



COURSE COMPACT

2017/2018 Academic Session.

COLLEGE: College of Science and Engineering
DEPARTMENT: Agricultural and Biosystems Engineering
PROGRAMME: Agricultural Engineering
COURSE COMPACT for: Design, Analysis and Management of Storage Systems

Course

Course code: ABE 413
Course title: Design, Analysis and Management of Storage Systems
Credit unit: 3 UNITS
Course status: Compulsory

Lecturers' Data

Name of the lecturer: Dr. Okunola, A. A.
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INTRODUCTION TO THE COURSE

Course Description – This course is necessary to expose students to the various storage structures in existence for storing different quantities of grains from a handful to thousands of tones. Furthermore, the materials of construction of these various structures would be assessed with a view to determine their advantages and disadvantages in terms of preserving the quality of stored grains. Some storage structure's design and construction would also be studied with the economic analysis of such facilities also evaluated. Different pests and rodents that affect grains in storage would be exposed to the students and their mode of entrance into such structures would be discussed as well.

Course Justification – There is an urgent need to review the present storage structures in existence with a view to determine their relevance in this age and proffer solutions with the development of new and functional storage structures with low economic cost of construction that would be affordable by the farmers. This design should demand no skilled labour to be effective and acceptable by them.

Course Objectives- At the end of this course, students would be able to:

- (i) identify traditional and modern storage structures
- (ii) design some storage structures.
- (iii) identify pests and rodents prevalent in the storage structures

Course Content – Review of traditional and modern crop storage systems, design of storage structures for grains, semi-perishable crops (e.g., potatoes, yam, etc) and perishable (e.g. fruits and vegetables. Storage facilities distribution criteria, strategic food reserve, silo complex and economic analysis and computer aided approach to the development of storage for tropical crops.

Course Requirement: To derive maximum benefits from the course and for fast grasping of many of the storage structures, the course requires that the students be familiar with some materials of construction that is naturally available in the area, be versed in the use of AutoCAD or ArchiCAD. However, the course is structured to accommodate to some extent, students that do not fall into this category.

Course Expectations:

S/N	GRADING	SCORE (%)
1.	Continuous Assessments	
	• C.AI	7%
	• C.AII (Mid-Semester Test)	15%
	• C.AIII	8%
2.	Assignment	
3.	Practical (Laboratory work)/ Case Studies	
4.	Final Examination	70%
5.	Total	100

Course Delivery Strategies: Combination of verbal exposition, slide presentation, participatory Students approach such as interactive questions and group discussion shall be adopted . Also Assignments would be given to students to write out some other storage structures they could identify, construction method, materials of construction and their principles of operation.

Course Duration: This shall consist of 3 hours of lectures for 15 weeks and 1 week will be devoted for revision at the penultimate week to examination.

LECTURE CONTENT

Module 1

Week 1: Basic definition and introduction to storage structures

➤ **Objectives:**

The students at the end of the lectures for the week should be able to define what they understand by storage, reasons for storage and the nature of bio-materials in relation to storage

➤ **Description**

First Hour Definition and description of various traditional storage structures shall be investigated.

Second Hour Importance of storage structures to agricultural practices Identifying modern storage structures

➤ **Study Question:**

1. Define in your own words what you understand by storage
2. Itemise some other storage structures not listed in the class that are available in their area

➤ **Reading List -**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan
Lecture notes

Module 2

Week II: Classification of the types of storage, duration of structures, size of structures and principle of storage

➤ **Objectives:**

The students at the end of the lectures for the week should be able to classify storage based on duration, size and principle of storage.

➤ **Description**

First hour: Response of study question from students and verbal exposition on classification of the types of storage facilities

Second hour: Definition of storage structures, discussion on life span and sizes of storage structures. General principles of storage

➤ **Study Question:**

Identify some storage systems and classify them based on duration, size and principle of the system

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan
Lecture notes

Week 3: Traditional Storage structures

Ø Objectives:

The students at the end of the lectures for the week should be able to identify various types of traditional storage structures. They should also be able to discuss their mode of operations.

➤ **Description**

First Hour: Slide presentation of traditional structures

Second hour: Discussion on mode of operation of traditional structures (case studies on available ones in the student domain)

➤ **Study Question:**

Identify some traditional storage structures.

Outline some problems of traditional storage structures.

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan

Lecture notes

Week 4

Topic: Storage structures continues

➤ **Objectives:**

The students at the end of the lectures for the week should be able to identify both traditional and modern storage structures. They should also be able to discuss their mode of operations.

➤ **Description**

First Hour: Slide presentation of modern structures

Second hour: Discussion on mode of operation of modern structures (case studies on available ones in the student domain)

➤ **Study Question:**

Identify some modern storage structures and their principle of operation.

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan

Lecture notes

Module 3

Week 5: Silo design and calculations

➤ **Objectives:**

The students at the end of the lectures for the week should be able to classify silo into either deep or shallow silos.

They should be able to use both Janseen and Rankine equations for designing silo structures.

➤ **Description:**

First hour: calculation to differentiate deep or shallow silo

Second hour: Presentation of formula for Janseen and Rankine equations, utilization of the equations to solve problems

Study Question:

Solve some problems relating to vertical wall pressure, floor pressure, maximum lateral pressure etc.

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan
Lecture notes

Module 4

Week 6: Design of suitable storage systems for crop storage

➤ **Objectives:**

The students at the end of the lectures for the week should be able to design some storage structures such as maize crib and earthen silos etc. The storage time, duration, materials of construction and cost would be discussed.

Description:

First hour: Requirements for design of improved maize crib and its management

Second hour: Requirement for design of earthen silo and its management

➤ **Study Question:**

Design some storage structures for crops such as grains, tubers and vegetables.

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan
Lecture notes

➤ **Week 7: MID SEMESTER EXAMINATION**

Week 8: Economic analysis and computer aided approach to the development of storage for tropical crops

➤ **Objectives:**

The students at the end of the lectures for the week should be able to evaluate the fixed cost, interest and variable cost of some of the structures would be considered. Computer aided design of some of these structures would also be discussed.

➤ **Descriptions:**

First & Second hours: Calculations on storage building cost and introduction to use of computer analysis in storage structures

➤ **Study Question:**

Some practical questions bordering on costing and economics of farm structures would be given to students.

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan

Lecture notes

Small Farm Storage by Carl Lindblad and Laurel Druben

Food Storage Manual by David J. Walker and Graham Farrell

Week 9: General design considerations for suitable storage systems for crop storage

➤ **Objectives:**

The students at the end of the lectures for the week should be able to state some of the factors that has to be considered before any design on crop storage structures has to be considered. These factors are the structural requirements, system capacity, location and orientation and the handling and equipments required.

➤ **Descriptions:**

First & Second hour: Group discussions on factors considered necessary to design of storage structures

➤ **Study Question:**

Explain some factors that has to be considered when designing any storage systems.

➤ **Reading List:**

Agricultural Processing Engineering J. C. Igbeka University Press Ibadan

Lecture notes

Module: 5

Week 10: Storage Pest: Insect

➤ **Objectives:**

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

Know importance of insect as a storage pest

Classification of insect pest and their life cycle

Factors affecting and methods of insect infestation of stored products

➤ **Description**

First hour: Definition of storage pest and insect. Class discussion was generated on importance of storage pest as it affects seed viability, contamination with body parts, local heating e.t.c. Verbal exposition on characteristics of insects, types of insect pests and white board illustration on complete and incomplete metamorphoses of their life cycles.

Second hour: Question was asked on how insect infest grains during storage? Students' responses were considered afterwards detailed information was communicated by white board presentation. Various factors encouraging insect infestation was also highlighted.

➤ **Study Question:**

Students are to classify life cycle of insects and differentiate category of insect pest.

➤ **Reading List -**

1. OFUYA .T. I & LALE N.E.S,2001 *Pest of stored cereals and pulses in Nigeria.: Biology, Ecology and Control. Dave Collins Publishers*
2. ODEYEMI O. O. & DARAMOLA A. A.2000 *Storage practices in the tropics Vol.1 Food storage and pest problems.*

Week 11 Storage Pest: Insect control

➤ **Objectives:**

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

Identify requirement for prevention of insect infestation of stored products

Know Insect control with insecticide

Know Insect control without insecticide

➤ **Description**

First hour: Verbal exposition on requirement preventing insect infestation i.e. early harvesting, proper drying and winnowing of cereals and pulses; separation of broken and damaged grains. Definition of insecticides, Identification of various types of insecticides (contact chemicals and fumigant gases) formulations of insecticides.

Second hour: Examples of insecticides for specific insects with the use of information sheets. Precaution of safe use of insecticides was also discussed among the students.

Biological control of insect pest was highlighted.

➤ **Reading List:**

1. OFUYA .T. I & LALE N.E.S,2001 *Pest of stored cereals and pulses in Nigeria.: Biology, Ecology and Control. Dave Collins Publishers*
2. ODEYEMI O. O. & DARAMOLA A. A.2000 *Storage practices in the tropics Vol.1 Food storage and pest problems.*

Assignment: Student are to understudy Information sheets on insecticides and its application.

Week 12 Other Storage Pest: Arachnids and Rodents

➤ **Objectives**

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

Recognise arachnids that affect stored products

Know the various types of rodents and their characteristics

Know rodent control with poison (rodenticide)

Know rodent control without poison

➤ **Description**

First hour: Definition and types of arachnids and their characteristics [white board presentation]. Types of rodents (i.e. Norway rat, roof rat and house rat); class discussion on characteristics of rats

Second hour: Types of rodenticide - Acute poison and anti coagulant. Types of bait and their preparations. Precaution on safe use of rodenticide.

➤ **Reading List:**

1. *OFUYA .T. I & LALE N.E.S,2001 Pest of stored cereals and pulses in Nigeria.: Biology, Ecology and Control. Dave Collins Publishers*

2. *ODEYEMI O. O. & DARAMOLA A. A. 2000 Storage practices in the tropics Vol.1 Food storage and pest problems.*

Information sheets on rodenticides and its application.

Module 6

Week 13 Storage Pest: Aves and Micro organisms

➤ **Objectives**

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

Identify the effect of aves on stored products

Know the various micro organisms affecting stored products

Identify the effects of micro organism on stored products

Recognise micro organism grouping by humidity and temperature requirements.

Control of storage fungi

➤ **Description**

First hour: Definition of aves and the effect on aves on stored products i.e. consumption, contamination with droppings and feathers, host to some insect pest.

Defination of micro organism and types - (fungi, yeast and bacteria). Verbal exposition on effect of fungi on stored products.

Second hour: Class discussion on factors affecting growth of storage fungi namely, relative humidity, safe moisture content for stored products. Micro organism grouping by humidity requirement i.e. hydrophytes, mesophytes and xerophytes. Micro organism grouping by temperature i.e. psychrophlic, mesophylic and thermophylic. Power point presentation on control of storage fungi.

➤ **Reading List:**

OFUYA .T. I & LALE N.E.S,2001 Pest of stored cereals and pulses in Nigeria.: Biology, Ecology and Control. Dave Collins Publishers

Week 14 Strategic grain storage complex

➤ Objectives

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

Identify the purpose of establishment of storage complex

Know the capacity and facilities available in the storage complex

Familiarize with grain reception procedure and management of the facilities

know the various components of the storage complex ecosystem and their interactions

➤ Description

First hour: Enumerate purpose of establishment of storage complex. Verbal exposition on various capacities and facilities in the storage complex. Description of grain reception and management of storage complex i.e. Silo and warehouse.

Second hour: Identification of components of storage structures namely, stored grains, storage structures, temperatures, humidity, atmospheric air, insects, micro organisms and foreign matter.

➤ Study Assignment:

Group assignment on location, capacity, types of grain stored and % utilization of storage complex in all states of the federation.

➤ Reading List -

1. Storage methods and Preparing grains for storage. A Volunteer in Technical Assistance Publication.
2. Information sheets on insecticides and rodents.
3. Course handouts

Week 15 Revision on the course and test questions

Objectives

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

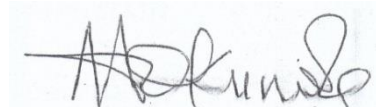
- i. To have a thorough understanding of the course
- ii. Interactive session on management of storage complex

Week 16 Terminal Examination

Objectives:

To examine the students on all that has been taught during the semester.

HOD's Observations and further Comments -----Course compact is adequate----



Name: Dr. Okunola, A. A.

Signature -----

Date 5/09/2016