COURSE COMPACT

Course

Course code: ABE 527

ABE 527 – Design of Environmental Controlled Structures (2 Credits)

Course status: ELECTIVE

Course Duration

2hours for 15 weeks (30hours)

Lecturer Data

Name of the lecturer:

Engineer AKINYEMI, BANJO AYOBAMI

Qualifications obtained: B.Eng, MSc, Regd Engr COREN

Department: AGRIC. & BIOSYSTEMS ENGINEERING

Faculty: SCIENCE AND ENGINEERING

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Office Location: Room A017, Inner Room, Engineering Workshop Building

Consultation Hours: Mondays (10am-3pm), Tuesday (10am-3pm) and Friday (11am-1pm)

Course Content:

Introduction to Environmental Control in Agricultural Structures, Psychrometrics: Thermodynamic properties of moist air, sensible heat and latent heat with evaporative cooling, Heat sources and exchange in farm structures: temperature, heat, latent heat of fusion, latent heat of sublimation, thermal conductivity. Ventilation: mechanical and natural ventilation, fans and blowers. Greenhouse engineering. Livestock and environmental interaction: thermal, thermo-neutral zone and heat balance at animal level. Farmstead sanitation and waste management, waste generation.

Course Description :

This course would enable the students to have general knowledge about the components of environment in which plants, animals and humans dwell in any typical place. As a discipline, farm environment is the subset of farm structures in the agricultural engineering discipline that deals with the design of conducive environment that would enhance optimum production for all operations and inhabitants on a farm as well as the design of control systems into already

existing and any proposed farm buildings with a view to enhance the quality and quality of the various activities being performed in any farm environment.

Course Justification

Designing an enabling environment for all activities on any farm ranging from crop production, crop storage, animal production and human shelter to processing of harvested crops, livestock shelters and their processing centers is necessary so that the quality and quantity would be enhanced. Also the optimum environmental factor at which maximum comfort which increases production and reduces energy and feed consumption has to be determined to reduce expenses and increase output of all farms. Lack of adequate ventilation in most storage medium is the major cause of postharvest losses in most farms therefore knowledge of the design of environmental controlled structures for all agricultural activities is necessary to produce a wholesome and seasoned agricultural engineer.

Course objectives

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

(i) Determine the environmental conditions that inhibit and enhance production in livestock.

(ii) Determine the safe storage environmental factors for most crops.

(iii) Develop a workable system for either reducing environmental conditions or increasing environmental conditions where necessary.

Course Requirement:

The course requires that the students be familiar with some basic science areas such as heat, latent heat, temperature, relative humidity, latent heat of vaporization etc. Also the students must know how to use the psychrometric chart. Other requirement is that the students should have a good analytical mind to resolve any problem in the design process. However, the course is structured to accommodate to some extent, students that do not fall into these category.

Method of Grading-

S/N Grading Score (%)

1. Test 20
2. Assignment 10
3. Final Examination 70

Total 100

Course Delivery Strategies :

Lecturing method involves the use of different environmental tables for the design. Assignments would be given to students to solve some calculations based on some designs.

LECTURE CONTENT

Ø **Week 1: Introduction to environmental control in agricultural structures**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to define what they understand by heat, temperature, ambient temperature, latent heat, sensible heat, latent heat of fusion etc.

Ø **Week 2: Psychrometric**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to use given values of certain environmental conditions to search for other environmental factors on the psychometric chart.

Ø **Week 3: Psychrometric continuation**

Ø **Objectives:**

The students at the end of the lectures for the week should understand the application of the psychrometric chart for estimation of heat and moisture thst could b added to any farm building.

Ø **Week 4: Heat sources in farm structure**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to identify the various sources of heat in a building with a view to either reduce or increase them to a comfortable level for the occupants.

Ø **Week 5: Heat exchange in farm structures**

Ø **Objectives:**

The students at the end of the lectures for the week should be able calculate the thermal properties of buildings and the insulating materials, heat of respiration of stored products with a view to provide a conducive storage medium is also essential.

Ø **Week 6: Introduction to ventilation**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to define what they understood by ventilation and its various types: mechanical and natural ventilation. They should also be able to explain the function of ventilation in agricultural environment.

Ø **Week 7: MID SEMESTER EXAMINATION**

Ø **Week 8: Mechanical and Natural Ventilation**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to explain in details what they understood by mechanical and natural ventilation. They should be able to solve practical application problems in ventilation systems.

Ø **Week 9: Livestock environmental interactions**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to give detailed explanation of the concept of animal environmental requirement which is classified under four sections namely; housing codes, space allowance depending on specie, age etc, provision of food, water and bedding and lastly the management and planning.

Ø **Week 10: Thermal, Thermo-neutral zone and Heat balance at house level**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to understand such terms like homeothermic, thermal balance and thermo-neutral zone in the livestock environment for some selected animals.

Ø **Week 11: Greenhouse engineering**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to understand the components of a typical greenhouse which are: seeders and seedline, transplanters, benches, irrigation system etc.

Ø **Week 12: Greenhouse climate control**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to understand the various climatic control units for monitoring water and feed intake, temperature, CO2, relative humidity, level of luminance of greenhouse covering etc within the structure.

Ø **Week 13: Farmstead Sanitation and Waste Generation**

Ø **Objectives:**

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

Ø **Week 14: Visitation to the Greenhouse at the Teaching and Research Farm**

Ø **Objectives:**

The students at the end of the lectures for the week should be able to explain what they understand by greenhouse structures with their components, accessories, materials of construction, design and location considerations and their advantages and disadvantages.

Ø **Week 15: Revisions and test**

Ø **Objectives:**

Revision of all the topics treated in the class would be done

Ø **Reading List -**

1. Structures and Environment Handbook, Midwest Plan Service, Eleventh Edition.
2. CIGR Handbook of Agricultural Engineering Volumes II and III.
3. The Design of Agricultural Environment by Yahaya Mijinyawa, Ibadan University Press, First Edition
4. Farm Structures in Tropical Climates by Lennart P. and Bengtsson James H. Whitaker