

LANDMARK UNIVERSITY, OMU-ARAN

COLLEGE OF SCIENCE AND ENGINEERING

Department of agricultural and Bio-system Engineering

COURSE COMPACT

Course

Course code: ABE 417

Course title followed by the credit unit: FOOD ENGINEERING (2 UNITS)

Course status: ELECTIVE

Course Duration

Two hours for 15 weeks (30hours)

Lecturer Data

Name of the lecturer: DR A.O.D. ADEJUMO

Qualifications obtained: B Eng, MSc, MBA, Ph.D, Regd Engr COREN

Department: AGRIC. & BIOSYSTEMS ENGINEERING

Faculty: SCIENCE AND ENGINEERING

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Office Location: Room A105, First Floor, First College Building

Consultation Hours: Mondays 2-4pm, Wednesdays and Thursdays 2-4pm.

Course Content:

Definition, Heat and mass transfer, Insulation, Heat exchangers-design and applications. Heat and cold preservation of foods. Food packaging, Food quality control. Principles and design of food equipment. E.

Course Description:

This course teaches food engineering concepts and application of engineering principles to several areas of food processing namely handling, storage, heat and cold preservation and packaging. Food preservation is a critical control point that influences and determines a whole range of outcomes, ranging from preservation of nutritional quality, food safety; the wholesome nature of food, texture, taste and organoleptic qualities, and consumer appeal, along with compliance to several points in the value chain that include long- term storage, long –distance transportation and marketing. In developing countries like Nigeria, where population is increasing daily, the food produced needs proper preservation not only for the availability of food for the populace , but also the quality food to the consumer at a reasonable price the can sustain the whole food value chain.

Course Justification

In Africa, there is always a limit to agricultural productivity to meet the ever increasing demand for food. High percentage of the scanty food produced is often lost due to poor processing, handling, packaging, storage and distribution of food products. Therefore, Food Engineering examines the applications of process engineering fundamentals to food processing technology, making it an important reference for Students of Agriculture and Bio-system interested in food processing and working in food processing industries.

Course objectives

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

- (i) Understand basic engineering principles based on fundamental physics.
- (ii) Understand application of heat transfer to preservation processes, refrigeration, freezing processes and evaporation processes.
- (iii) Understand application of mass transfer to dehydration processes, drying and packaging.
- (iv) Understand the need and process of food quality control.

Course Requirement:

A good understanding of fundamentals in physics and thermodynamics is essential. To derive maximum benefits from the course and for fast grasping of many of the principles underlying food engineering, students will have presentations on relevant topics and share their industrial experience during SIWES. Possibility of visit to any food processing industry in this environ will be explored.

Method of Grading:

S/N Grading Score (%)

1. Test 15
2. Assignments, Term paper 15
3. Practical (laboratory work)
4. Final Examination 70

Total 100

Course Delivery Strategies:

Expository or Lecture method relating topics to everyday events, workshop/ laboratory based approach, group interactive discussion and students may sometimes be grouped for mini-project

LECTURE CONTENT

Ø **Week 1:** Resumption, Registration and Acclimatization of returning Students

Ø **Objectives:** The students acquit themselves with the elected course, lecture time-table.

Ø **Week 2:** Introduction to Food Engineering. Understanding dimensions, system, state of system, intensive and extensive properties, Concentration, Moisture content: its relevance in food engineering, determination on wet and dry basis.

Ø **Objectives:** The students at the end of the lectures for the week should be able to:

- (i) Have an overview of the course Food Engineering
- (ii) Refreshed on their knowledge of engineering fundamentals as applicable to Food engineering.

Ø **Study Question:** Why should the knowledge of crop processing methods be of concern to the Food Engineer? Discuss.

Ø **Week 3:** Understanding enthalpy and energy calculation, phase diagram of water, Conservation of mass for open and closed system, Material and energy balance in food process operation.

Ø **Objectives:** The students at the end of the lectures for the week should be able to:

- (i) Differentiate open and closed systems, identify same in Food processing industries.
- (ii) Calculate material and energy balance in any operation.

Ø **Study Question:** Solve some worked examples.

Ø **Week 4:** Heat and Mass Transfer in Food Processing

Ø **Objectives:** The students at the end of the lectures for the week should:

- (i) Understand the various thermal properties of food as they affect processing.
- (ii) Understand different modes of heat transfer and how these influence choice of processing operations.

Ø **Study Question:** Solve some worked examples.

Ø **Week 5:** Further discussion on conductive heat transfer, convective heat transfer and radiation heat transfer.

Ø **Objectives:** The students at the end of the lectures for the week should:

- (i) Have adequate knowledge of heat and mass transfer during food processing
- (ii) Be able to calculate the quantity of heat transfer and the rate of heat transfer in any given processing operation.

Ø **Study Question:** Solve some worked examples.

Ø **Week 6:** Insulation

Ø **Objectives:** The students at the end of the lectures for the week should:

- (i) Be familiar with the common types of insulators, their characteristics and choice

Ø **Study Question:** Solve some worked examples.

Ø **Week 7:** Heat Exchangers: types, design and applications.

Ø **Objectives:** At the end of the week, students should be:

- (i) Familiar with the common types of heat exchangers (contact and non contact) in food processing operations
- (ii) Calculate energy balances on heat exchangers.

Ø **Week 8:** Tutorials and Mid-semester exams.

Ø **Objectives:** The students will be examined on topics treated so far. This is a fore-taste of the main examination.

Ø **Week 9:** Heat and Cold Preservation of Foods.

Ø **Objectives:** The most common processes found in a food processing plant involve heating and cooling. At the end of the week, students should be familiar with unit operations like freezing, refrigeration, thermal sterilization, drying and evaporation.

Ø **Study Question:** Heating and cooling operations affect foods in many ways. Discuss.

Ø **Week 10:** Food Packaging.

Ø **Objectives:** Students at the end of the week should be:

- (i) Acquitted with advances in materials used in packaging and the need to deliver high quality product to consumers.
- (ii) Carried out packaging of some food products

Ø **Study Question:** Make a list of ten packaging materials and state their advantages and disadvantages.

Ø **Week 11:** Food Quality Control.

Ø **Objectives:** At end of week, students should have in-depth knowledge on food quality control

Ø **Week 12:** Principles and Design of Food Equipment: dehydration, separation

Ø **Objectives: At the end of lectures:**

- (i) Students should understand the principles and design of food equipment
- (ii) Students should design a simple food equipment

Ø **Week 13: Tutorials**

Objectives: General revision of the course in preparation for Alpha Examination.

Ø **Week 14:** End semester test

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

Ø **Week 15:** Alpha semester Examination

Ø **Reading List - Books and materials students can read:**

1. K.M. Sahay and K.K. Singh (1994, Revised 2007, 2009), *Unit Operations of Agricultural Processing* / Vikas Publishing House PVT Ltd Noida-201301(UP)
2. R. Paul Singh and Dennis R. Heldman (2009). *Introduction to Food Engineering, Fourth Edition*. ISBN: 978-0-12-370900-4
3. Zeki Berk (2009) *Food Process Engineering and Technology*. Academic Press.
4. Abd Karim Alias and Goplnadhan Paliyath (2012) Edited by Rajeev Bhat. John Wiley and sons, Ltd Publication
5. Albert Ibarz and Gustavo V. Barbosa-Canovas (2014) *Introduction to Food Process Engineering*. CRC press, Taylor or Francis Group, Boca.
- 6.. *Whatever relevant materials on the internet.*