COURSE COMPACT

COLLEGE: College of Science and Engineering (CSE)
DEPARTMENT: Agric. & Biosystems Engineering
PROGRAMME: Agricultural Engineering
COURSE COMPACT for:

Course

Course code: ABE 431
Course title: Properties and Processing of Agricultural Materials
Credit unit: 3
Course status: Compulsory

Lecturer's Data

Name of the lecturer: Engr. Dr. J.O. OJEDIRAN
Qualifications obtained: B.Sc, M.Sc, MBA, PhD
Department: Agric. & Biosystems Engineering
College: College of Science and Engineering (CSE)
E-mail: **o**jediran.john@lmu.edu.ng
Office Location:

Consultation Hours: Tuesdays 1-3pm, Thursdays 1-3pm, Fridays 10am - 12noon

INTRODUCTION TO THE COURSE

Course Description – This is a course that teaches agricultural processing primarily aimed at conservation of produce and value adding to make materials more readily useable and to generate more income. The course discusses some very basic unit operations of agricultural processing.
The scope of discussion is limited to that specified in the course content above. Some areas not covered may however be given as assignment to students to explore.

Course Justification – In Africa, there is always a limit to agricultural productivity to meet the ever increasing demand for food and other agro based products. ''To avoid losses and to utilize by-products in an economical way, a proper understanding of appropriate post harvest processing is essential''.

Course objectives - At the end of this course, students would be able to:
(i) understand engineering properties of agricultural and their importance in processing.
(ii) understand some basic unit operations of agricultural processing.
(iii) develop some simple processing methods adaptable to our environment.

Course Content – Understanding Biological materials as distinct from Engineering materials, Different Engineering properties of agricultural materials and their importance in design of processing equipment: physical, frictional, mechanical, electrical, thermal, optical and rheological properties. Processing of agricultural materials: Cleaning, Sorting and Grading, Screens and seperators, Particle size analysis and size reduction processes, Dehydration and drying, equilibrium moisture content of agricultural materials, Psychrometry and analysis of processes, Design of dryers for tropical plant and animal products. The solar dryer.

Course Expectations:

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

Course Delivery Strategies - Lecture method complimented with laboratory work will be adopted. In the laboratory, diagrams will be explained and students will be given assignments to write and discuss. Students may sometimes be grouped for the laboratory work.

Course Duration- Four hours for 15 weeks (60hours)

LECTURE CONTENT

Lectures broken into Modules. Each week represents a module.

Ø **Week 1:** Understanding biological materials.
Ø **Objectives:** The students at the end of the lectures for the week should be able to appreciate the peculiarity of agricultural materials and also be able to conceptualize handling methods. Specifically, students should **i**) know what biomaterials are.
ii) know why they are living materials.
iii) know the distinguishing features from engineering materials.

Ø **Study Question:** Discuss the life sustaining processes biomaterials undergo that distinguish them as living bodies.

Ø **Week 2:** An overview of Engineering properties of agricultural materials and their importance in design of processing equipment and postharvest handling.
Ø **Objectives:** The students at the end of the lectures for the week should be able to classify engineering properties, their relevance in processing and specific examples.

Ø **Week 3:** Detailed discussion on physical properties of agricultural materials. Definitions and calculations on shape and size, roundness, roundness ratio, sphericity, volume. density and specific gravity. I=f(sh,s,o,p,fm…), use of the standard chart for describing shape of agricultural products.
Ø **Objectives:** The students at the end of the lectures for the week should understand the various physical properties and the method of determining them.
Ø **Study Question:** Using the standard chart, describe the shape of ten agricultural products.

Ø **Week 4:** Detailed discussion on porosity and its determination using the porosity tank, terminal velocity and drag coefficient. Frictional properties and mechanical properties, their relevance in design of postharvest systems.
Ø **Objectives:** The students at the end of the lectures for the week should understand the various physical properties listed above, the method of determining them and their relevance in agricultural processing.

Ø **Week 5:** Detailed discussion on some thermal and optical properties and their relevance in postharvest operations.
Ø **Objectives:** The students at the end of the lectures for the week should understand the importance of heat capacity, thermal conductivity, diffusivity, light transmittance etc in processing.

Ø **Week 6:** Rheology and rheological properties of agricultural materials, description of simple models i.e Hookean, Maxwell and Kelvin models.
Ø **Objectives:** The students at the end of the lectures for the week should know the various models, their sketch, equations and calculation.
Ø **Study Question:** Study worked examples

Ø **Week 7:** Processing of agricultural materials: Cleaning, Sorting and Grading, Screens and seperators: types and their effectiveness, calculation of cleaning efficiency.
Ø **Objectives:** The students at the end of the lectures for the week should understand the processing operations listed above.
Ø **Study Question:** Calculate the cleaning efficiency using the set of data given

Ø **Week 8:** Tutorials preparatory to Mid-semester Examination. 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:** Dehydration and drying: constant and falling rates, thin layer and deep bed, equilibrium moisture content of agricultural materials: determination using Henderson equation.
Ø **Objectives:** The students at the end of the lectures for the week should understand the difference between each pair of operation above, the relevance of equilibrium moisture content and its determination.
Ø **Study Question:** Derive the Henderson model of equilibrium moisture content for agricultural products.

Ø **Week 10:** Psychrometry, use of psychrometric chart, representation and analysis of processes using the psychrometric chart.
Ø **Objectives:** The students at the end of the lectures for the week should understand the use of the psychrometric chart for analyzing processes.
Ø **Study Question:** The dry bulb and wet bulb temperatures of a drying process are $20^{o}C$ and $25^{o}C$ respectively. Determine all other properties.

Ø **Week 11:** Further work on Psychrometry, Calculations using the psychrometric chart, representation and analysis of processes using the psychrometric chart.
Ø **Objectives:** The students at the end of the lectures for the week should be able to determine the energy requirement of various processes.

Ø **Week 12:** Theory of air separation. Design of seperators/screens for tropical crops:
Ø **Objectives:** The students at the end of the lectures for the week should know various seperators and screens for separation.

Ø **Week 13:** Particle size analysis using Rittinger's, Kick's and Bond's laws. Particle size reduction principles: Crushing, impact, shearing and cutting. Some examples: Hammer mill, Burr mill, Plate mill.
Ø **Objectives:** The students at the end of the lectures for the week should understand the various size reduction processes. Also, students should be able to carry out particle size analysis using the three laws above.

Ø **Week 14:** Design of dryers for tropical plant and animal products: rotating drum dryer and solar dryer. Understand the Luikov theoretical drying equation.
Ø **Objectives:** The students at the end of the lectures for the week should be familiar with simple adaptable technology for drying agricultural products.
Ø **Home Study:** Read up Continuous flow dryers – cross flow, concurrent flow and counter current flow.

Ø **Week 15: Topic:** Tutorials and Examination
Objectives:
To examine the students on all that has been taught during the semester.

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. *J.C. Igbeka (2013), Agricultural Processing and Storage Engineering/ Ibadan University Press ISBN: 978-978-8456-07-0*
3. *Physical properties of plant and animal materials, Nuri Mohsenin (Revised Edition)*
4. *Whatever relevant materials on the internet.*
5. Journal articles and references from Magazines related to the course.

HOD's COMMENTS----------

Name: Signature : Date: