UNIVERSITY OF AGRICULTURE AND ENVIRONMENTAL SCIENCES,

UMUAGWO, IMO STATE

STUDENT HANDBOOK

FOR

B. ENG. DEGREE PROGRAMME IN AGRICULTURAL AND BIOSYSTEM ENGINEERING

DEPARTMENT

2023 - 2028

i. History of the University

University of Agriculture and Environmental Sciences (UAES), Umuagwo is a public University established by an Act of Imo State Parliament Law No. 4 of 2019 and Amended Law No. 7 of 2020, official Gazette No. 20, Vol. 44. The University is approved and licensed by the National Universities Commission (NUC) as the 49th State University in Nigeria and 171st in the Federation, in 2019. The University started with five faculties namely; Engineering, Agriculture, Science and Computing, Art, Social and Management Sciences and Environmental Sciences. The University runs a total of 29 programmes under these faculties. The University also runs an entrepreneurship centre which is coordinated by a director appointed by the vice chancellor.

ii. Vision, Mission and Slogan of the university

Vision

The vision of the university is to become a leader in the discovery, dissemination and application of new knowledge in areas of agriculture and environmental sciences for the development of self and of society.

Mission

The mission of the University is to provide excellent and conducive environment for teaching, learning, research and services that shall be renowned, distinguished and attractive nationally and internationally.

Slogan

The slogan of the university is Donate, Plant and Nurture.

iii. The National Anthem of Nigeria

Arise, O compatriots, Nigeria's call obey
To serve our fatherland
With love and strength and faith
The labour of our heroes past
Shall never be in vain
To serve with heart and might
One nation bound in freedom, peace and unity.

iv. The National Pledge

I pledge to Nigeria my Country
To be faithful, loyal and honest
To serve Nigeria with all my strength
To defend her unity
And uphold her honour and glory
So help me God.

v. Uaes Anthem

1st Stanza

University of Agriculture and Environmental Sciences

The home of knowledge, innovation and excellence
The pride of the eastern heartland and star of the nation
We create a better tomorrow by grooming scholars and leaders
Beyond boundaries of race, creed and gender.

Refrain:

UAES!!! Eagles of the world
Brilliant and bright, we'll always shine
We pledge to lead by excellence
UAES!!! Eagles of the world.

2nd Stanza

Mother Nature! We care and cherish you, "A gift to us from the Creator"
We pray for light and wisdom, to preserve, protect and sustain thee
May we grow each day in knowledge, intuition and moral strength
That through all our efforts, innovations and discoveries
The earth will be renewed, and become a better place.

vi. Members of the University

The Members of the University are –

(a) the Officers of the University;
(b) the members of the Council;
(c) the members of the Senate;
(d) the members of the academic staff;
(e) the members of the non-academic staff;
(f) the graduates;
(g) the students;

vii. The Officers of the University

The Officers of the University are –

(a) the Pro-Chancellor;
(b) the Vice-Chancellor; **Prof. Christopher Chiedozie Eze**
B.Agric. (Hons) MSc., PhD (Nig) L.L.B., B.L., Dip. in SMEs, FNAAE, FFAMAN, FASN, EMF
(c) the Registrar; **Prince E. E. Njemanze,** B.A (HONS), PGDIS, MBA FCAI
(d) the Librarian; **Robert N. Anikputa,** MBA, MSC, FCA
(e) the Bursar; **Prof. (Mrs) C. C. Nwosu,** BLS, MLS, Ph.D

Ag. Dean of Faculty of Engineering

Engr. Dr. Monday M. Chukwu

B. Eng., M.Eng., PhD. MNSE, MNSChE, COREN Registered

viii. List of Academic Staff

S/No	Name	Qualification with dates	Rank/Designation	Specialization
1.	Engr. Dr. C. N. Ehumadu	B.Eng. (2009), M. Eng. (2014), PhD (2019), Reg. Engr. (COREN)	Lecturer I	Soil and Water Option
2.	Dr. N. N. Okoye	B.Eng. (2006), M. Eng. (2012), PhD (2019)	Lecturer II	Soil and Water Option
3.	Mr. M. C. Etumnu	B.Eng. (2018), M. Eng. (2020)	Assistant Lecturer	Soil and Water Option

ix. List of Non-Teaching Staff

S/No	Name	Qualification with dates	Rank/Designation

x. List of Administrative Support Staff

S/No	Name	Qualification with dates	Rank/Designation

xi. History and Background of the Department

The Department of Agricultural and Biosystems Engineering at the University of Agriculture and Environmental Sciences is part of the Faculty of Engineering. The Department collaborates with other departments in the University in teaching and research. The Department has workshop and laboratory facilities that are equipped with modern and state of the art facilities. The Department has a research farm which is used for Field experimentation and testing of agricultural implements.

The Department started as Water and Irrigation Engineering but was later changed to Agricultural and Biosystems Engineering in 2023. The laudable initiative was aimed at

accommodating other options that were hitherto not included. Water and Irrigation Engineering commenced with the admission of the 2021/2022 set.
Agricultural and Biosystems Engineering thereafter, commenced with the admission of 2023/2024 set. The departments in the faculty offer the same courses at Levels 100 and 200 except for the introductory courses for each of the programmes at 200 level second semester. Electives are provided to enable students acquire broader knowledge of the disciplines. Thus, curriculum for the programmes is designed such that graduate of the Department will be well equipped with both theoretical and practical skills.

Table of Content

1.0 Overview of the Department

This new agricultural and biosystems engineering curriculum contain courses that will produce Agricultural and Biosystems Engineers that will be globally competitive in a world that is now dictated by a knowledge-based economy. The desired and required competences in biological systems, process instrumentation and control, application of robots and drones to agriculture, irrigation and drainage, machine development, renewable energy and food process systems are supported by this new curriculum. The curriculum emphasises courses such as artificial intelligence, machine learning, renewable energy technologies, drone and robot technologies, project management, software engineering and design of machines and structural elements. Other courses include livestock production, aquaculture and, agroponic, instrumentation and measurement, greenhouse technology, biosystems engineering, solid modelling and environmental and social impact analysis. Agricultural and Biosystems Engineers will now have the skills to be gainfully employed as Design Engineers, Test Engineers, Product Engineers, Quality Control Engineers, Energy Engineers and Advisors, Machinery Maintenance Engineers, Waste Management Engineers, Diary Engineers, and Irrigation and Drainage Engineers. The new curriculum compares well with those of top global agricultural and biosystems engineering institutions. The synopsis of each of these courses have been made elaborate with indicated learning outcomes. In all, the new features of agricultural engineering and its transition to biosystems engineering are captured in this curriculum.

The major areas of Agricultural and Biosystems Engineering are:

1. farm power and machinery engineering;
2. soil and water resources engineering;
3. crop processing, storage and agro-industrial engineering;
4. farm structures, rural electrification and environmental control engineering;
5. forestry and wood products engineering; and
6. food process engineering.

It is pertinent to make a clarification. Global development in recent years have seen the adoption of various nomenclatures, world-wide, to define and describe the old Agricultural Engineering Programme. These include Agricultural and Biosystems, Agricultural and Environmental, Agricultural and Bioresources, Agricultural and Biological, Bioresources and Biological Engineering. The revised curriculum here applies to all these variants and is precisely adopting the name 'Agricultural and Biosystems Engineering (ABE)". This new Core Curriculum and Minimum Academic Standards (CCMAS) is a product of wide consultation with the agricultural engineering community (academic and field Agricultural Engineers) through the Nigerian Institution of Agricultural Engineers (NIAE), comparison with top universities of the world, alignment with the Council for the Regulation of Engineering (COREN) curriculum and the National Universities Commission (NUC) guidelines

1.1 Philosophy of the Department

Agricultural and Biosystems engineering encompasses the application of all engineering knowledge to solving problems encountered in agricultural production, handling and processing of biological materials for food, feed, fibre and fuel. The programme is designed to prepare students for careers in machine systems: design and provision of power for agricultural machines including renewable energies and design of machines for crop and livestock production; processing systems for food, biofuels and other by-products: crop processing and storage and

post-harvest handling; natural resources system: irrigation and drainage, erosion control and water conservation; environmental system: farm structures, waste remediation and farm electrification; biological system: sensors, controls and computer models to monitor biological processes and conversion of bio-based resources to food, fuel and others. It is thus very wide and all encompassing.

1.2 Objectives of the Department

The objectives of the programme are to train engineers that are equipped with appropriate knowledge and skills to play the following roles:
1. increase and sustain agricultural (crop and livestock), aquacultural and forest production;
2. maintain a high level of agricultural production without damage or distortion to the environment;
3. minimise the drudgery associated with agricultural production by use of appropriate machinery;
4. improve rural infrastructures by providing desirable amenities for communities;
5. convert bio-based resources to food, fuel and other renewable products;
6. design new generation of devices or processes for agricultural and biological systems;
7. control agricultural and biological systems for natural resource protection, waste remediation and eco-system restoration;
8. develop sensors, control systems and computer models to monitor and control biological processes in industries or the environment; and
9. develop innovative green products and industries.

1.3 Employability Skills

This curriculum emphasises skills that can gainfully employ Agricultural and Biosystems Engineers in all agricultural, biosystems, environmental, rural and industrial environments as Design Engineers, Test Engineers, Product Engineers, Plant Engineers, Quality Control Engineers, Process Engineers, Energy Engineers and Advisers, Consulting Engineers and Environmental Engineers. They can also be employed as Irrigation and Drainage Engineers, Waste Management Engineers, Machinery Maintenance Engineers and Dairy Engineers among others.
In addition to competence and savviness in problem-solving technical, technological and modern digital skills, the programme equips the students with appropriate cognitive, critical analytical and innovative skills, emotional and behavioural skills including communication, interpersonal, continuous and life-long learning capabilities that will make them to be conscious of their importance, and the need for sustainability in relation to the consequences of their professional activities on the human environment and ecosystem.

1.4 21st Century Skills

A graduate of the Agricultural and Biosystems Engineering programme is expected to have ability to:
1. collaborate (teamwork and ethics);
3. learn/metacognition;
4. integrate knowledge of areas of mechanical, electrical, environmental and civil engineering, construction technology, hydraulics and soil mechanics in a variety of agricultural and biological applications;

5. problem solving/decision making/computational thinking;
6. proffer sustainable solutions for addressing society's challenges in agriculture, food, energy, water and other natural resources by applying acquired technical, creativity and innovative thinking and modern digital skills, which they are able to communicate lucidly; and
7. create, select and apply appropriate techniques, resources and convergent technologies, including ICT tools, artificial intelligence, machine learning, robotics, modelling, cognitive science, biotechnology, genetic engineering, nanotechnology, GIS and optimisation to agricultural, food, energy and water problems.

1.5 Unique Features of the Programme

1. This programme compared to that of the North Dakota State University, USA, McGill University, Canada and Auburn University, Alabama, USA showed close similarity; most of the courses in the new curriculum are also offered in at least one of the world's top university, and in some cases in three of these universities.
2. This new programme has courses that support emerging engineering practices in agriculture such as the use of drones and robots, the overriding intervention of renewable energy in agriculture, the engineering of livestock and fisheries, need to deepen the design thinking and creative skills of students and the gradual shift from agricultural engineering to biosystems engineering as well as reflecting the impact of climate change on agricultural technology applications. Some of these courses are:
ABE 102: Introduction to Agricultural and Biosystems Engineering (2)
GET 102: Engineering Graphics and Solid Modelling (2)
GET 306: Renewable Energy Systems and Technology (3)
GET 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3)
ABE 307: Biosystems Engineering (2)
ABE 401: Instrumentation and Measurement in Agricultural and Biosystems Engineering
ABE 501: Environmental and Social Impact Analyses (2)
ABE 502: Aquaculture and Agroponics Engineering (2)
ABE 503: Livestock Production Engineering (2)
ABE 504: Greenhouse Technology (2)
ABE 505: Drone and Robot Technology in Agriculture (2)
3. The synopsis of most of the courses have been enriched to reflect the current practices of agricultural engineering.
4. The synopsis of the programme-based courses indicates the relevant excursion, laboratory and field practical to be undertaken by students.
5. The learning outcomes of each course is contained in this curriculum.

1.6 Admission Requirements

a. Candidates willing to apply to the undergraduate programme in Agricultural and Biosystens Engineering should have five credit passes in Chemistry, Physics, Mathematics, English language and Biology(or agricultural science) at WAEC and or NECO at not more than two sittings. Every other admission requirements into the department will be moderated by the University as may be stipulated by JAMB.

b. Direct Entry requirements: Holders of National Diploma (ND) and Higher National Diploma (HND) certificates with minimum of upper credit passes are eligible for admission into year two/three depending on attainment of the requisite academic preparation. Please note, the applicant must meet the basic UTME entry requirement specified in 1.6.a.

1.7 Agricultural and Biosystems Engineering Programme Structure

The department is structured to have five academic calendar years (of ten semesters) of which nine of the ten semesters are actually used for requisite training in class room/laboratory studies. One semester (in the fourth year) and the two long vacations (at the end of third and fourth year) are used for industrial training known as Students' Industrial Work Experience Scheme. At the fifth year of studies, students are assigned research project topics and design project topics which they are expected to defend at the end of the tenth semester under an external examiner not below the rank of a Professor of repute in Agricultural and Biosystems Engineering.

2.0 Inter-disciplinary Transfer

A student may be allowed to change his/her degree programme after completing the first or second academic year in the university. The change may prolong the time the student will stay in the university.

Procedure

a) The student applying for the inter-disciplinary transfer shall have made a minimum cumulative grade point of 3.00 on a five-point scale.

b) The student must possess at the time of entry to the university the entry requirements of the new programme to which he/she wishes to transfer

c) Inter-disciplinary transfer application forms which the student must complete are obtainable from the office of the registrar on presentation of the receipt for payment of the stipulated fee.

d) The registrar shall send the completed application forms to the relevant faculty/Department for recommendation.

e) Normally, not more than 10% of the number of the students admitted into a discipline for any one year shall be allowed to change their degree programmes.

f) Successful applicants shall be credited with those courses, including General Studies courses, taken in their former disciplines which are relevant to the new disciplines.

g) The receiving HoD shall have the responsibility of deciding on the relevance or otherwise of the courses taken in a student's previous discipline.

h) The registrar shall inform the applicants in writing of the results of their application.

i) The option to transfer can only be exercised once, and is without prejudice to the length of time required for graduation in the department concerned/

j) The completed application form with respect to inter-University Transfer shall submitted to the office of the Registrar for collation and presentation to the receiving Dean, and then to the

HoD, who shall make recommendation and send back to the registrar through the Dean for appropriate action.

2.1 Inter-University Transfer

a) Transfer students must come from Universities recognized by UAES and shall spend a minimum three academic sessions before graduation.

b) Students seeking transfer to UAES must have met the minimum entry requirements as well as the special entry requirements of the department to which they want to transfer

c) To be eligible for transfer, a student shall have achieved a minimum cumulative grade point average of 3.00 on a five point scale.

d) In determining the final grade point average for the graduation of a transferred student, account shall be taken of the courses offered at both UAES and the student's former University.

e) In all cases no transfer shall be allowed into the 100-level.

Procedure

a) Students wishing to transfer to UAES must complete the application the application form for transfer obtainable from the Registry on payment of the stipulated fee into a designated University Account with receipt daily issued by the Bursary Department.

b) The completed application forms with respect to inter-university shall be submitted to the office of the Registrar for collation and presentation to the receiving Dean, then to the HoD, who shall make a recommendation and send back to the Registrar through the Dean for appropriate action.

c) The registrar shall inform candidates of the results of their application for transfer.

d) Normally, the number of students offered admission by transfer shall not exceed 10% of the discipline/s total admission in any one year.

e) A transfer student shall register for and be examined in, or otherwise make up for, all and compulsory courses which he or she did not take or pass in his/her former University.

2.2 Registration and matriculation

Registration period

a) Normal registration of courses for both the first and second semester shall be at the beginning of the first semester of the academic session, and shall last for two weeks from the date the exercise begins/

Late registration

a) Students may be given permission for late registration upon payment of the stipulated late registration fee. Late registration shall not last beyond 2 weeks from the expiration of the official registration period.

b) At the expiration of the extra 2 weeks of late register shall lose that session.

Registrable courses, coding and numbering

a) Depending on the Department, a student shall take the following categories of courses: core courses, required courses, General Studies courses and electives/

b) Each course is designated by a 3-letter code e.g., ''GST'' for General Studies and "FRN" for French/

c) Course numbering is according to the level of course and each course is represented with 3 digits, e.g., 101, 202, 301, 401 and 502 in a five-year programme. Odd numbers are first semester courses, while even numbers are second semester courses, but numbers with two zeros, e.g., 300, are those taken in between semesters or sessions.

2.3 Procedure for registration (Manual)

a) At confirmation of payment of school fees, the student is given the course registration form which is quadruplicate.

b) Registration commences firstly by paying all school fees.

c) The Academic Adviser guides the student in the registration of courses for the session

d) After the completion of the course registration, the course registration form must be approved and endorsed by the academic adviser and HoD respectively.

e) At the completion of course registration, the quadruplicate form is distributed as follows: (a) Registrar (b) Dean of faculty (c) HoD Academic Adviser.

Please Note: The Add and Drop form should likewise be in quadruplicate and distributed as recommended above.

2.4 Procedures for Online Registration

a) The registration commences with payment of fees by the student who is then given an access code for registration

b) The student then access the registration portal with the assigned code to register for the courses for the given session

c) The portal limits the students on the courses registrable

d) The portal also closes at the expiration of deadline for registration

e) The registration portal opens again for late registration at a specified fee

f) The student is assigned an access code on the payment of late registration fee.

g) Portal for registration closes again after the expiration of the deadline for late registration.

2.5 Adding and Dropping of Courses

i. A student who wishes to add or drop a course(s) shall do so not later than four weeks from the date of registration.

ii. A student may use Add and Drop form duly completed to effect the amendment in his/her registration course form on payment of prescribed fee each Add and Drop form used.

iii. A student shall first register the courses he/she failed during the previous session before registering courses for the current session.

3.0 Matriculation

3.1 Requirement for Matriculation

Matriculation is to formally admit the student into the University and it is only for student who has obtained the matriculation number and such a student must have paid all the necessary fees for the Faculty and the Department. At the matriculation arena, the student swears to the University Oath of Allegiance and made to sign the matricula.

3.2 Orientation

At the beginning of each session, the Department usually organizes an orientation programme for new students. This is in addition to the orientation programme that is organized by both the Faculty and University. The purpose of the programme is to acquaint the new students with the departmental facilities and staff. Students will also freely interact with lecturers and are encouraged to ask questions on anything they may like to know about the department and its programmes.

4.0 Student's Welfare

4.1. Handling of Academic Grievances and any other Student's Complaints

Immediate attention is given to every complaints made by students. All academic grievances and any other student's complaints are documented and handed over to the appropriate committee through the Head of the Department for departmental matters and through the Dean of Faculty when it has to with omitted results, errors in computation of CGPA, correction of wrong grades etc. However, the students also have the right to petition the school Board or Senate when they feel they are not served justice with the decision of the departmental or Faculty Board.

4.2 Students Academic Advising

The department is also saddled with the responsibility of counseling the students. Each of the levels will have Class advisers who are appointed by the Head of the Department. Each student is advised and encouraged to reach the class adviser first on any issue (s) bordering such a student.

4.3 Class Period and Attendance

4.3.1 Duration of Classes, Class attendance and absence from Class

There is always a time – table that indicates period for each of the courses. While each lecture is expected to commence as scheduled and end 10 minutes before end of the scheduled period, seminars, tutorials, practical and workshops shall continue as long as scheduled.

Attendance to lectures, laboratories, workshop and tutorials is mandatory. Only a student who has been properly registered for a course and whose name appears on the official class list for that course shall be allowed into a class. A student who absents from prescribed course lecture

for more than three weeks during any one semester without permission of the Senate or the Vice – Chancellor acting on behalf of the Senate, that semester may not be included as part of the scheme or study which the student is required to complete.

5.0 Withdrawal from the University

5.1. Voluntary Withdrawal

Student who wishes to withdraw from the University shall write to the Registrar through the Dean of the Faculty and Head of his/her Department, seeking for approval of the Senate and upon approval, such withdrawal shall not exceed one academic year. Below are further guidelines regarding withdrawal from the University:

i. For fresh students, the written notice of withdrawal shall be given not later than two weeks after matriculation. For old students, the notice shall be given not later than four weeks after the beginning of the semester.
ii. Any student withdrawing from the University shall be required to complete a form giving a brief statement of the reason(s) and the effective date of leaving. The form shall be obtained from the Registrar.
iii. The student may retain grades carried for the semester examinations preceding the date of voluntary withdrawal.
iv. For such a student to re-admitted into the University, he/she is to write a formal application to the Registrar through his/her Head of Department and Dean of Faculty and has to receive official clearance from the Registrar.
v. It is the responsibility of the Senate to prescribe conditions such a student must fulfil before he/she resumes the programme after the period of withdrawal.

5.2 Unauthorized Withdrawal

A student who withdraws from the University without approval of the Senate for one academic year, may not be considered for readmission until his/her case has been considered on its merit by the Departmental/Faculty Board and approved by Senate.

5.3 Withdrawal for Academic Reasons

It is expected that every student admitted into the University maintains acceptable academic standards. Every student is also expected to maintain a minimum Grade Point Average for his/her year of study. The University through the Registrar shall send a letter of warning to any student who obtains a Cumulative Grade Point Average (CGPA) of 1.00 and a withdrawal letter shall be given to any student with a Cumulative Grade Point Average (CGPA) of less than 1.00.

5.4 Withdrawal for Health Reasons

A student may withdraw or be asked to withdraw on reasons of ill health but has to be certified by the Director of Health Services of the University. Such a student shall be readmitted into the University on once he/she produces a valid medical report from an approved Medical Officer and to be certified by the Director of Health Services.

5.5 Withdrawal based on Disciplinary Action

A student who is suspended on disciplinary grounds, may not be readmitted unless with the consideration and approval of the Senate.

5.6 Financial Obligation after Withdrawal

Student who withdraws from the University for any reason whatsoever shall be required to clear any outstanding debts before he/she may be considered for readmission.

5.7 Time Limit for Re –Admission

A student who withdraws from the University for any reason and who is not re-admitted within a period of three (3) consecutive academic sessions from the date of his/her withdrawal, may not be credited with course(s) taken prior to withdrawal should he/she returns to the University. The Head of Department may however make a general assessment of the student's knowledge of the course(s) taken prior to withdrawal and recommend the year of entry on readmission.

6.0 Examination Offences

i. If any candidate is suspected of cheating; receiving from or assisting other candidates or infringing any other examination regulations, a written report of the circumstance shall be submitted by the Chief Invigilator to the Dean of the Faculty offering the course within 24 hours of examination session. The candidate concerned shall be allowed to continue with examination, unless he/she behaves in such a manner as to disturb other students or peace of the invigilators.

ii. Any student suspected under regulation 6(1) above, shall be required to submit to the Chief Invigilator, a written report immediately after the said course and failure to make a report shall be regarded as a breach of discipline.

iii. Upon being informed that any candidate has committed a breach of any of this regulation, the Dean shall send report to the Faculty Board of Studies. The Faculty board of studies shall investigate through Examination Malpractice Panel the alleged offence and report to the Senate at the time the examination result of such candidate is considered. The Senate shall determine the penalty for each offence.

iv. Any candidate found infringing 6(1) shall on approval of the Senate be:

a. Expelled from the University, and

b. Handed over to the Police for prosecution under the appropriate law/decrees.

6.1 Absence from Examination

i. Candidate must present themselves for such University examination in courses which they have registered. Under these regulations, candidates who fail to do so for reasons other than illness or accident shall be deemed to have failed the examination.

ii. Misreading of the examination time table shall not be accepted as a satisfactory explanation for absence.

iii. Whenever a student is prevented by ill health from taking an examination, the candidate shall notify the Registrar through an application in writing through the Head of Department and the Dean of the Faculty, and shall submit a medical certificate issued or validated by the Director of Health Services of the University within one month of the examination.

iv. Such an application shall be processed to the Senate through the relevant Department Board of studies and School Board of Studies. Where successful, the Senate may approve that the student takes the examination at the next available opportunity as a first attempt.

6.2 Departmental Examination Board

Departmental Board of Examiners comprises:

i. The Head of Department
ii. Not less than 2 and more than 6 others comprising the most senior academic members of the Department representing the specialties in the Department.
iii. The Departmental Examination Officer shall be a member/secretary.

6.2.1 Functions of Departmental Examination Board

i. To moderate all question papers of the Department

ii. To approve the Departmental examination results with the course lecturers in attendance

iii. To advise the Head of Department on the appointment of External examiners.

iv. To undertake such other matters as may be referred to it by the Head of Department in accordance with the University standard

6.2.2 Appointment of External Examiners

The Department in agreement with the University laid down rules for appointment of an external examiner nominates an external examiner who shall be appointed by the Senate.

6.2.3. Functions of External Examiner

i. The External Examiner shall moderate all final year or professional examination question papers before the examination and shall send any comment on them to the Head of Department.

ii. The External Examiner shall mark or re –mark all such portions of candidate's scripts as he/she deems fit.

iii. The External Examiner shall participate in the determination of the results of all final year students.

iv. The External Examiner shall be required to submit to the Vice Chancellor or report on the result of the examination together with general comments on the work of the Department.

v. A person appointed as an External Examiner shall satisfy the following four conditions:

a. Must be external to the University

b. Must have had adequate experience in the University Academic work.

c. Must have high academic standing.

d. Must be fit to sign all Degree results before they are presented to the Faculty Board.

6.2.4 Setting of Examination Question Papers

i. Each lecturer shall be required to submit his/her questions as directed by the Departmental Board of Examiners, for the proposed examination for each course taught, through the Head of Department.

ii. Question papers for the first and second semester examinations in final year courses shall be submitted to the External Examiner for moderation.

6.2.5 Examination Ethics

The Department of Chemical and Petroleum Engineering deems it fit to always enforce strict examination ethics during quiz and examinations, as enshrined in the University student's hand book. Every student of the department is expected to refrain from committing any examination misconduct. The following actions are examination considered as misconduct by the University:

i. Use of any material like book, printed – paper etc meant to help the student in the examination hall.
ii. Giving any kind of assistance during an examination.
iii. Refusing to stop writing at the end of an examination.
iv. Refusing to surrender any suspected incriminating material.
v. Impersonation
vi. Being caught with leaked examination questions.
vii. Leaving the examination hall with the hope of coming back into the hall without permission from the invigilator(s).
viii. Speaking to another student during the course of an examination.
ix. Smoking or making noise during the course of examination.
x. Committing any other offence not specified here but which are connected with examination in the University.
xi. The punishment or penalty meted for the various offences very but ranges from instant expulsion, rustication from the University for some years. All students are encouraged and advised to refrain from examination malpractices in the University.

6.3 Review of Examination Scripts of Aggrieved Students

i. A student aggrieved about his/her grading shall in the first instance, petition the Registrar through the Head of Department. The Registrar shall refer the petition to the Faculty Board through the Dean of the Faculty for a review of student's answer script.

ii. For examinations in final year courses, the recommendation of the Faculty Board shall be sent to Senate through the Senate Committee on Examination for ratification.

iii. A student applying for review shall be required to pay the prescribed fees.

iv. Photocopies of the scripts to be reviewed, with all comments of the original marker removed, shall be forwarded for review such that:

a. Non – final year courses to be assigned to two internal examiners. In both cases, the reviewers shall not have participated in the original marking of the scripts.

v. Time limit for the submission of petition for review of scripts by the aggrieved student shall be as follows:

a. Final year courses: Two months from the date the results are officially published by the Registrar's Office.
b. For Non – Final year courses: Two months from the date the results (date stamped) are published in the Department.
c. The grade awarded in the review exercise shall supersede the earlier grade.

6.4 Classes of Degree

All degree courses (required, restricted elective, unrestricted elective and general studies) undertaken by the student as well as the successful completion of Industrial attachment, shall count toward the evaluation of his/her degree. The class of shall thereafter be determined as follows:

Class of Degree	**Cumulative Grade Point**
1st Class Honours	4.50 – 5.00
2nd Class Honours (Upper Division)	3.50 – 4.49
2nd Class Honours (Lower Division)	2.40 – 3.49
Third Class Honours	1.50 – 2.39
Pass	1.00 – 1.49
Fail	0.00 – 0.99

7.0 Grading System

The mark obtained in each course is made up of continuous assessment of 30% and the end of semester examination of 70%.

7.1 Grade point (GP)

The mark scored in each course (continuous assessment score plus the end of semester examination score) has an equivalent letter grade of A – F and each letter grade has a corresponding numerical value of 5.00 to 0.00 called Grade Point (GP) as in the table 1.

Table 1: Grading System

Marks (%)	Letter Grade	Grade Points (GP)
70 - 100	A	5.00
60 – 69	B	4.00
50 – 59	C	3.00
45 – 49	D	2.00
40 -44	E	1.00
0 – 39	F	0.00

7.2 Grade Point Average (GPA)

i. The academic performance of a student in any semester shall be measured with the Grade Point Average (GPA). The maximum value is 5.00 and the minimum is 0.00.

ii. Quality Point (QP), the product of the credit unit and grade point of each course defines the Quality Point for that course.

iii. Grade Point Average (GPA) – sum of Quality Point divided by Total Credit units for all the courses registered in the semester.

Table 2a: Grading System (First Semester)

Course Code	Course Title	Student Score	Course Credit	Letter Grade	Grade Point	Quality Point (QP)

		(%)	Unit (CU)			
MTH 101	General Mathematics I	70	3	A	5.00	5.00*3 = 15
GST 101	Communication in English I	60	2	B	4.00	4.00*2=8
CSC 101	Introduction to Computer	50	3	C	3.00	3.00*3 = 9
PHY 101	General Physics I	30	3	F	0.00	0.00*3= 0
			11			**32**

Calculation of Grade Point Average (GPA) for the semester is done by:

= TQP divided by TCU

= 15+8+9+0

=32/11 = 2.91

Table 2b: Grading System (Second Semester)

Course Code	Course Title	Student Score (%)	Course Credit Unit (CU)	Letter Grade	Grade Point	Quality Point (QP)
MTH 102	General Mathematics II	70	3	A	5.00	5.00*3 = 15
GST 102	Communication	60	2	B	4.00	4.00*2=8

	in English II					
CHM 102	General Chemistry II	50	3	C	3.00	3.00*3 = 9
PHY 102	General Physics II	40	3	E	1.00	1.00*2= 2
			11			**34**

GPA = 34/11 = 3.10

7.3 The Cumulative Grade Point Average (CGPA)

i. The Cumulative Grade Point Average (CGPA) is the measure of the student's overall academic performance at any given period in the programme.

ii. Cumulative Grade Point Average is normally computed at the end of each session as an up –to date weighted mean of the grade points, where the weights are the course credit units.

iii. The Grade Point earned at the end of all semester examinations shall count towards the CGPA (Cumulative Grade Point Average). Cumulative Grade Point Average (CGPA) is the sum of all Quality Points divided by sum of all credit units for all courses registered/repeated so far in the student's academic programme.

CGPA for First and Second Semester (Tables 2a and 2b)

= (32+34)/ (11 +11) = 66/22 = 3.00

iv. The Final Cumulative Grade Point Average (FCGPA) calculated at the end of a student's academic programme, shall determine the class of degree he/she shall be awarded.

7.4 Professional Associations

The following Professional Associations exist for students in the department to belong, where they are kept abreast of happenings in the Profession at seminars, conferences, workshops etc:

i. Nigerian Institution of Agricultural Engineers (NIAE), UAES Chapter

8. 0 Secret Cult and its activities

Secret cult associations and activities are banned by the University. Any student found or discovered to belong to any secret society will be expelled from the University.

9.0. Reports and Oral Presentation

9.1 Format for Research Thesis

The Preliminary Pages are to be arranged in this order:

(i) Title
(ii) Certification
(iii) Dedication
(iv) Acknowledgment
(v) Abstract
(vi) Contents
(vii) List of Tables
(viii) List of Figures/Charts

1.0 Introduction - Chapter 1

This consists of:

(i) Background Information
(ii) Problem Statement
(iii) Objectives
(iv) Justification of Study
(v) Scope of Study

2.0 Literature Review - Chapter 2

3.0 Methodology or Materials and Method – Chapter 3

This comprises of materials, apparatus, the description of the study area, sample, design, procedure for data collection and analysis.

4.0 Results and Discussion - Chapter 4

5.0 Conclusion and Recommendations - Chapter 5

References (Harvard or APA Style)

Appendices (if any)

1.0 **Format for Undergraduate Seminar Preparation and Presentation.**

The seminar report shall follow the same format as the research report. Emphasis will be placed on the presentation of the seminar report by the student and so each student is expected understand his/her work as the grading will be made on:

* Composure

* Technical

* Content of presentation

* Ability to answer question

* Use of visual aids

10.0 THE CURRICULUM

10.1 Faculty of Engineering Courses

10.2 AGRICULTURAL AND BIOSYSTEMS ENGINEERING DEPARTMENT

100 Level First Semester Courses

Course Code	Course Title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GET 101	Engineer in Society	1	C	15	-
CHM 101	General Chemistry I	2	C	30	-
CHM 107	General Practical Chemistry I	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 103	Elementary Mathematics III	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 103	General Physics III	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
UAES-AGR 101	Farm Practice I	1	C	-	45
UAES-LEP 105	Language Enhancement Programme I	1	C	15	-
UAES-ENG 101	Introduction to Engineering Workshop Practice	1	C	-	45
Total		**18**			

100 Level Second Semester Courses

Course Code	Course Title	Units	Status	LH	PH
GST 112	Nigerian Peoples and Culture	2	C	30	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
CHM 102	General Chemistry II	2	C	30	-

CHM 108	General Practical Chemistry II	1	C	-	45
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 102	General Physics II	2	C	30	-
PHY 108	General Practical Physics II	1	C	-	45
ABE 102	Introduction to Agricultural and Biosystems Engineering	2	C	30	-
UAES-AGR 102	Farm Practice II	1	C	-	45
UAES-EMT 102	Environment and Public Health	1	C	15	-
UAES-LEP 108	Language Enhancement Programme II	1	C	15	-
UAES-PHY 104	General Physics IV	2	C	30	-
UAES-STA 112	Probability I	3	C	45	-
Total		**22**			

200 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
ENT 211	Entrepreneurship and Innovation	2	C	30	-
GET 201	Applied Electricity I	3	C	45	-
GET 205	Fundamentals of Fluid Mechanics	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 211	Computing and Software Engineering	3	C	45	-
UAES-AGR 201	Farm Practice III	1	C	-	15
UAES-EVS 201	Occupational Safety	2	C	30	-
GET 207	Applied Mechanics	3	C	45	-
Total		**20**			

DIFFERENT COURSES FOR VARIOUS OPTIONS IN THE DEPARTMENT

SOIL AND WATER ENGINEERING OPTION

200 Level Second Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
GET 202	Engineering Materials	3	C	45	-

GET 204	Students Workshop Practice	2	C	15	45
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
UAES-SWE 202	Introduction to Water Resources and Environmental Engineering	1	C	15	-
GET 208	Strength of Materials	3	C	45	-
Total		**17**			

300 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 305	Engineering Statistics and Data Analysis	3	C	45	-
GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies and and Convergent Technologies	3	C	45	-
ABE 301	Design of Machine and Structural Elements	2	C	30	-
ABE 303	Crop Production	2	C	30	-
ABE 305	Soil Science	2	C	30	-
ABE 307	Biosystems Engineering	2	C	30	-
UAES-SWE 303	Hydraulics and Hydrology I	2	C	15	15
UAES-ENG 311	Engineering Economics	3	C	45	-
Total		**19**			

300 Level Second Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
ENT 312	Venture Creation	2	C	30	-
GST 312	Peace and Conflict Resolution	2	C	30	-
GET 304	Technical Writing and Communication	3	C	45	-

GET 306	Renewable Energy Systems and Technologies	3	C	45	-
ABE 302	Animal Production	2	C	30	-
ABE 304	Farm Management, Rural Sociology and Agricultural Extension	2	C	30	-
ABE 306	Land Surveying and Geographic Information System	2	C	15	15
ABE 308	Rural Infrastructural Engineering	2	C	30	-
Total		**18**			

400 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
ABE 401	Instrumentation and Measurement in Agricultural and Biosystems Engineering	3	C	45	-
UAES-SWE 401	Soil Mechanics and Foundation Engineering	3	C	30	15
UAES-SWE 403	Hydraulics and Hydrology II	3	C	30	15
UAES-SWE 405	Land Clearing and Development	2	C	30	-
UAES-SWE 407	Climate Change Impact and Mitigation	2	C	30	-
UAES-SWE 409	Hydrogeology (Groundwater Hydrology)	2	C	30	-
UAES-SWE 411	Engineering Geology	2	C	15	15
Total		**17**			

400 Level Second Semester

STUDENTS INDUSTRIALWORK TRAINING				
Course Code	**Course Title**	**Units**	**Status**	**Duration**
GET 299	SIWES I	3	C	9 Weeks
GET 399	SIWES II	4	C	12 Weeks

GET 499	SIWES III	8	C	24 Weeks
Total		**15**		

500 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 501	Engineering Project Management	3	C	45	-
ABE 501	Environmental and Social Impact Analysis	2	C	30	-
ABE 503	Livestock Production Engineering	2	C	30	-
ABE 505	Drone and Robot Technology in Agriculture	2	C	30	-
UAES-SWE 507	Drainage and Irrigation Engineering	3	C	30	-
UAES-SWE 505	Water and Waste Water Engineering	3	C	30	-
UAES-SWE 501	Soil and Water Conservation	2	C	30	-
Total		**17**			

500 Level Second Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 502	Engineering Law	2	C	30	-
ABE 502	Aquaculture and Agroponics Engineering	2	C	30	-
ABE 504	Greenhouse Technology	2	C	30	-
ABE 599	Final Year Project	3	C	45	-

UAES-ABE 506	Engineering Properties and Handling of Materials	2	C	30	-
UAES-SWE 502	Advanced Irrigation Engineering	3	C	45	-
UAES-SWE 506	Environmental Pollution Engineering	2	C	30	-
Total		**16**			

FARM POWER MACHINERY OPTION

200 Level Second Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
GET 202	Engineering Materials	3	C	45	-
GET 204	Students Workshop Practice	2	C	15	15
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
UAES-FME 202	Introduction to Farm Machinery and Maintenance	1	C	15	-
GET 208	Strength of Materials	3	C	45	-
Total		**17**			

300 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 305	Engineering Statistics and Data Analysis	3	C	45	-
GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent	3	C	45	-

	Technologies and and Convergent Technologies				
ABE 301	Design of Machine and Structural Elements	2	C	30	-
ABE 303	Crop Production	2	C	30	-
ABE 305	Soil Science	2	C	30	-
ABE 307	Biosystems Engineering	2	C	30	-
UAES-FME 301	Mechanics of Deformable Bodies	2	C	15	15
UAES-ENG 311	Engineering Economics	3	C	45	-
Total		**19**			

300 Level Second Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
ENT 312	Venture Creation	2	C	30	-
GST 312	Peace and Conflict Resolution	2	C	30	-
GET 304	Technical Writing and Communication	3	C	45	-
GET 306	Renewable Energy Systems and Technologies	3	C	45	-
ABE 302	Animal Production	2	C	30	-
ABE 304	Farm Management, Rural Sociology and Agricultural Extension	2	C	30	-
ABE 306	Land Surveying and Geographic Information System	2	C	15	15
ABE 308	Rural Infrastructural Engineering	2	C	30	-
Total		**18**			

400 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
ABE 401	Instrumentation and Measurement in Agricultural and Biosystems	3	C	45	-

	Engineering				
UAES-FME 403	Heat and Mass Transfer	3	C	30	15
UAES-FME 407	Agricultural Machinery	3	C	30	15
UAES-ABE 403	Land Clearing and Development	2	C	30	-
UAES-ABE 407	Climate Change Impact and Mitigation	2	C	30	-
UAES-FME 413	Advanced Mechanics of Materials	2	C	30	-
UAES-FME 409	Operation and Management of Farm Power and Machinery Systems	2	C	15	15
Total		**17**			

400 Level Second Semester

STUDENTS INDUSTRIALWORK TRAINING				
Course Code	**Course Title**	**Units**	**Status**	**Duration**
GET 299	SIWES I	3	C	9 Weeks
GET 399	SIWES II	4	C	12 Weeks
GET 499	SIWES III	8	C	24 Weeks
Total		**15**		

500 Level First Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 501	Engineering Project Management	3	C	45	-
ABE 501	Environmental and Social Impact Analysis	2	C	30	-
ABE 503	Livestock Production Engineering	2	C	30	-
ABE 505	Drone and Robot Technology in Agriculture	2	C	30	-
UAES-FME 5I7	Processing and Drying of Agricultural Product	3	C	30	-

UAES-FME 513	Physical Properties of Agricultural Materials	3	C	30	-
UAES-FME 519	Solar Energy Application to Processing and Storage	2	C	30	-
Total		**17**			

500 Level Second Semester

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
GET 502	Engineering Law	2	C	30	-
ABE 502	Aquaculture and Agroponics Engineering	2	C	30	-
ABE 504	Greenhouse Technology	2	C	30	-
ABE 599	Final Year Project	3	C	45	-
UAES-ABE 506	Engineering Properties and Handling of Materials	2	C	30	-
UAES-FME 562	Design and Maintenance of Agricultural Machinery	3	C	45	-
UAES-FME 514	Agricultural Machine Selection and Management	2	C	30	-
Total		**16**			

UNIVERSITY COURSES

GST 111: Communication in English (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. identify possible sound patterns in English Language;
2. list notable language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents

Sounds and sound patterns in English Language (vowels and consonants, phonetics and phonology); English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations); major word formation processes; the sentence in English (types: structural and functional); grammar and usage (tense, concord and modality). Reading and types of reading, comprehension skills, 3RsQ. Logical and critical thinking; reasoning methods (logic and syllogism, inductive and deductive argument, analogy, generalisation and explanations). Ethical considerations, copyright rules and infringements. Writing activities (pre-writing (brainstorming and outlining), writing (paragraphing, punctuation and expression), post- writing (editing and proofreading). Types of writing (summary, essays, letter, curriculum vitae, report writing, note-making). Mechanics of writing. Information and Communication Technology in modern language learning. Language skills for effective communication. The art of public speaking.

GST 112: Nigerian Peoples and Cultures (2 Units C: LH 30)

Learning Outcomes

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

1. analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;
2. identify and list the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political entity;
4. analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;
5. enumerate the challenges of the Nigerian state regarding nation building;
6. analyse the role of the judiciary in upholding fundamental human rights
7. identify the acceptable norms and values of the major ethnic groups in Nigeria; and
8. list possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents

Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and cultures; peoples and cultures of the minority ethnic groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian Civil War). Concepts of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigerian

peoples; trade, skill acquisition and self-reliance). Social justice and national development (definition and classification of law); Judiciary and fundamental rights. Individuals, norms and values (basic Nigerian norms and values, patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts [Cultism, kidnapping and other related social vices]). Re-orientation, moral and national values (The 3Rs – Reconstruction, Rehabilitation and Re-orientation; re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline and Corruption (WAIC), Mass Mobilization for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

CHM 101: General Chemistry I (2 Units C: LH 30)

Learning Outcomes

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

1. define atom, molecules and chemical reactions;
2. discuss the modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. rationalise the trends of atomic radii, ionisation energies, electronegativity of the elements, based on their position in the periodic table;
5. identify and balance oxidation–reduction equation and solve redox titration problems;
6. draw shapes of simple molecules and hybridised orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using Le Chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

Course Contents

Atoms, molecules, elements and compounds, and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence forces; Structure of solids. Chemical equations and stoichiometry; chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 102: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

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

1. state the importance and development of organic chemistry;
2. define fullerenes and its applications;
3. discuss electronic theory;

4. determine the qualitative and quantitative of structures in organic chemistry;
5. state rules guiding nomenclature and functional group classes of organic chemistry;
6. determine the rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. describe basic properties of transition metals.

Course Contents

Historical survey of the development and importance of organic chemistry; fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds; determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry; nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

CHM 107: General Practical Chemistry I (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:
1. state the general laboratory rules and safety procedures;
2. collect scientific data and correct carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. state the differences between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

Course Contents

Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CHM 108: General Practical Chemistry II (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:
1. state the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. carry out solubility tests on known and unknown organic compounds;
6. carry out elemental tests on known and unknown compounds; and

7. carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.

Course Contents
Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

MTH 101: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)
Learning Outcomes
At the end of the course students should be able to:
1. define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify various types of numbers; and
5. solve some problems using binomial theorem.

Course Contents
Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem, complex numbers, algebra of complex numbers, the argand diagram. De-Moiré's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. identify the types of rules in differentiation and integration;
2. recognise and understand the meaning of function of a real variable, graphs, limits and continuity;
3. solve some applications of definite integrals in areas and volumes;
4. solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. identify the derivative as limit of rate of change;
6. identify techniques of differentiation and perform extreme curve sketching;
7. identify integration as an inverse of differentiation;
8. identify methods of integration and definite integrals; and
9. perform integration application to areas, volumes.

Course Contents
Functions of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching, integration, definite integrals, reduction formulae, application to areas, volumes (including approximate integration: Trapezium and Simpson's rule).

PHY 101: General Physics I (Mechanics) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:

1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents

Space and time; units and dimension, vectors and scalars, differentiation of vectors: displacement, velocity and acceleration; kinematics; Newton's laws of motion (inertial frames, impulse, force and action at a distance, momentum conservation); relative motion; application of Newtonian mechanics; equations of motion; conservation principles in physics, conservative forces, conservation of linear momentum, kinetic energy and work, potential energy, system of particles, centre of mass; rotational motion; torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; circular motion; moments of inertia, gyroscopes and precession; gravitation: Newton's law of gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits.

PHY 102: General Physics II (Behaviour of Matter) (2 Units C: LH 30)

Course Contents

Heat and temperature, temperature scales; gas laws; general gas equation; thermal conductivity; first Law of thermodynamics; heat, work and internal energy, reversibility; thermodynamic processes; adiabatic, isothermal, isobaric; second law of thermodynamics; heat engines and entropy, Zero's law of thermodynamics; kinetic theory of gases; molecular collisions and mean free path; elasticity; Hooke's law, Young's shear and bulk moduli; hydrostatics; pressure, buoyancy, Archimedes' principles; Bernoullis equation and incompressible fluid flow; surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

PHY 107: General Practical Physics I (1 Unit C: PH 45)

Learning Outcomes

On completion, the students should be able to:

1. explain the concepts of heat and temperature and relate the temperature scales;
2. define, derive and apply the fundamental thermodynamic relations to thermal systems;
3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;

4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. describe and determine the effect of forces and deformation of materials and surfaces.

Course Contents

This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

PHY 107: General Practical Physics I (1 Unit C: PH 45)

Learning Outcomes

On completion, the student should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents

This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

PHY 108: General Practical Physics II (1 Unit C: PH 45)

Learning Outcomes

On completion, the student should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and
6. prepare and present practical reports.

Course Contents

This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and

graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

GET 101: Engineer in Society (1 Unit C: LH 15)

Learning Outcomes

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

1. differentiate between science, engineering and technology, and relate them to innovation;
2. distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. identify and distinguish between the relevant professional bodies in engineering;
4. categorise the goals of global development or sustainable development goals (SDGs); and
5. identify and evaluate safety and risk in engineering practice.

Course Contents

History, evolution and philosophy of science. engineering and technology. The engineering profession – engineering family (engineers, technologists, technicians and craftsmen), professional bodies and societies. Engineers' code of conduct and ethics, and engineering literacy. Sustainable development goals (SDGs), innovation, infrastructures and nation building - economy, politics, business. Safety and risk analysis in engineering practice. Engineering competency skills – curriculum overview, technical, soft and digital skills. Guest seminars and invited lectures from different engineering professional associations.

GET 102: Engineering Graphics and Solid Modelling I (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple everyday and also complex problems;
2. recognise the fundamental concepts of engineering drawing and graphics;
3. show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. analyse such models for strength and cost;
5. prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. recognise that engineering is multidisciplinary in the sense that mechanical, electrical and other parts of physical structures are modelled in context as opposed to the analytical nature of the courses they take; and
7. analyse and master the basics of mechanical and thermal loads in engineering systems.

Course Contents

Introduction to design thinking and engineering graphics. First and third angle orthogonal projections. Isometric projections; sectioning, conventional practices, conic sections and development. Freehand and guided sketching – pictorial and orthographic. Visualisation and solid modelling in design, prototyping and product-making. User interfaces in concrete terms. Design, drawing, animation, rendering and simulation workspaces. Sketching of 3D objects.

Viewports and sectioning to shop drawings in orthographic projections and perspectives. Automated viewports. Sheet metal and surface modelling. Material selection and rendering. This course will use latest professional design tools such as fusion 360, solid works, solid edge or equivalent.

ABE 102: Introduction to Agricultural and Biosystems Engineering (2 Units C: LH 30)

Learning Outcomes

The course exposes fresh students to:

1. the contents of agricultural and biosystems engineering;
2. the diverse role and relevance of the agricultural engineering profession;
3. the career opportunities; and
4. appreciate the strategic importance of agricultural engineering in supporting and sustaining agricultural production.

Course Contents

Philosophy and evolution of agricultural and biosystems engineering. The role of Agricultural and Biosystems Engineers in the society and human development. The relationship between agricultural and biosystems engineering and the other engineering disciplines. Significance of agricultural and biosystems engineering. Introduction to agricultural and biosystems engineering: farm power and machinery engineering; soil and water engineering; crop processing and storage engineering; farm structures and environment engineering; biosystems engineering. ABE and sustainable development. The global development goals (SDGs). Climate change impacts on agriculture, adaptation and mitigation measures; Climate smart agriculture. Career opportunities in agricultural and biosystems engineering.

UAES-LEP-105 Language Enhancement Programme I (1 Unit C: LH 15)

Learning Outcomes

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

1. Understand, explain and list the current Igbo orthography.
2. Differentiate between Igbo orthography and speech sounds.
3. Identify Igbo terminologies peculiar to their fields of study.
4. Apply the knowledge of the terminologies in research and practice.
5. Communicate fluently in Igbo.

Course Content

Introduction to language, Igbo language and its orthography. Outlining and understanding the word formation processes in Igbo. Learning the organs of speech and the speech sounds they produce. Outlining and understanding the spelling rules in Igbo. Learning of numbers. The concept of tone and tone marking. Punctuations marks, their importance and uses.

UAES-LEP-105 Language Enhancement Programme II (1 Unit C: LH 15)

Learning Outcomes

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

1. Understand, explain and list the current Igbo orthography.
2. Differentiate between Igbo orthography and speech sounds.
3. Identify Igbo terminologies peculiar to their fields of study.
4. Apply the knowledge of the terminologies in research and practice.
5. Communicate fluently in Igbo.

Course Content
Brief history of the Igbo people and their culture. Igbo grammar - parts of speech and affixation. Understanding the syllable and syntactic structures of the Igbo language. Figures of speech. Outlining and understanding the word duplication processes in Igbo. Essay writing. Introduction to the institutions, traditions and customs of the Igbo people.

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;
4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically asses the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge, and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents
Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding, etc.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Learning Outcomes
At the end of this course, students should be able to:
1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking;
2. state the characteristics of an entrepreneur;

3. analyse the importance of micro and small businesses in wealth creation, employment generation and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe the stages in enterprise formation, partnership and networking, including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. state the basic principles of e-commerce.

Course Contents
The concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship); theories, rationale and relevance of entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship, and creative destruction); characteristics of entrepreneurs (opportunity seeker, risk-taker, natural and nurtured, problem solver and change agent, innovator and creative thinker); entrepreneurial thinking (critical thinking, reflective thinking and creative thinking). Innovation (The concept of innovation, dimensions of innovation, change and innovation, knowledge and innovation). Enterprise formation, partnership and networking (basics of business plan, forms of business ownership, business registration and alliance formation, and joint ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office and networking). Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship, entrepreneurship support institutions, youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

GET 201: Applied Electricity I (3 Units C: LH 30; PH 45)

Course Learning Outcomes
Students will be able to:
1. discuss the fundamental concepts of electricity and electrical d.c. circuits;
2. state, explain and apply the basic d.c. circuit theorems;
3. explain the basic a.c. circuit theory and
4. apply to solution of simple circuits.

Course contents
Fundamental concepts: Electric fields, charges, magnetic fields. current, B-H curves Kirchhoff's laws, superposition. Thevenin, Norton theorems, Reciprocity, RL, RC, RLC circuits. DC, AC bridges, Resistance, Capacitance, Inductance measurement, Transducers, Single phase circuits, Complex j - notation, AC circuits, impedance, admittance, susceptance.

GET 202: Engineering Materials (3 Units C: LH 45)

Learning Outcomes
At the end of this course, the students should be able to :
1. demonstrate the role of atoms and molecules (aggregates of atoms) in the building of solid/condensed matter known as engineering materials, the electrons quantum numbers and how

the electrons are arranged in different atomic elements, and explain the role of electronic configuration and valence electrons in bonding;
2. define metals, alloys and metalloids, demonstrate mental picture of the solid mineral resources development as a relay race among four 'athletes': geologist, mining engineer, mineral processing technologist, process metallurgical engineer, and classify metallurgical engineering into 3Ps: process, physical and production;
3. explain the relationship between structure and properties of materials, characteristics, components and compositions of phase diagrams and phase transformations of solid solutions;
4. define ceramics, glass and constituents of glasses and understand application of ceramics in mining, building, art and craft industries;
5. define and classify polymers as a class of engineering materials and polymeric materials, demonstrate polymerisation reactions, their types and mechanism, and applications of polymers;
6. define properties, types and application of composite materials and fibres (synthetic and natural);
7. define and classify nanomaterials, demonstrate applications of nanomaterials, concept, design and classification of fracture mechanics, corrosion classification, including the five principal ways of controlling corrosion and metal finishing processes such as sherardising, galvanising and anodising; and
8. identify factors affecting the performance and service life of engineering materials/metals and metallography of metals/materials (materials anatomy), which
enables metallurgical and materials engineers to prescribe appropriate solutions to test metals/materials fitness in service through structure-property-application relationships.

Course Contents

Basic material science; atomic structure, atomic bonding and crystal structures. Engineering materials situating metals and alloys; metals and alloys, classifications of metals, metal extraction processes using iron and steel (ferrous) and aluminium (nonferrous) as examples, phase diagrams/iron carbon diagrams, and mechanical workings of metals. Selection and applications of metals and alloys for specific applications in oil, aerospace, construction, manufacturing and transportation industries, among others. Ceramics (including glass); definition, properties, structure and classifications of ceramics. Bioactive and glass – ceramics. Toughing mechanism for ceramics. Polymers; definition of polymers as engineering materials, chemistry of polymeric materials, polymer crystallisation, polymer degradation and aging. Thermoplastic and thermosetting polymers and concepts of copolymers and homopolymers. Composites; definition, classification, characterisation, properties and composite. Applications of composites. Nanomaterials; definition, classification and applications of nanomaterials as emerging technology. Processing of nanomaterials including mechanical grinding, wet chemical synthesis, gas phase synthesis, sputtered plasma processing, microwave plasma processing and laser ablation. Integrity assessment of engineering materials; effect of engineering design, engineering materials processing, selection, manufacturing and assembling on the performance and service life of engineering materials. Metallography and fractography of materials. Mechanical testing (destructive testing) of materials such as compressive test, tensile test, hardness test, impact test, endurance limit and fatigue test. Non-destructive test (NDT) such as dye penetrant, x-ray and eddy current.

GET 204: Students Workshop Practice (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. identify various basic hands and machine tools, analogue and digital measurement devices and instruments, and acquire skills in their effective use and maintenance;
2. practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology;
3. master workshop and industrial safety practices, accident prevention and ergonomics;
4. physically recognise different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
5. connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
6. determine household and industrial energy consumption, and understand practical energy conservation measures.

Course Contents

The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice. Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press-tool work, spinning, etc.). Metal joining processes (welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines. Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

GET 205: Fundamentals of Fluid Mechanics (3 Units C: LH 45)

Learning Outcomes

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

1. explain the properties of fluids;
2. determine forces in static fluids and fluids in motion;
3. determine whether a floating body will be stable;
4. determine the effect of various instruments, (valves, orifices, bends and elbows) on fluid flow in pipes;

5. measure flow parameters with venturi meters, orifice meters, weirs, etc;
6. perform calculations based on principles of mass, momentum and energy conservation;
7. perform dimensional analysis and simple fluid modelling problems; and
8. specify the type and capacity of pumps and turbines for engineering applications

Course Contents
Fluid properties, hydrostatics, fluid dynamics using principles of mass, momentum and energy conservation from a control volume approach. Flow measurements in pipes, dimensional analysis, and similitude, 2-dimensional flows. Hydropower systems.

GET 206: Fundamentals of Engineering Thermodynamics (3 Units C: LH 45)

Learning Outcomes
At the end of this course, the students should be able to:
1. describe basic concepts of thermodynamics, i.e., quantitative relations of Zeroth, first, second and third laws;
2. define and explain system (surrounding, closed and open system), control volume and control mass, extensive and intensive properties;
3. calculate absolute and gage pressure, and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy;
4. evaluate the properties of pure substances i.e. evaluate the state of the pure substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables; arrange the ideal and real gas equations of state,
5. formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;
9. formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. construct energy and mass balance for unsteady-flow processes;
11. evaluate thermodynamic applications using second law of thermodynamics;
12. calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and
13. restate perpetual-motion machines, reversible and irreversible processes.

Course Contents
Basic concepts, definitions and laws (quantitative relations of Zeroth, first, second and third laws of thermodynamics). Properties of pure substances: the two-property rule (P-V-T behaviour of pure substances and perfect gases); state diagrams. The principle of corresponding state; compressibility relations; reduced pressure; reduced volume; temperature; pseudo-critical constants. The ideal gas: specific heat, polytropic processes. Ideal gas cycles; Carnot;

thermodynamic cycles, turbines, steam and gas, refrigeration. The first law of thermodynamics – heat and work, applications to open and closed systems. The steady flow energy equation (Bernoulli's equation) and application. Second law of thermodynamics, heat cycles and efficiencies.

GET 209: Engineering Mathematics I (3 Units C: LH 45)

Learning Outcomes

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

1. solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
3. solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. describe the applications of double and triple integration in finding the area and volume of engineering solids, and explain the qualitative applications of Gauss, Stoke's and Green's theorem;
5. explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and
6. analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

Course Contents

Limits, continuity, differentiation, introduction to linear first order differential equations, partial and total derivatives, composite functions, matrices and determinants, vector algebra, vector calculus, directional derivatives.

GET 210: Engineering Mathematics II (3 Units C: LH 45)

Learning Outcomes

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

1. describe physical systems using ordinary differential equations (ODEs);
2. explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types; 3. numerically solve differential equations using MATLAB and other emerging applications;
3. perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals;
4. solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem, and perform operations with complex numbers;
5. apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions of complex variables, as well as the theory of conformal mapping to solve problems from various fields of engineering; and

6. evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula.

Course Contents
Introduction to ordinary differential equations (ODEs); theory, applications, methods of solution; second order differential equations. Advanced topics in calculus (vectors and vector-valued function, line integral, multiple integral and their applications). Elementary complex analysis including functions of complex variables, limits and continuity. Derivatives, differentiation rules and differentiation of integrals. Cauchy-Riemann equation, harmonic functions, basic theory of conformal mapping, transformation and mapping and its applications to engineering problems. Special functions.

GET 211: Computing and Software Engineering (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. develop skills in eliciting user needs and designing an effective software solution;
5. recognise human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalisation of services; and
6. acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas.

Course Contents
Introduction to computers and computing; computer organisation – data processing, memory, registers and addressing schemes; Boolean algebra; floating-point arithmetic; representation of non-numeric information; problem-solving and algorithm development; coding (solution design using flowcharts and pseudo codes). Data models and data structures; computer software and operating system; computer operators and operators precedence; components of computer programs; introduction to object oriented, structured and visual programming; use of MATLAB in engineering applications. ICT fundamentals, Internet of Things (IoT). Elements of software engineering.

GET 299: Students Industrial Work Experience I (3 Units C: 9 weeks)

Learning Outcomes
SIWES I should provide opportunity for the students to:
1. acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;

2. learn and practise basic engineering techniques and processes applicable to their specialisations;
3. build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and
4. acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

Course Contents
Practical experience in a workshop or industrial production facility, construction site or special centres in the university environment, considered suitable for relevant practical/industrial working experience but not necessarily limited to the student's major. The students are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation, etc. (8-10 weeks during the long vacation following 200 level).

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

Learning Outcomes
At the end of this Course, students should be able to:
1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe the roles of international organisations, media and traditional institutions in peace building.

Course Contents
The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political Conflicts; structural conflict theory, realist theory of conflict, frustration-aggression conflict theory; root causes of conflict and violence in Africa: indigene and settlers phenomenon, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations; selected conflict case studies – Tiv-Junkun, ZangoKartaf, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & Destructive. Justice and Legal framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and terrorism. Peace mediation and peace keeping. Peace and Security Council (international, national and local levels). Agents of conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives. Alternative Dispute Resolution (ADR) (dialogue,. arbitration, negotiation, collaboration, etc). The roles of international organizations in conflict resolution ((a) The United Nations, UN and its conflict

resolution organs. (b) The African Union & Peace Security Council (c) ECOWAS in peace keeping). The media and traditional institutions in peace building. Managing post-conflict situations/crises: Refugees. Internally Displaced Persons (IDPs);the role of NGOs in post-conflict situations/crises.

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students, through case study and practical approaches, should be able to:

1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. state how original products, ideas and concepts are developed;
4. develop a business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises;
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, micro-finance, personal savings, small business investment organizations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, E-commerce business models and successful e-commerce companies). Small business management/family business: Leadership & Management, basic book keeping, nature of family business and family business growth model. Negotiation and business communication (strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, idea pitching). Technological solutions (The concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies - artificial intelligence (AI), virtual/mixed reality (VR), Internet of things (IoTs), blockchain, cloud computing, renewable energy, etc. Digital business and e-commerce strategies).

GET 304: Technical Writing and Communication (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the student should be able to:

1. demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
2. demonstrate the skills of language flexibility, formatting, logic, data presentation styles, referencing, use of available aids, intellectual property rights, their protection, and problems in engineering communication and presentation; and
3. demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different sociocultural milieu for engineering designs, structural failure scenarios and presentation of reports.

Course Contents

A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreement. Active and passive sentences Lexis and structure Fog Index concept. Skills for communication and communication algorithm. Types and goals of communication; Interpersonal communication; features and the Finger Model or A,B,C,D,E of good interpersonal communication (accuracy of technical terms, brevity of expression, clarity of purpose, directness of focus and effectiveness of the report). Language and organisation of reports. Technical report writing skills(steps, problems in writing, distinguishing technical and other reports, significance, format and styles of writing technical reports). Different formats for communication; styles of correspondences – business report and proposal, business letter, memorandum, e-mails, etc. Proposals for projects and research; format, major steps and tips of grant-oriented proposals. Research reports(competency, major steps, components and formats of research reports and publishable communication). Sources and handling of data, tables, figures, equations and references in a report. Presentation skills; overview, tips, organisation, use of visual aids and practising of presentation. Intellectual property rights in research reports. Case studies of major engineering designs, proposals and industrial failures with professional presentation of reports.

GET 305: Engineering Statistics and Data Analytics (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:
1. work with data from the point of view of knowledge convergence, machine learning, and intelligence augmentation, which significantly raises their standard for engineering analysis (the approach forces them to learn statistics in an actionable way that helps them to see the holistic importance of data analytics in modern engineering and technology);
2. anticipate the future with Artificial Intelligence while fulfilling the basic requirements of conventional engineering statistical programming consistent with their future careers;
3. perform, with proficiency, statistical inference tasks with language or programming toolboxes such as R, Python, Mathematica or MATLAB, and Design Expert to summarise analysis and interpretation of industry engineering data, and make appropriate conclusions based on such experimental and/or real-life industrial data;
4. construct appropriate graphical displays of data and highlight the roles of such displays in data analysis, particularly the use of statistical software packages;

5. plan and execute experimental programmes to determine the performance of programme-relevant industrial engineering systems, and evaluate the accuracy of the measurements undertaken; and
6. demonstrate mastery of data analytics and statistical concepts by communicating the results of experimental and industry-case investigations, critically reasoned scientific and professional analysis through written and oral presentation.

Course Contents
Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles, etc. Probability. Binomial, poison hyper-geometric, normal distributions, etc. Statistical inference intervals, test hypothesis and significance. Regression and correlation. Introduction to big data analytics and cloud computing applications. Introduction to the R language; R as a calculator; Vectors, matrices, factors, data frames and other R collections. Iteration and looping control structures. Conditionals and other controls. Designing, using and extending functions. The Apply Family. Statistical modelling and inference in R.

GET 306: Renewable Energy Systems and Technologies (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. identify the types, uses and advantages of renewable energy in relation to climate change;
2. design for use the various renewable energy systems;
3. recognise and analyse the current energy systems in Nigeria, their impacts on development and the global energy demand and supply scenarios;
4. appreciate the environmental impact of energy exploitation and utilisation, and pursue the sustainable development of renewable energy for various applications; and
5. recognise the exploitation, excavation, production, and processing of fossil fuels such as coal, petroleum and natural gas, and discuss the sources, technology and contribution to future energy demands of renewable energy.

Course Contents
Current and potential future energy systems in Nigeria and globally - resources, extraction, concepts in energy conversion systems; parallels and differences in various conversion systems and end-use technologies, with emphasis on meeting 21st-century national, regional and global energy needs in a sustainable manner. Various energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic), nuclear (fission and fusion) and renewable (solar, biomass, wind, hydro, and geothermal). Energy types, storage, transmission and conservation. Analysis of energy mixes within an engineering, economic and social context. Sustainable energy; emphasise sustainability in general and in the overall concept of sustainable development and the link this has with sustainable energy as the fundamental benefit of renewable energy.
Practical Content: Simple measurement of solar radiation, bomb calorimeter determination of calorific value of fuels and biomass; measurement of the velocity of wind, waves and the energy that abound in them; laboratory production of biogas and determination of energy available in it; simple conversion of solar energy to electricity; trans esterification of edible oil into biodiesel; simulation of geothermal energy; Geiger-Muller or Scintillation Counters' determination of

uranium or thorium energy; simple solid or salt storage of energy; hybrid application of renewable energy.

GET 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3 Units C: LH 45)

Learning Outcomes

At the completion of the course, the students are expected to be able:

1. explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
2. explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. demonstrate the difference between supervised, semi-supervised and unsupervised learning;
4. demonstrate proficiency in machine learning workflow and how to implement the steps effectively;
5. explain natural languages, knowledge representation, expert systems and pattern recognition;
6. describe distributed systems, data and information security and intelligent web technologies;
7. explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and
8. explain the concepts, characteristics, models and benefits, key security and compliance challenges of cloud computing.

Course Contents

Concepts of human and artificial intelligence; artificial/computational intelligence paradigms; search, logic and learning algorithms. Machine learning and nature-inspired algorithms – examples, their variants and applications to solving engineering problems; understanding natural languages; knowledge representation, knowledge elicitation, mathematical and logic foundations of AI; expert systems, automated reasoning and pattern recognition; distributed systems; data and information security; intelligent web technologies; convergent technologies – definition, significance and engineering applications. Neural networks and deep learning. Introduction to python AI libraries.

GET 399: Students Industrial Work Experience II (4 Units C: 12 weeks)

Learning Outcomes

At the end of the SIWES, students should be able to:

1. demonstrate proficiency in at least any three softwares in their chosen career choices;
2. demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers;
3. carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;,
4. demonstrate proficiency in generating data from laboratory analysis and develop empirical models;
5. demonstrate proficiency in how to write engineering reports from lab work ;
6. fill logbooks of all experience gained in their chosen careers;
7. write a general report at the end of the training.

The experience is to be graded and the students must pass all the modules of the attachment and shall form part of CGPA.

Course Contents

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (Students are to proceed on three months of work experience i.e. 12 weeks during the long vacation following 300 level). Students are engaged in the more advanced workshops, indoor software design training similar to what they will use in the industry and outdoor construction activities to sharpen their skills. The use of relevant animation videos that mimic industrial scenarios is encouraged. Students are to write a report at the end of the training. As much as possible, students should be assisted and encouraged to secure 3 months placement in the industry. Examples of outline of activities and experiences to which students are expected to be exposed to earn prescribed credits include:

Section A: Welding and fabrication processes, automobile repairs, · lathe machine operations: machining and turning of simple machine elements, such as screw threads, bolts, gears, etc. Simple milling machine operations, machine tool maintenance and trouble-shooting, and wooden furniture making processes.

a. Design of machine components;
b. Product design and innovation;
c. Part modelling and drafting in SolidWorks; and
d. Technical report writing.

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solidworks: software capabilities, design methodologies and applications. Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solidWorks drawing drafting. Top-down assembly technique exploded view, exploded line sketch. Introduction to PDMS 3D design software; autoCAD mechanical, SPSS.

A comprehensive case study design project. The student should be introduced to the concept of product/component design and innovation and then be given a comprehensive design project. Examples of projects should include the following:

ABE 301: Design of Machine and Structural Elements (2 Units C: LH 15; PH 45)

Learning Outcomes

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

1. Explain the theories of failure of machine components;
2. Analyse the loads on machine and structural elements;
3. Apply shear force, bending moment, torsion, bending stresses in designing machine and structural elements;
4. Design machine components such as belt drives, shafts, chain drives, gears;
5. Design beams and columns;
6. Select fasteners such as nut and bolts, studs, bearings, etc. in designing machines; and
7. Use computer software and empirical methods in designing machine and structural elements.

Course Contents
Design of machine elements: Theories of failure. Design of shafts, belt and pulley drives, gears, sprockets, bolts and nuts, keys and keyways; selection of bearings. Practical session: Use of computer software in machine design.
Design of structural elements: Definitions. Hooke's law. Stress and strain due to loading. Torsion of circular members. Shear force. Bending moment and bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations. Mohr cycle. Elastic buckling of columns. Design of beams using empirical methods and computer software. Design of columns using empirical methods and computer software. Group design assignment of machine or structural elements or complete system.

ABE 302: Animal Production (2 Units E: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. appreciate the basic science of animal production;
2. apply various engineering interventions in livestock housing, waste management, diary production; and
3. implement mechanization strategies in livestock production.

Course Contents
Types of livestock (for eggs, milk, meat, wool, etc). Distribution of livestock in Nigeria. Livestock housing. Livestock processing equipment.

ABE 303: Crop Production (2 Units E: LH 15; PH 45)

Learning Outcomes
At the end of the course, students will be able to:
1. Appreciate the various farming systems in agriculture with emphasis on Nigerian small farm holding including the impact of climate change;
2. Describe the various farm machinery used in crop production;
3. Implement mechanical operations in crop production;
4. Establish small, medium and large-scale mechanize farms;
5. Undertake the application of fertilizer types for different crops;
6. Plan and implement irrigated agriculture; and
7. Undertake some post-harvest crop processing activities.

Course Contents
Classification and ecology of crops in Nigeria. Nutrient requirements and mineral nutrition of plants. Manures and fertilizers. Plant growth and development. Growth stages. Tillage and weed control. Other cultural practices. Cropping sequences and rotation. Farming systems. Production practices for specified crops. Conservation agriculture and sustainability in tropical agriculture.

ABE 304: Farm Management, Rural Sociology and Agricultural Extension (2 Units **E: LH 30)**

Learning Outcomes

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

1. Apply extension strategies to adopt technologies on Nigerian small rural farms from the understanding of rural sociology;
2. Apply appropriate financial system to account for farm activities with a view to practicing profitable agriculture; and
3. Take decisions appropriate to a farm establishment on staffing and machinery inputs.

Course Contents

Management decision making. Functions of management planning, organisation, staffing, directing and controlling. Financial management. Principles of extension: diffusion, adoption and rejection of innovations. Communication and leadership in agricultural extension.

ABE 305: Soil Science (2 Units E: LH 30)

Learning Outcomes

After taking this course, this course, the students should be able to:

1. apply the knowledge acquired in soil pedagogy, nutrient and nutrient exchange to managing soil fertility;
2. apply the different fertilizer types (organic and inorganic) appropriately to different soil types;
3. explain and describe the paedology, mineralogy and classification of soils;
4. undertake soil survey and mapping; and
5. manage soils for agricultural production.

Course Contents

Origin and formation of soils. Physical properties of soils. Basic concept of soil paedology. Soil colloids; soil reaction; soil mineralogy. Soil organic matter. Soil survey and mapping. Soil classification. Soil fertility and fertilizers. Particle size distribution analysis/sieve analysis. Properties and management of Nigerian soils.

ABE 306: Land Surveying and Geographical Information System (2 Units C: LH 30)

Learning Outcomes

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

1. Undertake cadastral, levelling and topographic surveys essential for anti-soil erosion intervention;
2. Conduct levelling survey for road construction and farmstead planning; and
3. Use GIS to do contour mapping for contour farming and reclamation of gullies.

Course Contents

Definitions. Measurement of distances. Ise of minor instruments. Random errors. Chain surveying. Bearing of lines. Levelling. Topographic surveys. Traversing. Theodolite traversing. Plane table surveying. Triangulation. Land shaping and earthwork. Map reading. Photogrammetry. Aerial photography. Geographical Information System.

ABE 307: Biosystems Engineering (2 Units C: **LH 30)**

Learning Outcomes
Upon completing this course, students will be able to:
1. appreciate biological engineering processes;
2. analyse biosystems such as waste treatment systems;
3. design the various gadgets involved in unit operations in biological processes such as bio-reactors;
4. develop biosystems for energy production, municipal waste treatment; and
5. apply computer to biological systems.

Course Contents
Definitions. Modelling and design of fermentation systems. Microbial growth kinetics. Design of bio-reactors. Heat and mass transfer. Bioremediation of wastes. Design of anaerobic and aerobic systems. Energy from biological systems. Monitoring and control of biological systems. Application of computer to biological processes.

ABE 308: Rural Infrastructural Engineering (2 Units C: LH 30)
Learning Outcomes
After taking this course, students should be able to:
1. Identify the various engineering infrastructures for a rural community;
2. Plan and design rural infrastructures such as roads, earth dams, electricity projects and irrigation projects; and
3. Develop and implement a rural water scheme.

Course Contents
Concept of integrated rural development (planning and implementation). Overview of the problems of rural infrastructures. Review of agricultural construction survey. Rural road network. Rural road design, construction and maintenance; erosion of earth roads; minor road crossing. Small scale irrigation; rural electricity; rural water supplies; rural sanitation.

Practical contents: A levelling survey exercise for road construction. Excursion: Visit to an earth dam site and an irrigation project.

ABE 401: Instrumentation and Measurement in Agricultural and Biosystems Engineering (3 Units **E: LH 30; PH 45)**

Learning Outcomes
This course will help students to:
1. identify the appropriate instruments for measuring parametres relevant to agricultural activities;
2. manage the acquisition, transmission, recording, analysing and computing of data; and
3. apply these instruments, particularly for research in agricultural and biosystems engineering.

Course Contents
Motion, force, torque and shaft power, pressure and sound flux; humidity measurement; application of primary sensing element; data manipulation, computing and compensating devices; data transmission and recording.

GET 499: Students Industrial Work Experience III (8 Units C: 24 weeks)

Learning Outcomes

Students on Industrial Work Experience Scheme (SIWES) are expected to:

1. be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human relations, key performance assessment methods, and ways of safeguarding the work environment – human and materials;
3. experience/simulate the transition phase of students from school to the world of work and the environment seamlessly,and expose them to contacts for eventual job placements after graduation;
4. be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

Course Contents

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc, for a period of 6 months under the guidance of an appropriate personnel in the establishment but supervised by an academic staff of the Department. On completion of the training, the student submits the completed Log book on the experience at the establishment., Also, there will be a comprehensive report covering the whole of the student's industrial training experiences (GET 299, GET 399 and GET 499), on which a seminar will be presented to the Department for overall assessment.

GET 501: Engineering Project Management (3 Units C: LH 45)

Learning Outcomes

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

1. explain the basics of project management as it relates to the Engineering discipline;
2. demonstrate knowledge and understanding of engineering, management and financial principles and apply these to their own work, as a member and/or leader in a team, to manage projects and in multi-disciplinary environments;
3. conduct, manage and execute projects in multi-disciplinary areas;
4. possess the skills needed for project management; and
5. work within the budget when executing a project for proper management.

Course Contents

Project management fundamentals – definitions, project environment, nature and characteristics, development practice, management by objectives, and the centrality of engineering to projects, infrastructures, national and global development. The scope of project management – organisational, financial, planning and control, personnel management, labour and public relations, wages and salary administration and resource management. Identification of project

stakeholders; beneficiaries and impacted persons – functions, roles, responsibilities. Project community relations, communication and change management. Project planning, control and timeliness;decision making, forecasting, scheduling, work breakdown structure (WBS), deliverables and timelines, logical frameworks (log frames), risk analysis, role of subject matter experts (SMEs), role conflicts; Gantt Chart, CPM and PERT. Optimisation, linear programming as an aid to decision making, transport and materials handling. Monitoring and Evaluation – key performance indices (KPIs); methods of economic and technical evaluation. Industrial psychology, ergonomics/human factors and environmental impact considerations in engineering project design and management. Project business case - financial, technical and sustainability considerations. Case studies, site visits and invited industry professional seminars. General principles of management and appraisal techniques. Breakthrough and control management theory; production and maintenance management. Training and manpower development. The manager and policy formulation, objective setting, planning, organising and controlling, motivation and appraisal of results.

GET 502: Engineering Law (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. describe and explain the basic concept, sources and aspects of law;
2. describe and explain the major differences between the various categories of law, courts and legal jurisdictions;
3. describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and
4. develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles undertake critical analysis of reliable information to develop, and practically present technical reports for use in varying judicial/quasi-judicial settings including as an expert witness.

Course Contents

Common Law: its history, definition, nature and division. Legislation, codification interpretation. Equity: definition and its main spheres. Law of contracts for Engineers: Forms of contract and criteria for selecting contractors; offer, acceptance, communication termination of contract. Terms of Contracts; suppliers' duties – Damages and other Remedies. Termination/cancellation of contract Liquidation and Penalties; exemption clauses, safety and risk. Health and Safety. Duties of employers towards their employees. Duties imposed on employees. Fire precautions act. Design for safety. General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

ABE 501: Environmental and Social Impact Analysis (2 Units C: LH 30)

Learning Outcomes

After taking this course, students should be able to:

1. determine the impact and consequences of agricultural projects on the environment and measure them;
2. explain the environmental policies and regulations of their locality;

3. analysis projects and take decisions as to whether it will have a positive or negative impact on the environment; and
4. design the remediation of projects with negative impact.

Course Contents
Concept of environmental and social consequences/dimensions of development projects. Methods of impact analysis. Physical, sociological, legal, economic, environmental and public health implications of human activities. Effects of changed environments on man. Examples of impact assessment with particular reference to developing countries. Role of environmental engineering in preventing or reducing environmental stress. Environmental and social management plans (ESMP); Planning and policy, administration and organisation of natural resources development and public health. Land use planning and landscape design. Monitoring and evaluation of projects for ESIA compliance. Practical content: Students are expected to undertake an environmental and social impact analysis of an on-going project on campus.

ABE 502: Aquaculture and Agroponic Engineering (2 Units C: LH 30)

Learning Outcomes
Students will after taking this course have the capacity to:
1. appreciate fish farming, the machinery involved and integration of fish farming aspect to the other crop and livestock enterprises on a farm;
2. design mechanized fish ponds, conserve water, manage the wastes from the ponds;
3. design and construct efficient fish drying kilns; and
4. explain the benefits, practice and management of agroponic agriculture.

Course Contents
Aquaculture: Types of fish ponds. Design and construction of fish ponds. Integrated fish farming. Water quality for fish farming. Water conservation. Machinery for fish farms. Pollution control. Ecological re-use and disposal of water. Product harvesting, sorting and processing. Design of fish kilns. Agroponics: Agroponic farming systems. Prospects of agroponic agriculture in Nigeria. Soil and water management in agroponic systems. Economics of agroponic systems. Modern aquaponics and hydroponics systems design and use. Practical content: Each student is expected to plant a yam seedling in a bag of sand and monitor its growth until harvest during the semester. Excursion: Visit to a commercial fish farm site or the university fish farm.

ABE 503: Livestock Production Engineering (2 Units C: LH 30)

Learning Outcomes
After taking this course, the students will be able to:
1. Explain the various rearing systems including the transhumance system of rearing;
2. Describe the production systems in the livestock enterprise;
3. Design livestock housing types;
4. Identify the various engineering interventions in the livestock enterprise, which include the machinery for feeding, sanitation of the livestock housing, milking, irrigation of the pastures in a ranch;
5. Plan, design and implement a ranch;

6. Select appropriate machinery for various operations; and
7. Manage livestock wastes for energy production.

Course Contents

Production systems: rearing, fattening and milk production systems. Rearing systems: objectives; nomadic, transhumant, sedentary, scavenging and industrial (ranching) – organisation, personnel and infrastructures. Design, construction and equipment for housing for pigs, sheep, goats, domestic fowls, cattle and dairy cattle. Fattening production systems: Grass and intensive fattening. Milk production systems: factors limiting tropical milk production; milking bail; milking parlour: selection, design and types.

Environmental requirements for animals. Environmental impact on animal growth and reproduction on their general physiology. Assessment of thermal comfort. Parametres affecting thermal comfort of animals. ASHRAE comfort charts. Ventilation systems: natural and automated. Aerodynamics of animal buildings. Building design methodology. Integrating animals with their environment through building designs.

Disease control: Causes, factors favouring transmission. Design of buildings to control diseases. Animal waste management: Characteristics of animal wastes. Objectives of waste treatment; aerobic and anaerobic treatment of waste; manure disposal equipment.

Excursion: Visit to a functional biogas plant.

ABE 504: Greenhouse Technology (2 Units C: LH 30)

Learning Outcomes

Students are expected to be able to:

1. Define greenhouse and associated technologies;
2. Describe the types of greenhouses;
3. Analyse the thermal profile of greenhouses;
4. Determine the influence of the climate on the control and implementation of the environment in greenhouses;
5. Undertake climate control and cultivate plants in greenhouses; and
6. Design and construct low cost and effective greenhouses for crop cultivation.

Course Contents

Definition of greenhouse. Meaning of greenhouse technology and controlled environment agriculture (CEA). History and present scenario of greenhouse cultivation. Importance of greenhouse crop cultivation. Types of greenhouses. Types of covering materials and thermal screens for greenhouses. Planning of greenhouses. Importance of different climatic and non-climatic factors in selecting proper greenhouse technology. Measuring systems required for greenhouse. Design, construction and cost estimate of a greenhouse. The bamboo greenhouse technology. Control mechanisms for different climatic conditions: light, temperature, humidity, precipitation and carbon dioxide. Special methods of crop husbandry in greenhouse cultivation.

Excursion: Visit to a commercial farm with greenhouse facility.

ABE 505: Drone and Robot Technology in Agriculture (2 Units C: LH 30)

Learning Outcomes

This course will enable students know control, tools, programming languages, sensors and actuators involved in automation; design and use of robots and drones in agriculture.

Students are expected to be able to:
1. Identify and explain the forms of automation and its control systems, automation tools and various computer programming languages;
2. Explain the types and application of sensors;
3. Design and select sensors and actuators;
4. Describe and explain the types, classification and architecture of drones;
5. Explain the types, characteristics and advantages of agricultural robots;
6. Apply drones and robots in agriculture; and
7. Evaluate the performance, accuracy and repeatability of robots.

Course Contents
Automation: Introduction to automation. Control systems: open-loop and closed-loop, feedback control, logic control, on-off control and linear control systems. Control actions: discrete control (on/off); PID controller; sequential control and logical sequence or system state control; computer control. Automation tools: artificial neural network (ANN); distributed control system (DCS); human machine interface (HMI); robotic process automation (RPA); supervisory control and data acquisition (SCADA); programmable logic controller (PLC); instrumentation; motion control; robotics. Programming languages: introduction to programming language; Matlab programming, R programming, C, C# and C++ programming, Java and Java Script programming and Python programming. Sensors and actuators: introduction to sensors, types and applications. Design and selection of sensors. Introduction to actuators, types and applications. Design and selection of actuators.
Drones or Unmanned Aerial Vehicles (UAVs): Introduction, types and classification of drones. Architecture (components) of a drone: flight controller; electronic speed controller (ESC); battery; radio transmitter/receiver; antenna; propellers; electric motor; camera and its accessories.; ground station; intelligent sensors; intelligent battery; GNSS and RTK module. Advantages and disadvantages of drones. Design and selection of drones. Working principles of a drone. Performance considerations criteria of a drone. Application of drones in agriculture. Robots: Introduction, types and characteristics of agricultural robots (Agribot). Primary areas of robotics: operator interface; mobility or locomotion; manipulators and effectors; programming; sensing and perception. Advantages and disadvantages of robots. Robot design process. Design of components of agricultural robots: end effectors; grippers; manipulators. Operating principles of an agricultural robot. Performance evaluation of robots: productive time, overhead time and working efficiency index. Accuracy and repeatability of a robot. Application of robot to agriculture.

ABE 599: Final Year Project (3 Units C: 15 LH; PH 90)

Course Contents
Individual student project to deepen knowledge, strengthen practical experience and encourage creativity and independent work. The project ends in a comprehensive written report.

ADDITIONAL COURSES FOR THE DEPARTMENT

SOIL AND WATER ENGINEERING

AGR 101: Farm Practice I (1 Unit; C; LH =0; PH = 45)

Learning outcome

It is expected that at the end of this practical course, the students will be able to:

1. Identify different types of farm enterprise
2. Identify, describe, and use tools for record keeping and farm inventory
3. Explain factors to consider in making a choice of farm enterprise
4. Demonstrate farm design and layout
5. Identify and describe the various structures in the farms
6. Identify crops based on their life span and type of product they field
7. Identify different types of fish and livestock species
8. Explain the common practices in livestock and fish production
9. Describe processes of feed formulation and feed types in livestock and fish production
10. Explain practices in livestock and fish production
11. Identify various farm machineries, their uses and maintenance practices

Course Contents

Students will evaluate factors considered in making choice of farm enterprise and Site selection. Design of Farm layout and Farm infrastructure (farmstead, roads, structures, fences). Design of farm records; Inventory Table; Valuation and management.

AGR 102: Farm Practice II (1 Unit; C; LH =0; PH = 45)

Learning outcome

It is expected that at the end of this practical course, students should be able to:

1. Define horticulture and identify horticultural crops
2. Identify and explain different branches of horticulture/classes of horticultural crops
3. Describe how to establish and manage horticultural crops Describe and practice nursery operations for horticultural and field crops
4. Describe and practice budding and grafting as methods of vegetative propagation
5. Explain the principles and tools for seedling transplanting
6. Appreciate the principles/technics for establishing a homestead vegetable farm.
7. Explain socioeconomic, bioclimatic, and edaphic factors influencing crop farming in Nigeria

Course Contents

Nursery types and practices for vegetable and tree crops production. Budding and grafting of vegetable and tree crops (Types of budding and grafting, Use of budding and grafting implements). Establishment and economics of vegetable and fruit trees production.

EMT 102: Environmental Studies And Public Health (1 Unit; C; LH =15; PH = 0)

Learning Outcomes

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

1. define terms used in environmental health
2. describe the historical background of environmental and public health
3. discuss some of the public health laws in Nigeria
4. explain the principles of environmental health
5. outline the pillars of environmental health
6. discuss health in relation to environment

Course Contents

Introduction to public health. Public Health definition and key terms (clinical care, determinant, epidemic or outbreak, health outcome, intervention, pandemic, population health, prevention). The purpose of public health. History of public health: sanitation and environmental health, pandemics (e.g., cholera, influenza, polio, HIV, Ebola, COVID-19, etc.). Stakeholders in the field of public health. Disaster response, Prevention through policy (e.g., Bible, tobacco laws, obesity). Public health approach: surveillance, Risk factor identification, intervention evaluation, implementation. Public health core sciences. Individual rights and public health. Vaccination and associated politics. The concept of infectious diseases, non-communicable diseases, mental health, and injuries. Maternal and child health. Sexual and reproductive health and rights, child health. Impact of environment, climate change, and migration on health policy, health systems, and the health of individuals. First Aid administration, Cardiopulmonary resuscitation (CPR): steps, types, etc. The place of food and water. Food and drug regulatory authorities in Nigeria (NAFDAC, SON). Drug abuse. Waste management.

AGR 201 Farm Practice III (1 Unit; C; LH = 0; PH = 45)

Learning outcomes

It is expected that at the end of this practical course, students should be able to:

1. describe landscaping and floriculture;
2. describe at least three (3) tropical ornamental plants;
3. describe propagation of ornamental plants;
4. describe the nursery practices in the production of ornamental plants;
5. describe the procedure for lawn establishment and maintenance;
6. describe landscaping as a business;
7. describe at least four (4) importance of landscaping; and
8. State three (3) differences between horticulture and floriculture.

Course Contents

Landscaping and floricultural practices. Identification of plants of landscaping and floricultural significance. Design of landscapes. Nursery practices for landscaping and floricultural plants. Lawn establishment and maintenance.

UAES-SWE 202: Water Resources and Environmental Engineering (1 Unit; C; LH = 15; PH)

Learning Outcomes

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

1. Explain what water resources engineering entails.
2. Describe hydrological cycle, domestic and industrial use of water and the treatment of water and wastewater
3. Plan, design, construct, operate and maintain water resources management related structures

4. Explain career opportunities for the water resources and environmental engineers at all levels.
5. Explain the application of engineering principles in water treatment, wastewater treatment, air quality, and solid wastes
6. Describe environmental regulations and policies needed for pollution prevention and risk assessment.
7. Explain modern computer software available for the design, treatment, distribution and analysis of water resources systems.

Course Contents

Introduction: Definition and scope of water resources engineering. Use of water for irrigation, water supply and wastewater engineering, navigation, hydropower generation, environmental sanitation and industrial use. Introduction to surface water hydrology and groundwater hydraulics, control structures such as dams, reservoirs, e.t.c. Introduction to pollution control and abatement. Introduction to field measurement and computation in water resources engineering. Career opportunities in water resources engineering

Introduction to environmental science. Ecosystem's considerations, food chain, natural decomposition, recycling. Environmental problems and impact of engineering activities. Various modes of pollution - water, air, and soil contamination, noise pollution; pollution measurement, and quantification. Water and waste-water physical, chemical, and biological characteristics; turbidity and colour, dissolved oxygen, hardness, pH, alkalinity, organic content, sampling and analysis, chemical and biochemical oxygen demand. Basic processes of treatment: flocculation and coagulation, sedimentation, filtration. Mass and energy balances, chemical reaction engineering. Environmental regulations and policy, pollution prevention, risk assessment.

UAES-GET 313: Engineering Economics [3 Units, C: LH 45]

Learning outcome

It is expected that at the end of this practical course, the students will be able to:

1) define economics and discuss the flow of goods, services, resources, and money payment.
2) give the definition and scope of engineering economics.
3) explain with examples microeconomic and macroeconomic branches of engineering economics in decision making with limited resources.
4) clearly explain the method of determining the selling price of a product.
5) discuss the factors that influence demand and supply.

Course content

The nature and scope of economics. Basic concepts of engineering economy. Elements of cost. Interest formulae. Discounted cash flow. Inflation. Resource depletion. Break-even analysis. Capital financing. Taxes and tax credits. Present worth. Equivalent annual growth, and rate of return comparisons. Replacement analysis. Depreciation. Make or buy decision. Breakdown analysis. Benefit-cost analysis. Minimum acceptable rate of return. Judging attractiveness of proposed investment.

UAES-FME 301 Mechanics of Deformable Bodies (2 Unit; C; LH = 30; PH =)

Course Contents

Three dimensional stress and strain. Theories of failure. Stress concentration. Moments and products of inertia and area. Mohr's strain and inertia circles. Unsymmetrical bending, shear center. Curved beams.

UAES-SWE 303 Hydraulics and Hydrology I (2 Unit; C; LH = 15; PH = 15)

Course Content

Introduction, descriptive hydrology: Hydrologic cycle, precipitation, evaporation and transpiration. Quantitative Hydrology: Hydrography, Volume runoff, storage routing. Groundwater: Occurrence, hydraulics, well, yield. Stream gauging. Watershed management. Flood control.

UAES-SWE 401 Soil Mechanics and Foundation (3 Unit; C; LH = 30; PH = 15)

Course Contents

Formation of soils. Soil-air-water relationship – void ratio, porosity, specific gravity and other factors. Soil classification: Atterberg limits – particle size distribution. Flow in soils – Seepage and permeability. Laboratory work. Soil Structures. Compaction and soil stabilisation, stability of slopes earth pressures, Retaining Walls. Concepts of permeability, stress distribution, shear strength and pressure in relation to foundation engineering. Bearing capacity of soils. Shallow and Deep foundations. Pile foundations. Site Investigation.

UAES-SWE 403 Hydraulics and Hydrology II (3 Unit; C; LH = 30; PH = 15)

Course Contents

Open channels; Hydraulics of open channel flow, culverts and bridges. Steady uniform flow. Steady gradually varied flow. Hydraulic Jump. Surge Waves. Measurement of flow in open channels. Drainage: Estimates of Flow, municipal storm drainage, land drainage, highway drainage, Culverts and Bridges.

UAES-ABE 403: **Land Clearing and Development (2 Unit; C; LH = 30; PH =)**

Learning outcome

It is expected that at the end of this practical course, the students will be able to:

1. Explain the importance of land resources to agriculture and what the Land Use Act in relation to Nigeria culture
2. Describe what land clearing and development entails
3. Explain the equipment used for land clearing and development
4. Identify and describe the machineries used for land clearing and development
5. Explain the meaning and importance of land reclamation
6. Describe earthmoving machinery and its mechanics

Course content

Land resources and Land Use Act in relation to Nigerian agriculture. Objectives, methods and equipment for land clearing and development. Machinery selection, mechanics of operation and vegetation types. Land reclamation. Earthmoving machinery and earthmoving mechanics.

UAES-SWE 408 **Engineering Geology (2 Unit; C; LH = 30;)**

Course Contents

Geological structures and mapping. Rocks and minerals. Stratigraphy – time scale – fossils and their importance: Special reference to Nigeria. Introduction to geology of Nigeria: Engineering Applications – Water supply – site investigations – Dams, Dykes, etc.

UAES-SWE 413 Hydrogeology (Groundwater Hydrology) (2 Unit; C; LH = 15;)

Course Contents

Groundwater and Aquifers: Physical Properties of Aquifers. Darcy's Law and Hydraulic conductivity. Well Flow Systems: Measurement of hydraulic conductivity, Transmissivity, Specific yield and storage coefficient. Groundwater Exploration, well construction and pumping. Mathematical Techniques – Analytical and numerical solutions and simulation. Digital Computers – Finite Difference and Finite Element techniques in groundwater modelling. Unsaturated Flow. Surface – Subsurface water relations. Computer Aided Design in Water Resources

UAES-FME 409 Operation and Management of Farm Power and Machinery Systems (2 Unit; C; LH = 30)

Course Contents

Integrated approach to machinery usage and agricultural production sequence. Equipment selection, scheduling of operation, seasonality factor. Machinery management. Machinery ownership and financing. Gross margin analysis. Optimisation of machinery – input combinations. Management of farm enterprise. Case studies.

UAES-FME 413 Advanced Mechanics of Materials (2 Unit; C; LH = 30)

Course Contents

Thick cylinders; compound cylinders. Rotating disks. Bending of flat plates. Beams on an elastic foundation. Membrane stresses in shells of revolution. Two-dimensional theory of elasticity. Elastoplastic problems and limit theory.

UAES-ABE 506: Properties, Handling, Processing and Storage of Agric. Materials [2 Unit, C: LH 30]

Learning outcome

It is expected that at the end of this practical course, the students will be able to:

1. Explain the properties and characteristics of agricultural materials
2. Describe what the importance of cleaning, sorting, grading and separation of agricultural materials entail and how it can be achieved effectively.
3. Explain the principles and techniques of particle size analysis.
4. Describe the characteristics of packaging materials and testing for structural quality and performance of agricultural materials
5. Design and construct appropriate material handling equipment for agricultural products.
6. Explain the economics of material handling and crop drying
7. Describe the meaning, types and importance of crop storage and the resultant effect of deterioration of produce in storage

Course content

Properties and characteristics of agric. Materials. Cleaning, sorting, grading and separation: Principles, techniques and machine, communication, Particle size analysis. Handling methods. Characteristics of packaging materials. Testing for structural quality and performance. Processing techniques. Physical, mechanical, rheological and thermal properties of agricultural materials. Newtonian and Non-Newtonian fluids. Design and construction of appropriate material handling equipment for tropical products. Economics of material handling. Crop Drying; Heat treatment, Dehydration and drying. Crop storage; Psychrometry, Storage types and environment. Deterioration of produce in storage. Containerization. Design of grain storage structures. Environmental control in storage

UAES-FME 513 Physical Properties of Agricultural Materials (3 Unit; C; LH = 30; PH = 15)

Course Contents

Properties and characteristics of agric. Materials. Cleaning, sorting and grading. Handling methods. Processing techniques. Crop drying. Crop storage.

UAES-FME 5I7 Processing and Drying of Agricultural Product (2 Unit; C; LH = 30)

Course Contents

Cleaning, sorting, grading and separation: Principles, techniques and machine, communication, Particle size analysis. Heat treatment. Dehydration and drying. Psychrometry, Storage types and environment. Deterioration of produce in storage. Containerisation. Design of grain storage structures. Environmental control in storage.

UAES-FME 562 Design and Maintenance of Agricultural Machinery (2 Unit; C; LH = 30)

Course contents

Machine design processes and procedures. Materials of construction: selection, strength properties, stress analysis, costing. Design of machine elements. Machine fabrication. Typical designs of low cost agricultural machinery. Problems and prospects of agricultural machinery development and commercial manufacture in Nigeria.

UAES-**FME 519 Solar Energy Applications to Processing and Storage (2 Unit; C; LH = 30)**

Course contents

Fundamentals of solar radiation. Solar heating and cooling, Heat transfer, solar energy conversion efficiency. Principles of solar collectors. Solar heat storage and storage systems for tropical crops.

UAES-FME 562 Design and Maintenance of Agricultural Machinery (2 Unit; C; LH = 30)

Course Contents

Machine design processes and procedures. Materials of construction: selection, strength properties, stress analysis, costing. Design of machine elements. Machine fabrication. Typical designs of low cost agricultural machinery. Problems and prospects of agricultural machinery development and commercial manufacture in Nigeria.

UAES-SWE 501: Soil and Water Conservation (2 Unit; C; LH = 30)

Learning Outcomes

Upon completion of this course, student should be able to:

1. Explain the general concept of climate change.
2. Identify factors responsible for climate change.
3. Demonstrate knowledge on past and present climates.
4. Understand the mitigation strategies for managing the impacts of climate change.
5. Communicate the existing and potential effects of climate change on agriculture.
6. Explain the technological options for reducing the emission of greenhouse gases.

Course Contents

Types of erosion, Soil erosion by water, Universal soil loss equation. Control of soil erosion by water. Wind erosion and its control, Desertification and control measures. Earth dams and farm ponds. Design of soil conservation structures.

UAES-SWE 507: Advance Irrigation Engineering (2 Unit; C; LH = 30)

Learning Outcome

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

a. Describe the fundamentals of crop water requirement and irrigation system design, including soil-water-plant relationships and water application scheduling techniques.
a. Explain the various types of irrigation systems, including their layout, design, and selection and sizing of their components. They will also have gained knowledge of pumping systems, energy requirements, and water conservation strategies.
b. Explain irrigation system management, including operation, maintenance, automation, and control, as well as performance evaluation of irrigation systems.
c. Explain the concept advanced topics such as irrigation water quality and treatment, advances in irrigation technology, and the impact of climate change on irrigation.
d. Exhibit hands-on experience with fieldwork, case studies, and real-life irrigation engineering problems and solutions, which will have equipped them with practical skills and critical thinking abilities.
e. Carryout hands-on experience with the latest technology used in irrigation engineering, which will prepare them for the workforce and/or further research in the area.

Course Contents

Introduction to Advanced Irrigation Engineering, Overview of the course**,** Historical perspective on irrigation engineering**,** Importance of irrigation engineering**,** Irrigation Water Requirement**,** Crop water requirement and water use efficiency**,** Determining water application rates and scheduling**,** Soil-water-plant relationship**,** Irrigation Systems Design**,** Types of irrigation systems (precision irrigation, drip irrigation, sprinkler irrigation, and micro-irrigation)**,** Layout and design of irrigation systems**,** Selection and sizing of irrigation components**,** Pumping systems and energy requirements, Irrigation Water Management; Water conservation strategies**,** Irrigation scheduling techniques**,** Operation and maintenance of irrigation systems**,** Irrigation system automation and control. Advanced Topics in Irrigation Engineering **(**Irrigation water quality and treatment, Irrigation system performance evaluation**,** Advances in irrigation technology, Climate change and its impact on irrigation)**, Computer Software Programs (**Geographic Information Systems (GIS) software, such as ArcGIS, QGIS, and GRASS GIS, for mapping and analyzing

spatial data related to irrigation systems, Irrigation design software, such as AutoCAD, Irricad, and Land F/X, for designing and simulating irrigation systems, Water management software, such as WaterSmart, SWIIM, and AquaSpy, for managing and monitoring water resources**,** Climate modeling software, such as AquaCrop, DSSAT, and CROPWAT, for assessing the impact of climate change on water resources and irrigation systems**,** Data analysis and visualization software, such as Excel, R, and Tableau, for analyzing and visualizing large datasets related to irrigation systems). Field Work and Case Studies **(**Field trips to irrigation projects and facilities**,** Case studies on real-life irrigation engineering problems and solutions**,** Student projects and presentations)

UAES-ABE 506 Engineering Properties and Handling of Agricultural Materials (2 Unit; C; LH = 30)

Learning outcome

It is expected that at the end of this practical course, the students will be able to:

1. Explain the properties and characteristics of agricultural materials
2. Describe what the importance of cleaning, sorting, grading and separation of agricultural materials entail and how it can be achieved effectively.
3. Explain the principles and techniques of particle size analysis.
4. Describe the characteristics of packaging materials and testing for structural quality and performance of agricultural materials
5. Design and construct appropriate material handling equipment for agricultural products.
6. Explain the economics of material handling and crop drying
7. Describe the meaning, types and importance of crop storage and the resultant effect of deterioration of produce in storage

Course Content

Physical, mechanical, rheological and thermal properties of agricultural materials. Newtonian and Non-Newtonian fluids. Handling methods. Design and construction of appropriate material handling equipment for tropical products. Economics of material handling.

UAES ABE 407: Climate Change Impact and Mitigation (2 Unit; C; LH = 30)

Learning Outcomes

Upon completion of this course, student should be able to:

7. Explain the general concept of climate change.
8. Identify factors responsible for climate change.
9. Demonstrate knowledge on past and present climates.
10. Understand the mitigation strategies for managing the impacts of climate change.
11. Communicate the existing and potential effects of climate change on agriculture.
12. Explain the technological options for reducing the emission of greenhouse gases.
13.

Course Contents

Basic Climate Change Science: Global Warming, Greenhouse Gases and Consequences. Key Terminologies in Climate Change. Past, Present and Future Climate Scenarios. Climate Change Policies and Legal Frameworks. Impact of Climate Change on Agriculture. Drought and Climate Change. Plant Diseases and Climate Change. Insect Pests and Climate Change. Agricultural

Surfaces and Climate Change. Projection of Climate Change Impacts. Climate Change Impacts affecting Poverty Alleviation. Mitigation and Adaptation Strategies for Managing the Impacts of Climate Change. Modern Agro-Meteorological Techniques. Climate Smart Agriculture. Overview of Climate Change Models.

UAES-SWE 505 Water and Waste Water Engineering (3 Unit; C; LH = 45)

Course Contents

Water and wastewater inter-relationship, water and health water-borne diseases. Elements of water chemistry. Treatment processes for surface water and for groundwater. Design fundamentals for water supply, treatment and water distribution systems, including storage, pumping and piping. Sources of wastewater, Industrial and domestic wastewater surveys. Elements of wastewater microbiology; waste – water collection, treatment and disposal and their designs. Wastewater re-use-option and alternatives. Effluent standards.

UAES-SWE 506 Drainage and Irrigation Engineering (3 Unit; C; LH = 45)

Course Contents

Land classification: Crop Water requirements; Crop: Irrigation requirements; Farm delivery requirements; Diversion requirements; Soil-water relationships; Movement of soil moisture; Measurement of Infiltration and Soil Moisture: Irrigation water quality. Irrigation Planning Criteria.

Irrigation Methods; supplemental Irrigation, Irrigation structures. Design, construction, operation and maintenance of surface, sub-surface and sprinkler irrigation systems. Surveys and Investigation – Sources of water, soils and salinity. Water Tables; Drainage structures. Subsurface drains. Design criteria – Drain size, materials used; Installation of subsurface Drains; Urban Storm Drainage. Land Drainage.