



# COURSE COMPACT

## 2016/2017 Academic Session.

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**COLLEGE:** *College of Science and Engineering*  
**DEPARTMENT:** *Agricultural and Biosystems Engineering*  
**PROGRAMME:** *Agricultural and Biosystems Engineering*  
**COURSE COMPACT for:** *Food and Crop Storage Engineering*

### Course

Course code: *ABE 523*  
Course title: *Food and Crop Storage Engineering*  
Credit unit: *3 Credits*  
Course status: *Compulsory*

### Lecturers' Data

Name of the lecturer: *Engr. Prof. Zinash Delebo Osunde*  
Qualifications obtained: *MSc. Ph.D*  
Department: *Department of Agricultural and Biosystems Engineering*  
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Office Location: *Office A226 New College Building*  
Consultation Hours: *Monday and Thursday 10 am – 12 noon*

Name of the lecturer: *Engr. Dr. John O. Ojedirán*  
Qualifications obtained: *BSc., MSc. Ph.D, MBA*  
Department: *Department of Agricultural and Biosystems Engineering*  
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Office Location: *Office A214 Old College Building*

### INTRODUCTION TO THE COURSE

**Course Description** –: *This is a course designed to teach students the importance of storage of agricultural products and special requirements for successful storage of various agricultural products. Methods and engineering requirements of various types of storage structures and its design and development will also be thought*

**Course Justification –:** *One of the major problems of the developing world is food insecurity. Increasing production alone cannot assure food security. In addition all agricultural products are seasonal, for it to be available all year round; thereby making food available to the teeming population it has to be stored. Appropriate storage methodology is the key to make food available throughout the year. Thus any Agricultural Engineering Student must have a good knowledge on storage requirements of various types of agricultural products and must be able to design and develop storage structure for various agricultural products.*

**Course objectives**

*At the end of this course, students should be able to:*

- (i) Identify various storage structures used in the country for storing agricultural products.*
- (ii) Should be able to clearly understand the storage requirements of different agricultural product.*
- (iii) Should be able to design a storage structure for different types of agricultural commodity*
- (iv) Should be able to understand the effect of different environmental factors (temperature, relative humidity and air composition) on stored agricultural products.*
- (v) Should be able to understand Equilibrium moisture content of agricultural products and sorption isotherms in relation to stored products.*

**Course Content:** *Reasons for storage of agricultural products. Review of indigenous and modern systems for storing agricultural and biological materials. Design of storage system and structures for tropical plants and animal products Storage types and environment for Grain and pulses; tubers and bulbs; fruits and vegetables. Storage of perishable agricultural products, control atmosphere and modified atmosphere storage, Storage facilities, distribution criteria, economic analysis of storage systems. Deterioration of produce in storage. Equilibrium moisture content, Sorption isotherms, packaging of agricultural materials. Containerization, Environmental control in storage.*

**Course Requirement –: none**

**Method of Grading-**

<b>S/N</b>	<b>Grading</b>	<b>Score (%)</b>
1.	Assignment	7
2.	Test	15
3.	Oral presentation	8
4.	Final Examination	70
	<b>Total</b>	<b>100</b>

## Course Delivery Strategies –

*Lecture, oral presentation, group and individual work, field work/excursion, laboratory work*

**Course Duration** *Three hours per week for 15 weeks (45hours)*

## LECTURE CONTENT

- **Week 1:**
- **Topic: General introduction**
- **Objective:** The objective this session is to familiarise with the students, and give them the general overview of the course, methods of teaching and assessment.
- **Description:** The students and the lecturer will be introduced to each other. Students will be given the course outline, method of lecture delivery and relevant literature will be given. General overview of the course will be given to the students. At the end of the lectures for the week the students will know the method of lecture delivery, lecturer and students will familiarise and students should be able to know the basics of storage in an agricultural enterprise,
- **Study Questions:** what is crop storage?
- **Reading List:**
  1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
  
- **Week 2**
- **Topic:** Definitions of storage, reason for crop storage, from the farmer prospective, traders prospective and government prospective.
- **Objectives:** for the students to understand what storage is and why it is important. Its importance from different prospective.
- **Description:** this will be a lecture session, with the help teaching aid such as power point projector. There will also be an interactive session to assess the students understanding of the subject matter
- **Study Questions:** why do we need to store crop harvested? Why do farmers, traders and government store harvested crops? Discuss the basic operational factors that should be taken in to consideration in crop storage
- **Reading List:**
  1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
  2. Elements of Crop Storage; Musa-Makama and Onwualu

➤ **Week 3:**

➤ **Topic:** Review of indigenous and modern systems for storing agricultural and biological materials.

➤ **Objectives:** Explain the development of storage systems, different types of storage systems, its advantages and disadvantages will be discussed.

➤ **Description:** this will be a lecture session with the use of visual aid. The students will learn different types of storage structures and its development for different crops, including advantage and disadvantage of such structures.

➤ **Study Questions:** what are the peculiarities of traditional storage structures? Identify the different types of storage structures used in Nigeria.

➤ **Reading List:**

1. Agricultural Process and Storage Engineering; J. C. Igbeka
2. Elements of Crop Storage; Musa-Makama and Onwualu

➤ **Week 4**

➤ **Topic;** Design of storage system and structures for tropical plants and animal products  
Storage types and environment for Grain and pulses;

➤ **Objectives:** to understand the basic engineering requirements while designing a storage structure for grains, legumes and oil seeds

➤ **Description:** this will be a lecture and an interaction session. Engineering principles that govern the design and development of storage structures will be discussed. An assignment for oral presentation will be given.

➤ **Study Questions:** what are the major challenges of crop storage in the tropics? What are the basic requirements in grain storage? Identify the various types of grain storage structures, what are the basic design requirements for storage structures?

➤ **Reading List:**

1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
2. Agricultural Process and Storage Engineering; J. C. Igbeka
3. Elements of Crop Storage; Musa-Makama and Onwualu

➤ **Week 5:**

➤ **Topic:** storage type and environment for tubers and bulbs

➤ **Objectives:** To understand the storage requirement of high moisture crops. Effect of temperature and relative humidity in storage. Respiration and transpiration during storage. Storage requirement of root, tuber and bulbs.

➤ **Description:** This will be a lecture and an interaction session. Using real examples,

the storage requirements of semi perishable and perishable agricultural products will be discuss.

➤ **Study Questions:** what are the storage requirement of root, tuber and bulbs? What is the relationship between relative humidity temperature and respiration rate?

➤ **Reading List:**

1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
2. Agricultural Process and Storage Engineering; J. C. Igbeka
3. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 6**

➤ **Topic:** Storage type and environment for fruit and vegetables (Test 1)

➤ **Objectives:** To understand the storage requirement of fruits and vegetables. Effect of temperature and relative humidity in storage. Respiration and transpiration during storage. Maturity ripeness and senescence in crops and its effect on storage.

➤ **Description:** This will be a lecture and an interaction session. Using real examples, the storage requirements of perishable agricultural products (fruits and vegetables) will be discuss.

➤ **Study Questions:** what are the factors that affect respiration in stored fruits? What are the various methods of fruit and vegetable storage?

➤ **Reading List:**

1. Agricultural Process and Storage Engineering; J. C. Igbeka
2. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 7**

➤ **Topic:** Storage of perishable agricultural products, control atmosphere and modified atmosphere storage,

➤ **Objectives:** more on storage of perishable agricultural products, how to achieve MA and CA storage.

➤ **Description:** this will be a lecture session with the use of visual aid. The importance and engineering principle of CA and MA will be discussed.

➤ **Study Questions:** understand modified and control storage methods for fruit and vegetable? Design requirement for perishable crops?

➤ **Reading List:**

1. Agricultural Process and Storage Engineering; J. C. Igbeka
2. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 8**

➤ **Topic:** CA test

➤ **Objectives:** To examine the students on all that has been taught during the past weeks.

➤ **Description:** this is the mid term test

➤ **Study Questions:** as in the question papers.

➤ **Reading List:**

1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
2. Agricultural Process and Storage Engineering; J. C. Igbeka
3. Elements of Crop Storage; Musa-Makama and Onwualu
4. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 9**

➤ **Topic:** Storage facilities, distribution criteria, economic analysis of storage systems.

➤ **Objectives:** To explain how to estimate the economic viability of any storage structure.

➤ **Description:** This is a lecture session, economy of crop storage is an important aspect of storage. This will be discussed in detail.

➤ **Study Questions:** force distribution in storage silos? What is the importance of economic analysis in storage?

➤ **Reading List:**

1. Agricultural Process and Storage Engineering; J. C. Igbeka
2. Elements of Crop Storage; Musa-Makama and Onwualu
3. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 10**

➤ **Topic:** Deterioration of produce in storage. Equilibrium moisture content, Sorption isotherms,

➤ **Objectives:** how to keep produce in good condition? How to keep dry produce in store? Effect of relative humidity on stored dry products

➤ **Description:** this is a lecture session with the use of visual aid. Crops should be kept safe and wholesome during storage. Factors that mitigate against this will be discussed.

➤ **Study Questions:** how can EMC for different crops be generated? What are the factors responsible for deterioration in stored crops?

➤ **Reading List:**

1. Agricultural Process and Storage Engineering; J. C. Igbeka
2. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 11**

- **Topic:** packaging of agricultural materials.
- **Objectives:** to understand the importance of food packaging before storage, identify packaging materials that can be used for food and agricultural materials packaging, advantages and disadvantages of such materials.
- **Description:** this is a lecture and interaction session. Students will be thought the importance of packaging before storage.
- **Study Questions:** what are the environmental factors responsible to deterioration of stored crops? List the various packaging materials used in food storage?
- **Reading List:**
  1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
  2. Elements of Crop Storage; Musa-Makama and Onwualu
  3. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 12**

- **Topic:** Containerization, Environmental control in storage.
- **Objectives:** understand the effect of the environmental condition on stored products, how to guard product from environmental conditions.
- **Description:** this is a lecture session, students will thought the importance of the environmental factors during storage and its control.
- **Study Questions:** what are environmental requirement in storage? Design of containers
- **Reading List:**
  1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
  2. Agricultural Process and Storage Engineering; J. C. Igbeka
  3. Elements of Crop Storage; Musa-Makama and Onwualu
  4. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 13**

- **Topic:** submission of assignment and oral presentation
- **Objectives:** : To examine the students on all that has been taught during the past weeks. Students will make presentation on given topics.

- **Description:** each student will make his or her presentation with the use of visual aids
- **Study Questions:** question will be asked based on the students presentation?
- **Reading List:**
  1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
  2. Agricultural Process and Storage Engineering; J. C. Igbeka
  3. Elements of Crop Storage; Musa-Makama and Onwualu
  4. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,
  5. Internet search by individual students

➤ **Week 14**

➤ **Topic:** Revision

➤ **Objectives:** To revise the semester lecture, interact with students if they have any difficulty or questions for discussion

➤ **Description:** this will be a general revision of the entire semester lecture.

➤ **Study Questions:**

➤ **Reading List:**

1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
2. Agricultural Process and Storage Engineering; J. C. Igbeka
3. Elements of Crop Storage; Musa-Makama and Onwualu
4. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,

➤ **Week 15**

➤ **Topic:** Examination

➤ **Objectives:** To examine the students on all that has been taught during the semester.

➤ **Description:** end of semester examination

➤ **Study Questions:**

➤ **Reading List:**

1. Fundamentals of Engineering for Agriculture by: A. P. Onwualu; C. O. Akubuo and I. E. Ahaneku
2. Agricultural Process and Storage Engineering; J. C. Igbeka
3. Elements of Crop Storage; Musa-Makama and Onwualu
4. CIGR transaction 1999 volume IV Agro processing Engineering; F. W. Bakker Arkema *et al.*,



HOD's Observations and further Comments -----  
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Name:

Signature

Date 23/01/2017