.
  Explain why prevention of biodeterioration should be taken serious.

- **Description**

Various types of biodeterioration will be considered and their consequences on the material. The essence of this course will be dealt with as we consider the cost implication and why prevention is a good alternative

- **Study Question:**

  Distinguish between aesthetic biodeterioration and chemical assimilatory biodeterioration.

- **Reading List –**

  1. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)

- **Week 3:** Biodeterioration of natural products: paper and wood

- **Objectives**

  The student at the end of the lectures for the week should be able to……

  Explain why paper and wood are susceptible to several deteriogens.
  Mention some microbial deteriogens of these materials and the enzymes they possess.

- **Description**

  The reasons for susceptibility of paper and wood to microbial deterioration will be explored. Prevention techniques will also be considered. Discussions will be restricted to microbial deteriogens as insect will be considered later in the course.

- **Study Question:**
- What groups of enzymes are involved in degradation of cellulose? What role does each enzyme play?

- **Reading List –**
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1. Flavia Pinzari, Gioranma Pasquariello and Antonella De Mico. 2006. Biodeterioration of Paper: A SEM fungal spoilage reproduced under controlled conditions. Macromol. Symp. 238: 57-66.
2. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)
3. Morris P.I. Understanding Biodeterioration of Wood in Structures.

- **Week 4:** Biodeterioration of textile: natural and synthetic

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Explain the composition of common textile materials.
  Mention textile materials that are prone to biodeterioration and explain why.

- **Description**
- Both natural and artificial fibres will be considered. The composition of such materials will be discussed and reasons for it susceptibility to biodeterioration. Preventive measures to deterioration of textile will also be discussed.
- **Study Question:**
- Which textile materials are prone to microbial deterioration and why is this so?

- **Reading List –**

1. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.).
2. Elena Pekhtasheva, Anatoly Neverov, Stefan Kubica and Gennady Zaikov. 2012. Biodegradation and Biodeterioration of Some Natural Polymers. Chemistry & Chemical Technology 6(3): 263- 280.
3. Boryo, D.E.A.. 2013. The Effect of Microbes on Textile Material: A Review on the Way-Out So Far. The International Journal Of Engineering And Science 2(8) : 09-13

- **Week 5:** Biodeterioration of stored food

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  State factors that support biodeterioration of stored products.
  Mention some organisms implicated in biodeterioration of such food materials.
  State some preventive measures.

- **Description**

Organisms involved in biodeterioration will be elaborated and their roles in biodeterioration of such food will be considered. Method of preventing biodeterioration in such food will also be considered.

- **Study Question:**

  Why are stored products prone to fungal spoilage?

- **Reading List –**

1. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2^{nd} edi.)

- **Week 6:** Insects involved in biodeterioration

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Mention some insects of terrestrial and marine origin that undertake biodeterioration especially of wood in such environment.
  State specific steps needed to prevent biodeterioration of wood by these insects.

- **Description**

Insects involved in biodeterioration both on land and in the marine environment will be considered. Specific examples will also be discussed as well has measures that can be used to prevent and stop their activities.

- **Study Question:**

  What are some features possessed by Shipworm that make it a suitable deteriogen in the marine environment?

- **Reading List –**

  1. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2^{nd} edi.)
  2. Terry L. Highley. Biodeterioration of Wood. Pg 1-13

- **Week 7:** Mid-semester test

- **Objectives**
  The student at the end of the lectures for the week should be able to……
  Show good understanding of topics previously treated.

- **Description**
  Knowledge gained in the previous weeks will be assessed.

- **Study Question:**
- All study questions in previous weeks

- **Reading List –**

All references in previous lectures.

- **Week 8:** Biodeterioration of fuels and lubricants

- **Objectives**
  The student at the end of the lectures for the week should be able to……

  Describe how fuels undergo deterioration.
  Mention some common deteriogens of fuel and lubricants and their mode of action.
- **Description**
  The possibility of deterioration of fuels and lubricants will be considered and the agents responsible for same. Also preventive measures will be discussed.

- **Study Question:** How can biodeterioration of fuels affect the performance of automobile engines?

- **Reading List –**
- Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2^{nd} edi.)

- **Week 9:** Biodeterioration of plastics and rubber

- **Objectives**
  The student at the end of the lectures for the week should be able to……
  Describe the group of organisms that are capable of causing biodeterioration in rubber and plastics.
  Discuss how to prevent biodeterioration in rubber.

- **Description**

The composition, predisposing factors to biodeterioration as well as preventive

measures will be elaborated.

- **Study Question:**
- Is it possible for recalcitrant materials to undergo deterioration? Explain.
- **Reading List –**
- Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)

- **Week 10:** Biodeterioration of paints and leather

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Describe the composition of paints and explain why it is susceptible to deteriogen.
  Recognize paint that is undergoing biodeterioration.
  Mention some biodeteriogens that affect leather.

- **Description**

  The composition of paint and leather will be examined. Organisms that cause biodeterioration of paint and leather will be discussed. Methods of preventing biodeterioration of these materials will also be considered.

- **Study Question:**

  Discuss the major microbial group(s) involved in biodeterioration of leather, their mode or action and visible effects of the material.
- **Reading List –**
- Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)

- **Week 11:** Biodeterioration of stones/building materials

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Mention some factors that predispose building materials to biodeterioration.
  State organisms responsible for deterioration of named building materials.
- **Description**

  A basic understanding of the possibility of deterioration of some materials considered resistant to biodeteriogens. Preventive measures against deterioration of building materials will be discussed.

- **Study Question:**

  What are some basic steps to take to ensure the durability of buildings?

- **Reading List –**

1. Hanne Viitanen, Juha Vinha, Kati Salminen Tuomo Ojanen, Ruut Peuhkuri, Leena Paajanan and Kimmo, Lahdesmaki. Moisture and biodeterioration risk of building material and structures.
2. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)
3. Ortega-Calvo, J.J., Hernandez-Marine M. and Saiz-Jimenez C., Biodeterioration of building materials by Cyanobacteria and Algae.
4.

- **Week 12:** Biodeterioration of metals I

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Define the term biocorrosion.
  Explain how and why metals undergo biodeterioration.

- **Description**

The nature of metals, factors that predispose metals to deterioration and biocorrosion will be elaborated.

- **Study Question:**

  Why is biocorrosion a concern to the petroleum industry?

- **Reading List –**

1. Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd edi.)

- **Week 13:** Biodeterioration of metals II

- **Objectives**

  The student at the end of the lectures for the week should be able to……
  Discuss elaborately on the group organisms involved in biocorrosion giving specific examples.
  Mention some ways of preventing deterioration of metals.

- **Description**

Organisms involved in biocorrosion and their mode of action will be expatiated. Also, methods of controlling and preventing deterioration of metals will be examined.

- **Study Question:**

Discuss three ways of preventing biocorrosion.

- **Reading List –**
- Dennis Allop, Kenneth J. Seal, Christine C. Gaylarde. 2004. Principle of microbial deterioration of materials: Introduction to biodeterioration (2nd

edi.)

- **Week 14:** Revision
- **Objectives**
  The student at the end of the lectures for the week should be able to……

  Show understanding of various concepts discussed in the course.
  Ask relevant questions that will equip them for the examination.
- **Description**
  A review of all topics taught in the semester.
- **Study Question:** All study question given since the semester began.
- **Reading List –** All reference materials listed for the past weeks.

Week 15: Examination

Objectives:
To examine the student on all that has been taught during the semester.

Reading List:
All reference materials listed for the past weeks.