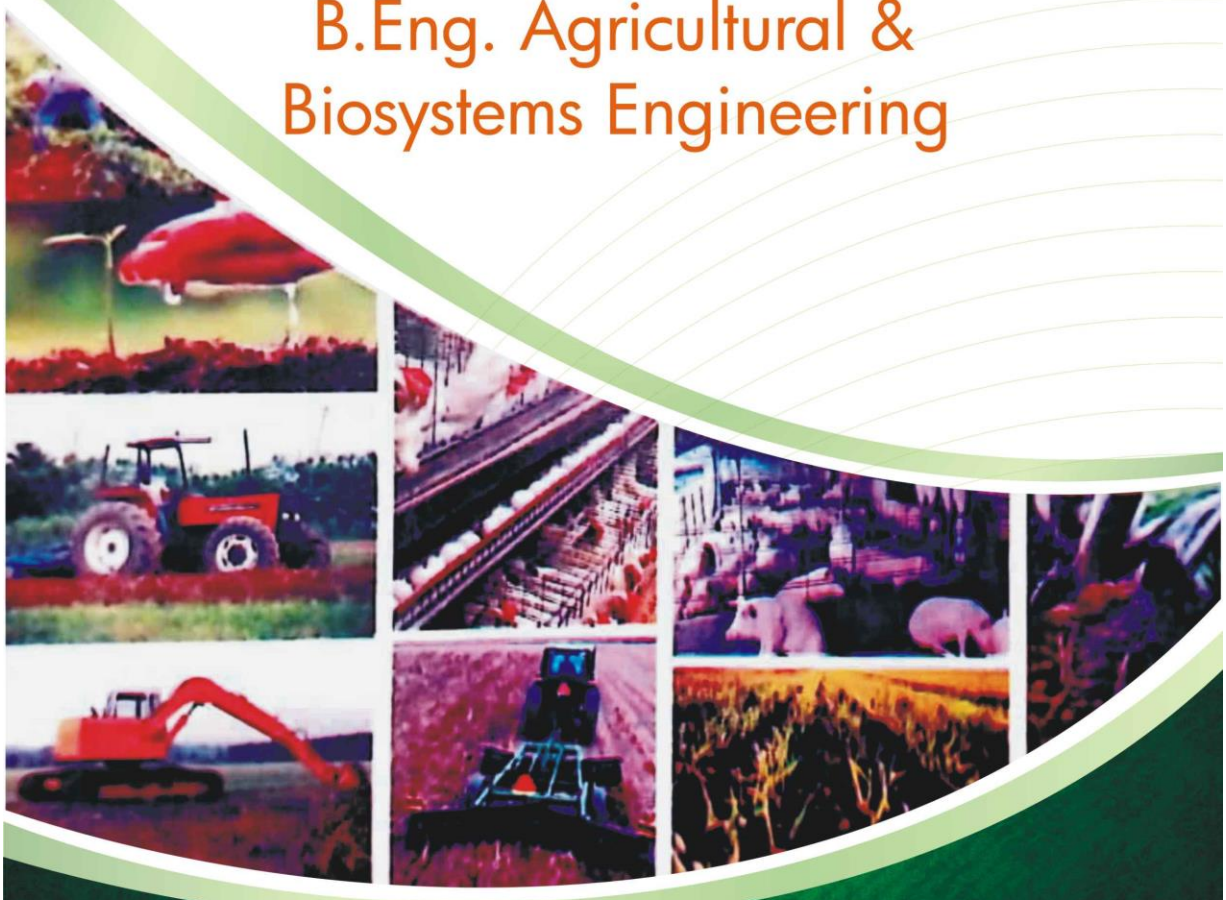
NIGER DELTA UNIVERSITY

Wilberforce Island

B.Eng. Agricultural & Biosystems Engineering



STUDENT HANDBOOK

2023 - 2028

NIGER DELTA UNIVERSITY, WILBERFORCE ISLAND
FACULTY OF ENGINEERING
DEPARTMENT OF AGRICULTURAL & BIOSYSTEMS ENGINEERING

Mission Statement of the University

To strive to maintain an international reputation for high quality scholarship, research and academic excellence, for the promotion of the social, cultural and economic well-being of mankind.

Vision Statement of the University

To be a centre of excellence defined by well-articulated programmes that will produce creative and innovative minds.

Motto

Creativity, Excellence and Service

Principal Officers of the University

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   DR. BIOKUROMOYE FYNEMAN PhD (IMSU)

Staff of the Department of Agricultural & Biosystems Engineering

S/No.	Name	Qualification	Area of Specialization	Designation
1.	Engr. Prof. Rotimi Moses Davies	BSc (IBADAN), MSc (IBADAN), PhD (ABU), MASABE, COREN	Agricultural Processing & Storage Engineering, & Renewable Energy	Professor/HOD
2.	Engr. Prof. Woyengi-Ebinipre Burubai	BTech (RSUST), MTech (RSUST), PhD (RSUST), MNIAE, COREN	Agricultural Processing & Storage Engineering	Professor
3.	Engr. Dr. Ebizimor A. Kiridi	BSc (RSUST), MSc, PhD (UNILORIN), COREN	Soil & Water Engineering	Senior Lecturer
4.	Dr. D. Castro D. Mathew	BSc (RSUST), MSc (UK) PhD (UK)	Environmental Engineering	Senior Lecturer
5.	Engr. D. Wenapere	BTech (RSUST) MTech (RSUST), COREN	Farm Structure Engineering	Lecturer I
6.	Engr. Dr. P. Diwenist Ebienfa	BSc (Belarus), MSc (Belarus), PhD	Agricultural Processing & Storage Engineering	Lecturer I
7.	Engr. Ifiemi Tulagha-Ocholi	BEng (NDU), MSc (UI), PhD (IN VIEW)	Agricultural Processing & Storage Engineering	Lecturer II
8.	Engr. Branly Eric Yabefa	BTech (RSUST), MSc (RSUST), PhD (IN VIEW)	Farm Structure Engineering	Lecturer II
9.	Engr. Jonathan Biebelemo	BEng (NDU), MEng (NDU), PhD (IN VIEW)	Farm Structure Engineering	Lecturer II
10.	Mr. Tariebi Karikarisei	MSc (Belarus)	Agricultural Mechanization	Lecturer II
11.	Mr. Dandy Makpah	BEng (NDU)	Farm Power & Machinery	Graduate Assistant

B.Eng Agricultural and Biosystems Engineering

Overview

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

Philosophy

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.

Objectives

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.

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.

21st Century Skills

A graduate of the Agricultural and Biosystems Engineering programme is expected to have ability to:

1. Collaboration (teamwork and ethics);
2. Citizenship (local and global);
3. Learning to 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.

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.

Admission and Graduation Requirements
Admission Requirements

Candidates are admitted into the degree programme in any of the following two ways:

1. Indirect Entry (5 Year Degree Programme)

2. Direct Entry (4 Year Degree Programme)

Indirect Entry
For Five year Indirect admission, in addition to acceptable passes in Unified Tertiary Matriculation Examination (UTME), the minimum academic requirement is credit level passes in Senior Secondary Certificate (SSC) in at least five subjects which must include English Language, Mathematics, Physics, Chemistry and other acceptable science subject at not more than two sittings.

Direct Entry
For Four year Direct Entry, in addition to five (5) Senior Secondary Certificate (SSC) credit passes which must include English Language, two of which must be principal subjects at Advance GCE Level or NCE and its equivalent. Holder of upper credit level at HND are eligible for consideration for admission into 300 levels respectively.

Graduation Requirements
The following regulations shall govern the conditions for the award of a honours degree in Engineering and Technology:

1. Candidates admitted through the UTME mode shall have registered for a minimum of 150 and maximum of 180 units of courses during the 5 – year engineering degree programme. Such candidates shall have spent a minimum of ten academic semesters.
2. Candidates admitted through the Direct entry mode shall have registered for minimum of 120 and maximum of 150 units of courses during a 4– year engineering degree programme. Such candidates shall have spent a minimum of eight academic semesters
3. The minimum and maximum credit load per semester is 15 and 24 credit units respectively.
4. A student shall have completed and passed all the Courses registered for, including all compulsory courses and such elective /optional courses as may be specified by the university/faculty or department; obtained a minimum Cumulative Grade Point Average (CGPA) specified by the university but not less than 1.00.
5. A student shall also have earned the 15 credit units of Students Industrial Work Experience Scheme (SIWES), eight credit units of University General Study courses and four credit units of Entrepreneurship courses.

For the purpose of calculating a student's cumulative grade point average (CGPA) in order to determine the class of Degree to be awarded, grades obtained in ALL the courses registered, whether compulsory or optional and whether passed or failed must be included in the computation. Even when a student repeats the same course once or more before passing it or substitutes another course for a failed optional course, grades scored at each and all attempts shall be included in the computation of the GPA.

Furthermore, if a student fails to graduate at the end of normal academic session, he or she would not be allowed to exceed a total of 15 semesters in the case of students admitted through UTME and 13 semesters in the case of Direct Entry students.

Global Course Structure

Level	GST	ENT	Basic Sciences	Faculty (GET)	Programme (ABE)	SIWES	Total
100	4	0	16	3	2	0	25
200	2	2	0	23	0	3	30
300	2	2	0	12	20	4	24
400	-	0	0	0	0	8	8
500	-	0	0	5	14	0	18
Total	**8**	**4**	**16**	**43**	**34**	**15**	**105**

100 level

Course Code	Course title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian People and Culture	2	C	30	-
CHM 101	General Chemistry I	2	C	30	-
CHM 102	General Chemistry II	2	C	30	-
CHM 107	General Practical Chemistry I	1	C	-	45
CHM 108	General Practical Chemistry II	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 102	General Physics II	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45
GET 101	Engineer in Society	1	C	15	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
ABE 102	Introduction to Agricultural and Biosystem Engineering	2	C	30	-
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
NDU-MTH 105	Basic Mathematics	2	C	30	-
NDU-PHY 103	Principles of Physics I	2	C	30	-
NDU-PHY 106	Principles of Physics I1	2	C	30	-
NDU-ABE 108	Agricultural and Biosystems Engineering Tools & Equipment	3	C	30	45
NDU-ABE 110	Statistics for Agricultural and Biosystems Engineering	3	C	45	-
Total		**37**			

200 Level

Course Code	Course title	Units	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
ENT 211	Entrepreneurship and Innovation	2	C	30	-
GET 201	Applied Electricity I	3	C	45	-
GET 202	Engineering Materials	3	C	45	-
GET 204	Students Workshop Practice	2	C	15	45
GET 205	Fundamentals of Fluid Mechanics	3	C	45	-
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
GET 211	Computing and Software Engineering	3	C	45	-
GET 299	SIWES I	3	C	9 Weeks	
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
NDU-GET 201	Fundamentals of Engineering Graphics	3	C	30	45
NDU-GET 206	Principles of Mechanics	3	C	45	-
NDU-GET 210	Basic Strength of Materials	3	C	45	-
NDU-ABE 215	Solar Energy Application in Agricultural Processing	3	C	15	45
Total		**42**			

300 Level

Course Code	Course title	Units	Status	LH	PH
ENT 312	Venture Creation	2	C	15	45
GST 312	Peace and Conflict Resolution	2	C	30	-
GET 304	Technical Writing and Communication	3	C	45	-
GET 305	Engineering Statistics and Data Analysis	3	C	45	-
GET 306	Renewable Energy Systems and Technologies	3	C	30	45
GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies	3	C	45	-
ABE 301	Design of Machine and Structural Elements	2	C	15	45
ABE 302	Animal Production	2	E	30	-
ABE 303	Crop Production	2	E	30	-

ABE 304	Farm Management, Rural Sociology and Agricultural Extension	2	E	30	-
ABE 305	Soil Science	2	E	30	-
ABE 306	Land Surveying and Geographic Information System	2	E	15	45
ABE 307	Biosystems Engineering	2	C	30	-
ABE 308	Rural Infrastructural Engineering	2	E	30	-
GET 399	SIWES II	4	C	12 weeks	
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
NDU-ABE 310	Processing and Storage of Biomaterials	3	C	30	45
NDU-ABE 311	Aquatic Resources Engineering	3	C	30	45
NDU-ABE 315	Fundamental Heat and Mass Transfer	3	C	15	45
NDU-GET 371	Engineering Economics	3	C	45	-
NDU-ABE 321	Agricultural Land Surveying and Farmstead Planning	3	C	30	45
Total		**47**			

400 Level

Course Code	**Course title**	**Units**	**Status**	**LH**	**PH**
ABE 401	Instrumentation and Measurement in Agricultural and Biosystems Engineering	3	E	30	45
GET 499	SIWES III	8	C	-	24 weeks
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
NDU-ABE 411	Farm Power and Machinery	3	E	30	45
NDU-ABE 421	Introduction to Farm structures, Tendering and Estimation	3	E	30	45
NDU-ABE 431	Environmental Engineering	3	C	30	45
NDU-ABE 441	Soil and Water Conservation Engineering	3	E	30	45
Total		**23**			
Student Industrial Work Experience (SIWES**)**					
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

Course Code	Course title	Units	Status	LH	PH
GET 501	Engineering Project Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
ABE 501	Environmental and Social Impact Analysis	2	C	30	-
ABE 502	Aquaculture and Agroponics Engineering	2	C	30	-
ABE 503	Livestock Production Engineering	2	C	30	-
ABE 504	Greenhouse Technology	2	C	30	-
ABE 505	Drone and Robot Technology in Agriculture	2	C	15	45
ABE 599	Final Year Project	3	C	15	90
Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
NDU-ABE 501	Agricultural Waste Management	3	C	30	45
NDU-ABE 508	Indigenous Crops Processing and Storage Engineering	3	E	30	45
NDU-ABE 509	Fundamental of Agricultural Mechanization	2	C	15	45
NDU-ABE 510	Baking Technology	3	E	30	45
NDU-ABE 512	Fish and meat processing and Storage	3	E	30	45
NDU-ABE 522	Design and Analysis of Farm Structures	3	C	30	45
NDU-ABE 531	Farm and Rural Electrification	3	C	30	45
NDU-ABE 534	Refrigeration and Air Conditioning systems	3	C	30	45
NDU-ABE 542	Flood and Drainage Engineering	3	C	30	45
NDU-ABE 543	Farm and Rural Water Supply	3	C	30	45
NDU-GET 571	Principles of Engineering Management	2	C	30	-
Total		**49**			

Course Contents and Learning Outcomes

100 Level

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)

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

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 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.

NDU-MTH 105 Basic Mathematics (3 Units; C; LH 45)

Senate-approved Relevance
Training of high-quality graduates that are well skilled and knowledgeable in the required mathematical skills in Nigeria is in line with NDU's mission to address African developmental challenges in producing graduates in agricultural and biosystems engineering. Relevance is seen in Agricultural and Biosystems Engineering in Niger Delta University been able to produce graduates that are technologically-oriented and self-reliant.

Overview
Vectors coordinate geometry and dynamic is a vital course which prepares the graduate in agricultural and biosystems engineering to be able to appropriate mathematical skills required in Science and Engineering, use mathematical Techniques in solving real life problems and improve on the infrastructural deficit for sustainable development. This highlights the importance of preparing students in chemical engineering with the knowledge and skills on how to solve problems which they will encounter in the course of their training.

This course is designed to introduce and prepare students on how mathematics could be used in solving problems in the contemporary Scientific world. Thus, the course is structured to expose students to the skills required in other to attain a level of proficiency in sciences, technology and engineering professions. The significance of the course lies in meeting the need in achieving sustainable development goals (SDGs) numbers 1 and 2 in the areas of reducing poverty and zero hunger respectively. The objectives of the course, learning outcomes, and contents are provided to address this need

Objectives
The objectives of the course are to:
1. define vectors, types of vectors, physical quantities of vectors, geometrical representation of vectors;

2. describe components of a vector in terms of unit vectors and vectors in space;
3. explain basic operations on vectors dimensional coordinates systems;
4. discuss, solve some vectors in addition and multiplication and represent a vector in its coordinate form;
5. enumerate equation of circle, tangent and normal to a circle;
6. state the properties of parabola, ellipse, hyperbola, straight lines and planes in space;
7. describe components of velocity and acceleration of a particle moving in a plane;
8. solve differentiation and integration of vectors with respect to a scalar variable;
9. explain and calculate force, momentum, laws of motion under gravity, projectiles, resisted vertical motion, angular momentum and simple harmonic motion; and
10. enumerate impact of two smooth spheres and of a sphere on a smooth surface.

Learning outcomes

On completion of the course, students should be able to:

1. define at least four types of vectors;
2. describe at least three components of a vector in terms of unit vectors and vectors in space.
3. explain two basic operations on vectors dimensional coordinates systems;
4. discuss at least two ways of solving vectors in addition and multiplication and represent a vector in its coordinate form;
5. enumerate at least four different equation of circle, tangent and normal to a circle;
6. state at least four characteristics of parabola, ellipse, hyperbola, straight lines and planes in space;
7. describe at least three components of velocity and acceleration of a particle moving in a plane;
8. solve at least five differentiation and integration of vectors with respect to a scalar variable;
9. explain at least four simple harmonic motion; and
10. enumerate at least three impacts of two smooth spheres and of a sphere on a smooth surface.

Course contents

Define vector. Types of vectors: Position vector, Line vector, free vector. Geometric representation of vectors in 1 – 3 dimensions. Physical quantities of vectors. Two equal vectors. Addition of vectors. Components of a vector in terms of unit vectors and vectors in space. Direction Cosines. Scalar product of two vectors. Basic operations on vectors including: addition, subtraction, and scalar multiplication. Represent a vector in its coordinate form, as a directed line segments and as a linear combination of unit vectors. Interpret these operations geometrically. Loci. Coordinate Geometry (Circle). Parabola. Ellipse and Hyperbola. Scalar, multiplication of vectors, linear independence. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse,

hyperbola. Tangents, normal, Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles, resisted vertical motion. Angular momentum. Simple harmonic motion, elastic string, simple pendulum, impulse. Impact of two smooth sphere and of a sphere on a smooth surface.

Minimum Academic Standards
General engineering laboratory with a NUC-MAS requirement facilities.

NDU-PHY 103: Principle of Physics 1 (2 Units, C; LH 30)

Senate-approved Relevance
The vision of the Niger Delta University is to train skilled and practical-oriented graduates of high academic standard to fit into either academic or industrial set-up. The students will be expose to field viewpoint and the action-at-a-distance viewpoint of electric and magnetic forces and have capacity to solve mechanical and electrical oscillating system problems. Relevance is seen in agricultural and biosystems engineering from NDU being able to address the electric energy crises.

Overview
This course therefore offers students an in-depth knowledge in the computation of resistances, capacitances, and inductances for simple geometries and understand the effect of conductive, dielectric, and magnetic media for such geometries and also to be able to solve simple AC-Circuit problems involving characteristics such as impedances, resonance, power, phase and as well as the use the oscilloscope to measure time-varying voltages, frequencies, periods, amplitudes, phase. Demonstrate understanding of Ohm's Law for resistors, and also the constitutive defining relations for capacitors and inductors.

This course is designed to produce broad-based engineers as the content of this course indicate. The learning outcomes will inspire students to solve simple problems computing the magnetic field and magnetic forces on moving charges and wires. The students will be equipped to solve simple DC-Circuit problems such as RC, RL, RLC circuits with various characteristics involving the charging discharging and "relaxation of such circuits.

Objectives
The objectives of the course are to:

1. explain the concepts of electric and magnetic fields;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. distinguish measure and compute electric current in d.c and a.c. circuit;
4. state principles of electromagnetic induction as they apply to both d.c. and a.c. generators;
5. demonstrate how circuit elements are connected;

6. describe the principles of cathode ray oscilloscope, ammeters, voltmeters, x-ray tubes and dry cells as well as accumulators;
7. identifying the advantages and disadvantages of x-rays;
8. describe the structure of the nuclear atom;
9. describe the terrestrial magnetic field; and
10. distinguish between nuclear fusion and nuclear fission.

Learning Outcomes

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

1. explain at least two concepts of electric and magnetic fields;
2. describe at least four electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. mention five differences between measure and compute electric current in d.c and a.c. circuit;
4. state at least five principles of electromagnetic induction as they apply to both d.c. and a.c. generators;
5. discuss three methods on how circuit elements are connected;
6. describe at least four principles of cathode ray oscilloscope, ammeters, voltmeters, x-ray tubes and dry cells as well as accumulators;
7. identify at least four advantages and disadvantages of x-rays;
8. describe the structure of the nuclear atom;
9. enumerate at least three terrestrial magnetic field; and
10. state five differences between nuclear fusion and nuclear fission.

Course Contents

Electric charge. Force and Field. Gauss's Law. Electric Potential. Potential for Continuous Charge Distribution and Energy. Dielectrics and Capacitors, Electric Current. Direct-Current Circuits and Instrument. Magnetic Field. Motion of Charge Particles in Electric and Magnetic Field. Electrolysis and Cells. Thermal Effects of Electric Currents and Electric Power. Magnetic Properties of Matter. Terrestrial Magnetism. Electromagnetic Induction. Electromagnetic Induction. Alternating Current Theory. Thermoelectric. Photoelectric Thermionic Effects. Forces in nature. Electrostatics (electric charge and its properties, methods of charging). Coulomb's law and superposition. Electric field and potential. Gauss's law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators. DC circuits (current, voltage and resistance. Ohm's law. Resistor combinations. Analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère's laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step-down transformers. Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, and resistance.

Minimum Academic Standards

General engineering laboratory with a NUC-MAS requirement facilities.

NDU- PHY 106: Principles of Physics I1 (2 Units; C; LH 30)

Senate-approved Relevance

The vision of the Niger Delta University is to produce a globally relevant and competitive graduates who are highly skilled and knowledgeable in vibrations and waves, including the harmonic oscillator, the wave equation, wave propagation, and optics to address the challenges of the 21st century. Relevance is seen in agricultural and biosystems engineering from NDU being able to turn out high quality graduates that are self-reliant, problem solvers, and effective army of human capital for the nation.

Overview

This course will equip the students with broad knowledge of vibrations and waves, including the harmonic oscillator, the wave equation, wave propagation, and optics. The ideas covered in this course will form a fundamental basis for understanding an enormous range of physical phenomena and therefore are key for all physicists and engineers.

This course is designed expose students to the fundamental concepts and mathematical treatment of mechanical vibrations and physical waves, to explore various phenomena arising from the superposition of two or more waves, and to outline some of the general principles governing the propagation of light. This course is designed to produce broad-based engineers as the content of this course indicate. The learning outcomes will inspire students have basic understanding of simple harmonic, oscillatory, and vibration motions, propagation and properties of waves in sound and light, explain the physics of the laser and processes involved in producing laser radiation to solve simple problems.

Objectives

The objectives of the course are to:

1. distinguish simple harmonic, oscillatory, and vibration motions;
2. identify plane electromagnetic waves energy and waves propagation;
3. describe the transport of electromagnetic energy;
4. explain scattering, interference, diffraction, reflection, polarization, and refraction of electromagnetic waves;
5. enumerate problems which require the use of wave representations of electric and magnetic fields in propagating electromagnetic waves;
6. state simple examples of interference and diffraction phenomena;
7. explain the propagation and properties of waves in sound and light;
8. list the principles of operation of a range of equipment used in modern optics, notably the Michelson interferometer and Fabry-Perot etalon; and
9. mention the physics of the laser and processes involved in producing laser radiation to solve. simple problems.

Learning Outcomes

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

1. state at least four differences between simple harmonic, oscillatory, and vibration motions;
2. identify at least three plane electromagnetic waves energy and two types of waves propagation;
3. describe at least three transport of electromagnetic energy;
4. explain at least two types of scattering, interference, diffraction, reflection, polarization, and refraction of electromagnetic waves;
5. enumerate at least four problems which require the use of wave representations of electric and magnetic fields in propagating electromagnetic waves;
6. state at least three simple examples of interference and diffraction phenomena;
7. explain at least three ways propagation of light and four properties of waves in sound and Light;
8. list at least three principles of operation of a range of equipment used in modern optics, notably the Michelson interferometer and Fabry-Perot etalon; and
9. mention at least four lasers and processes involved in producing laser radiation to solve simple problems.

Course Contents

Concept of Simple harmonic motion (SHM). Oscillatory motion. Vibration motion. Energy in a vibrating system. Damped SHM. Resonance and transients. Coupled SHM. Q values and power response curves. Normal modes. Waves (types and properties of waves as applied to sound). Transverse and longitudinal waves (superposition, interference, diffraction, dispersion, polarization). Waves at interfaces (energy and power of waves). Review of Maxwell's equations and wave equations in a dielectric. Electromagnetic potentials. Propagation of plane and spherical waves. Huygen's wavelets and Fermat's principle. Michelson interferometer and Fabry-Perot etalon. Fourier transform spectroscopy. Young's slits. Lloyd's mirror. Fraunhofer diffraction. The wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo and beats. The Doppler-effect. Propagation of sound in gases, solids and liquids and their properties. Nature and propagation of light. Reflection and refraction. Resolution of optical instruments. Internal reflection. Scattering of light. Reflection and refraction at plane and spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Dispersion. Huygens's principle (interference and diffraction). Wave guides and optical cavities. Lasers (rate equation, Steady state operation; threshold and efficiency).

Minimum Academic Standards

General engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 108 Agricultural and Biosystems Engineering Tools & Equipment

(3 units; C; LH 30; PH 45)

Senate-approved Relevance

The vision of Niger Delta University is to turn out graduates of creativity, excellence and high-performance service providers to fit into either academic or industrial set-up with sound knowledge in both practical and theoretical approaches to the art of application of the related principles in designing, equipment, and agricultural production, handling and processing of biological materials for food, feed, fibre and fuel. Relevance is seen in agricultural engineers from NDU being able to design, manufacture, protect, preserve, install, manage and operate the equipment and tools in the laboratories for better performance and safety being the watchword.

Course Overview

This course offers in-depth knowledge in designing, installing, maintaining and operating agricultural and biosystem Engineering equipment and tools for conserving livestock and crops, processing and storage, and reducing labour requirements to a minimum. This course empowers graduates to lead the agricultural transformation of food production in Africa to address the challenges of meeting the Sustainable Development Goals (SDGs).

The maintenance of tools and equipment is fundamental to the effective operation of any agricultural and biosystems engineering project works. This course will equip students with a first-class knowledge of available equipment and tools, handling, operation, maintenance and safety consciousness. Proper care and maintenance of tools and equipment will increase durability, and efficiency, reduction in the costs of replacement, ensure the safety of the user/avoid accidents and damage to the equipment and tools. This course empowers graduates to lead the agricultural transformation of food production in Africa to address the challenges of meeting the Sustainable Development Goals (SDGs).

Objectives

The objectives of the course are to:

1. identify different types of tools and equipment used in Agricultural and biosystems Engineering laboratories;
2. list the tools and equipment in the different units of the Agricultural and biosystems Engineering laboratories;
3. discuss the precision of various tools and equipment in the laboratories;
4. describe the use of various tools and equipment;
5. enumerate safety precautions of the equipment and tools;
6. state the precision of tools and equipment in Agricultural and biosystems Engineering Laboratories;
7. describe ten maintenance practices on tools and equipment;
8. explain the function of the tools and equipment;

9. discuss safety implications of each tool/equipment;
10. enumerate how safety of tools and equipment can prevent accidents; and
11. identify one or more operation that is possible with each equipment/tool.

Learning Outcomes

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

1. identify at least twenty different types of tools and equipment used in Agricultural and biosystems Engineering laboratories;
2. list at least twenty tools and equipment in the different units of the Agricultural and biosystems Engineering laboratories;
3. discuss at least four precisions of tools and equipment in the laboratories;
4. describe at least five uses of each of tool and equipment;
5. enumerate at least ten safety precautions of the equipment and tools;
6. state at least four precisions of tools and equipment in Agricultural and Biosystems Engineering Laboratories;
7. describe ten maintenance practices on tools and equipment;
8. explain at least five functions of the tools and equipment;
9. discuss seven safety implications of each tool/equipment;
10. enumerate at least seven on how safety of tools and equipment can prevent accidents; and
11. identify at least four operations that are possible with each equipment/tool.

Course contents

Introduction to Agricultural and biosystems Engineering tools. Equipment used in Agricultural and biosystems Engineering. Importance of tools and equipment in Agricultural and biosystems Engineering works and research. Quality of tools. Characteristics of suitable hand tools. Tools for clearing. Equipment for tillage operations. Tools for gravelling. Tools for setting out. Maintenance of tools and storage. Laboratory safety. Operating manual. Crops processing equipment. Farm structures equipment and tools. Soil and water equipment. Farm power and Machinery. Environmental Engineering equipment and tools. Safety precautions. Care and maintenance of tools and equipment. Operation equipment. Estimating equipment precision. Detecting faulty equipment. farm clearing. Construction principles.

Minimum Academic Standards

General engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 110 Statistics for Agricultural and Biosystems Engineering

(3 Units; C; LH 45)

Senate – approved Relevance

The vision of Niger Delta University, is to produce graduates of excellence and creativity that can launch their careers in Nigeria and overseas with sound knowledge in both practical

and theoretical approaches to the art of application of the related principles in in the management of data, including ways to gather, review, analyse, and draw conclusions from data. Relevance is seen in Agricultural and Biosystems Engineers from NDU been able to produce highly technologically-oriented and self-reliant high-level manpower committed to self-employment as the basis for national development.

Overview.

This course is designed to enable students acquire far-reaching knowledge in the management of Agricultural and Biosystems Engineering data, including ways to gather, review, analyse, and draw conclusions from data and this will facilitate the decision-making process by quantifying the element of chance or uncertainties. This course will equally provide broad based education in the use of a limited sample to make intelligent and accurate conclusions about a greater population. The use of tables, graphs, and charts will also play a vital role in presenting data being used to draw these conclusions.

Students are given intensive exposure to probability and introductory statistical methods, introducing the ideas of likelihood and regression modelling. Other statistics topics that will be covered include experimental design, inference, computational inference, sampling and databases, and sources and methods of collection presentation of data. Graduates of the programme will acquire sufficient theoretical and practical knowledge to enhance sustainability of a better development and can compete favourably in any place.

Objectives

The objectives of the course are to:

1. explain the scope for statistical methods in Agricultural and Biosystems Engineering;
2. state the importance of Statistics to Agricultural and Biosystems Engineering;
3. explain the elements of probability. probability distributions: binomial, Poisson, geometric; hypergeometric, negative binomial and normal, student's t and chi-square distributions;
4. differentiate point from interval estimation and could be able to test for hypotheses concerning population means, proportions and variances;
5. describe for regression and correlation as well as conduct some non–parametric tests with reference to contingency table analysis;
6. explain the elements of design of experiments and analysis of variance;
7. describe the types of statistics;
8. identify the difference between deterministic and statistical (Stochastic) models;
9. outline the differences that exist among: binomial distribution, normal distribution, geometric distributions, poisson distribution, negative binomial distributions and exponential distribution;
10. define reliability function and state the relation mathematically; and
11. define regression and carry out linear regression on set of given data.

Learning Outcome

On completion of the course, students should be able to:

1. explain at least four scopes for statistical methods in Agricultural and Biosystems Engineering;
2. state at least five the importance of Statistics to Agricultural and Biosystems Engineering;
3. explain at least three elements of probability. probability distributions: binomial, Poisson, geometric, hypergeometric, negative binomial and normal, student's t and chi-square distributions;
4. state at least four different points from interval estimation and could be able to test for hypotheses concerning population means, proportions and variances;
5. describe at least two types for regressions and correlations as well as conduct some non–parametric tests with reference to contingency table analysis;
6. explain three elements of design of experiments and analysis of variance;
7. describe the five types of statistics;
8. state at least five differences between deterministic and statistical (Stochastic) models
9. outline at least three differences that exist among: binomial distribution, normal distribution, geometric distributions, Poisson distribution, negative binomial distributions and exponential distribution;
10. define at least three reliability functions and state the relation mathematically; and
11. state two types of and regression and carry out linear regression on set of given data.

Course contents

Scope of statistics and probability. Statistical method in Agricultura and biosystems engineering. Statistical data. Types, sources and methods of collection. Presentation of data. Tables chart and graph. Errors and approximations. Frequency and cumulative distributions. Measures of location, partition, dispersion, skewness and Kurtosis. Rates, ratios and index. Concepts and principles of probability. Permutation and combination. Random variables. Elements of probability distributions. Binomial distributions. Poisson distributions. geometric distributions. Hypergeometric distributions. Negative binomial and normal distributions. sampling distributions and exploratory data analysis Student's t and chi-square distributions. Reliability function. Estimation (point and interval) and tests of hypotheses concerning population means, proportions and variances. Regression and correlation. Non–parametric tests. Contingency table analysis. Introduction to design of experiments. Analysis of variance.

Minimum Academic Standards

General engineering laboratory with a NUC-MAS requirement facilities.

200 Level

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).

NOTE: **Each programme to indicate additional details of programme-specific activities for their students.**

NDU-GET 201: Fundamentals Engineering Graphics (3 Units; C; LH 30; PH 45)

Senate-approved Relevance
Producing high-quality graduates who are highly skilled and informed in the fundamental concepts and principles of engineering graphics as a language useful in agricultural processing are desirable areas in Nigeria and agree with NDU's vision to apply technology-driven knowledge to creativity and excellence, thereby meeting socio-cultural needs of the society through the production of competent agricultural and biosystems engineering graduates. Relevance is seen in agricultural

and biosystems graduates from NDU being able to identify problems of graphics in the designs and construction of appropriate machines to meet indigenous sustainable food production needs.

Overview

The Engineering Graphics course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections). Dimension and annotate two-dimensional engineering drawings. The application of industry standards and best practices applied in engineering graphics. Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically. Introduce CAD software for the creation of 3D models and 2D engineering drawings.

This course will empower students on engineering graphics and the concepts of engineering design. It includes sketching, dimensioning practices and tolerances, computer-aided design (CAD), basic part modeling, and three-dimensional (3D) assembly modeling. The students will be knowledgeable in the fundamental concepts and principles of the computer-aided design (CAD) system and also the ability to read engineering drawings.

Objectives

The objectives of the course are to:

1. explain the basic terminology and geometrical explain relationships associated with dimensioning practice;
2. explain how to prepare detailed working drawing of objects and designs;
3. enumerate at least four fundamental concepts and principles of engineering graphics;
4. identify at least three methods of orthographic projection to produce detail;
5. describe the fundamental concepts and principles of the computer-aided design (CAD) system;
6. identify objects, sketch engineering lettering and dimensioning by freehand;
7. enumerate at least four needs for the theoretical perspectives that create the basis for the analysis that are possible in design and optimization, and recognize/understand the practical link to excite their creativity and ability to innovate;
8. describe production of shop drawings for multi-physical, multidisciplinary design;
9. state orthographic projection method to obtain: Multiview, auxiliary view and section view of an object; and
10. identify sketching techniques to the creation of solid features through the use of extrusions, cuts, rotations, patterns and sweeps.

Learning Outcomes

Students should be able to:

1. explain at least three basic terminology and geometrical explain relationships associated with dimensioning practice;
2. explain at least three ways on how to prepare detailed working drawing of objects and designs;
3. enumerate at least four fundamental concepts and principles of engineering graphics;
4. identify at least three methods of orthographic projection to produce detail;

5. describe three the fundamental concepts and principles of the computer-aided design (CAD) system;
6. identify at least four Objects, Sketch engineering lettering and dimensioning by freehand;
7. enumerate at least four needs for the theoretical perspectives that create the basis for the analysis that are possible in design and optimization, and recognize/understand the practical link to excite their creativity and ability to innovate;
8. describe at least three production of shop drawings for multi-physical, multidisciplinary design;
9. state at least two orthographic projection method to obtain: Multiview, auxiliary view and section view of an object; and
10. identify at least three sketching techniques to the creation of solid features through the use of extrusions, cuts, rotations, patterns and sweeps.

Course Contents

Introduction to limits, fits and tolerance. Surface roughness determinations. Drawing methods for cam profiles. Presentation and drawing of various types of gears. Projection of lines, auxiliary views and mixed projection. fundamental concepts and principles of the computer-aided design (CAD) system. Preparation of detailed working production drawing; semi-detailed drawings, conventional presentation methods. Solid, surface and shell modeling. Faces, bodies and surface intersections. Component-based design. Component assembly and motion constraints. Constrained motions and animation. Introduction to electronics modeling. Electronics board layout preparation, Component libraries and Schematic design. Parametric modeling and adaptive design. Simulation for material optimization. Designing for manufacturing. Additive and subtractive manufacturing. Production for 3-D printing, Laser cutting and CNC machinery. Arrangement of engineering components to form a working plant (Assembly Drawing of a Plant). Assembly and sub-assembly drawing of elements. Workshop drawing correction and modification of drawings symbols. Reading of blueprints.

Minimum Academic Standards

General engineering laboratory with a NUC-MAS requirement facilities.

NDU-GET 206: Principles of Mechanics (3 Units; C; LH 30; PH 45)

Senate-approved Relevance

The vision of the Niger Delta University is to train skilled and practical-oriented graduates of high academic standard to fit into either academic or industrial set-up. The students will be expose to field viewpoint and the action-at-a-distance viewpoint of to develop skills to use the basic principles of mechanics in engineering applications and have capacity to solve applied mechanics problems. Relevance is seen in agricultural and biosystems engineering from NDU being able to address the mechanization problems faced by farmers.

Overview

This course offers students an in-depth knowledge in the application of Newtonian physics to relatively simple physical situations. It follows on from the Statics course, but considers systems that are not in equilibrium i.e. with velocity and acceleration. Some of the topics covered are pure kinematics (a mathematical description of motion only), while others are kinetic (determine motion in problems involving the concepts of force and energy).

This course is designed to produce broad-based engineers to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. This course will enable students to demonstrate an understanding of load actions and frictional forces acting on bodies in equilibrium. demonstrate proficiency in calculating reactions in beams and trusses. determine properties of area including centroids and first and second moments of area.

Objectives

The objectives of the course are to:

1. explain basic kinematics concepts;
2. discuss basic concepts and system of forces;
3. enumerate basic dynamics concepts – force, momentum, work and energy;
4. state basic principles of mechanics in engineering applications related to farm power and machinery domain;
5. enumerate Newtonian Physics with static analysis to determine the complete load impact (net forces, shears, torques, and bending moments) on all components;
6. discuss the design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
7. explain at least five fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum;
8. describe the concepts of principles of engineering mechanics (i.e. statics and dynamics) for different simple situations;
9. mention free body diagrams of real case phenomenon considering engineering mechanics point of view; and
10. enumerate basic machine parts such as pulleys and mass-spring systems.

Learning Outcomes

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

1. explain at least five basic kinematics concepts
2. discuss at least five basic concepts and system of forces.
3. enumerate at least five basic dynamics concepts – force, momentum, work and energy.
4. state six basic principles of mechanics in engineering applications.

related to farm power and machinery domain.

5. enumerate at least three Newtonian Physics with static analysis to determine the complete load impact (net forces, shears, torques, and bending moments) on all components (members and joints) of a given structure with a load; and
6. discuss at least five design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
7. explain at least five fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum;
8. describe at least three design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
9. mention at least four free body diagrams of real case phenomenon considering engineering mechanics point of view
10. enumerate at least five basic machine parts such as pulleys and mass-spring systems

Course Contents

Introduction and classification of mechanisms. definition and terminology. Forces. Moments. Couples. Equilibrium of simple structures. Machine parts. Friction. First and second moments of area; centroids. Kinematics of mechanisms. Gears and geared systems. Cams. Analytical and dynamic processes. Inertia forces. Kinetic energy methods. Fluctuation of energy and speed. Balancing of rotating. Reciprocating masses. Governors; types, controlling forces and stability. Rectilinear motion. Curvilinear motion. Newton's equation of motion. Force and acceleration. Work and energy. Impulse and momentum. Introduction to practical use of the above principles and properties. Dynamic equilibrium. Introduction to practical use of the above principles and properties. Kinematics of particles and rigid bodies in plane motion. Newton's laws of motion. Law of gravitation. Kinetic energy.

NDU-GET 210 Basic Strength of Materials (3 Units; C; LH 45)

Senate approved Relevance:

The vision of Niger Delta University is to produce graduates of creativity, excellence and quality service provider that can launch their careers in Nigeria and overseas with sound knowledge of Strength of Materials is the foundation for Engineering design courses. Relevance is seen in agricultural and biosystems graduates from NDU capable of applying Strength of Materials theories, analytical tools, knowledge and skills to solve engineering problems for sustainable development.

Overview

The strength of a material is its ability to resist external forces without breaking. Strength of Materials is the foundation for Engineering design courses. The course covers material behaviour, stresses, strains and deformations with simple applications in engineering designs. Topics to be chosen from: elastic and elastic-plastic behaviour; plane stress and strain; constitutive relationships, principal stress and strain; failure criteria; stresses in thin-walled pressure vessels;

bending and shearing stresses in beams; Mohr's circle; deflections of beams; Euler buckling; short and long columns; torsion of solid and hollow circular sections; introduction to statistical indeterminacy and simple redundant structures; work and strain energy concepts.

The knowledge of strength of materials will produce foundation for Engineering design courses for graduates with the competencies in structural members and their strength, stiffness, and stability. This course will enable the understanding of, and the capability to, solve practical engineering problems involving stress and strain analysis in elementary structural members, such as bars and beams. A thorough understanding of concepts related to strength, stiffness, and stability of structures needed for engineering analysis and design. The students will be empowered to develop the capability to design new structural members based on strength and stiffness requirements and also be able to verify the safety of existing or designed structures.

Objectives

The objectives of the course are to:

1. discuss the relationships between stress, strain and displacement in deformable bodies;
2. enumerate relationships between loads, member forces and deformations and material stresses and strains in structural members under axial loading, torsion, flexural loadings, shear, and thin-walled pressure vessels;
3. describe the stress-strain relation for single and composite members based on Hooke's law;
4. enumerate the stresses and strains in single and composite members due to temperature changes;
5. evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
6. determine bending stresses and their use in identifying slopes and deflections in beams;
7. describe the use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
8. evaluate the stresses and strains due to torsion on circular members;
9. identify the buckling loads of columns under various fixity conditions at the ends. identify the principles and concept of engineering economics and their applications; and
10. mention assumptions and limitations of the theories used in mechanics of materials.

Learning Outcomes

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

1. discuss at least four relationships between stress, strain and displacement in deformable bodies;
2. enumerate at least three relationships between loads, member forces and deformations and material stresses and strains in structural members under axial loading, torsion, flexural loadings, shear, and thin-walled pressure vessels;
3. describe at least three stress-strain relation for single and composite members based on Hooke's law;
4. enumerate at least four stresses and strains in single and composite members due to temperature changes;

5. evaluate at least three the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
6. state at least three bending stresses and their use in identifying slopes and deflections in beams;
7. describe at least three the use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
8. evaluate at least three the stresses and strains due to torsion on circular members; and
9. identify at least three buckling loads of columns under various fixity conditions at the ends; and
10. mention at least five assumptions and limitations of the theories used in mechanics of materials.

Course Contents

Force equilibrium. Free body and force diagrams. Concept of stress and strain. Tensile test. Biaxial and triaxial states of stress and strain. Axially loaded bars. Composite bars. Temperature stresses. Hoop stress in cylinders and rings. Bending moment. Shear force and diagrams. Torsion and application. Stress transformations. Failure theories, and the Mohr's Circle. Strain energy and applications. stress-strain relation. Generalized Hooke's law. Stresses and strains due to loading and temperature changes. Shear force. Bending moments. Bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations. Mohr's circle. Elastic buckling of columns.

NDU-ABE 215 Solar Energy Application in Agricultural Processing

(3 Units: C; LH 30; PH 45)

Senate-approved Relevance

Niger Delta University (NDU) 's mission is to produce graduates of creativity, excellence and high-performance service providers who are highly skilled and knowledgeable in designing, installing, maintaining and operating photovoltaic power systems. Relevance is seen in agricultural and biosystems engineering from NDU being able to design, install and maintain. The adoption and operations of photovoltaic power systems to address the electric energy crises result from inadequate, epileptic, unreliable, unsafe and uneconomical electric power generation and supply. It will help mitigate climate change and increase and improve the electric energy mix in terms of quality and quantity through best practices for sustainable development. Agricultural engineers are empowered to lead the farm transformation of food production in Africa to address the challenges of meeting Sustainable Development Goals (SDGs).

Overview

Photovoltaic systems explore the design, installation, maintenance and operation of solar photovoltaic (PV) systems and their applications in agricultural processing. It will positively affect the electric energy mix in terms of quantity and quality of electricity supply to all categories of consumers for sustainable development. Solar energy, as a renewable and clean energy resource, can replace fossil fuels, producing heat, creating chemical reactions and generating electricity. In

addition, solar energy technology can be built flexibly at scale, allowing the collected energy to be stored for later use. The amount of potential solar energy that reaches the earth every day far exceeds the world's current and expected future energy requirements.

This course empowered graduates to design, install, maintain and operate different types of the photovoltaic power system in power generation. Also, to build students' capacity in addressing inadequate electric power generation and climate change in Nigeria. The importance of this course is that it prepares the graduates to meet the need for sustainable development goals (SDGs) numbers 1, 2, 11, and 13 in poverty reduction, zero hunger, sustainable communities/cities, and climate action issues, respectively.

Objectives

The objectives of the course are to:

1. state the origin and sources of light;
2. describe the methods conversion of solar energy to electricity;
3. enumerate the factors that determines the performances of solar panels;
4. state the different types of solar cells;
5. identify Nigeria's photovoltaic power potential;
6. describe how solar energy is used in sustainable engineering applications;
7. explain solar energy and why it changes with time and location;
8. describe the prospects and challenges of photovoltaic power generation in Nigeria;
9. identify the future application of solar photovoltaic;
10. explain safety hazards of photovoltaic systems;
11. state different techniques use for proper installation and troubleshooting procedures; and
12. describe applications of solar energy in agricultural and food processing.

Learning outcomes

On completion of the course, students should be able to:

1. state at least four origins and sources of light;
2. describe the two principles and methods of converting sunlight energy into electricity;
3. enumerate three practical exercises on the impact of geographical location, time of the day season of the year, environmental and climatic weather conditions on the performances of solar panels in the laboratory and field work;
4. state five characteristic features between the three types of solar cells;
5. identify three types of photovoltaic system;
6. describe at least six uses of solar energy in sustainable engineering applications;
7. mention at least four ways solar energy changes with time and location;
8. describe at least five prospects and challenges of photovoltaic power generation in Nigeria;

9. identify at least three future application of solar photovoltaic;
10. explain at least four safety hazards of photovoltaic systems in relation agricultural processing equipment and operation;
11. state at least three ways by which proper installation and troubleshooting procedures are conducted; and
12. describe at least three applications of solar energy in agricultural and food processing.

Course contents

The origin and sources of light. History of the Sun. An overview of the Nigeria electricity industry. Relationship between electricity consumption and development. Solar radiation: Theory of Solar Collectors; types of collectors, flat plate, bare plate, cover plate etc. storage of solar energy by rocks, water etc. Methods of conversion of solar energy to electricity. Shortcomings and prospects of solar energy in Nigeria. Solar energy application: water heating and distillation, water pumping, crop drying, solar cookers and refrigeration. Photovoltaic cells, direct conversion of solar energy into mechanical energy. Design and installation of photovoltaic system. Heat transfer methods. Prospects and challenges of photovoltaic system in Nigeria. Future application of solar photovoltaic. Renewable energy. Design of solar dryers. Case studies on application of solar energy in agricultural and food processing.

Minimum Academic Standards

Crop processing laboratory with a NUC-MAS requirement facilities.

300 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; transesterification 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, andwooden furniture making processes.

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

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 E: 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 E: 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.

NDU-ABE 310 Processing and Storage of Biomaterials
(3 Units; C; LH 30; PH 45)

Senate approved Relevance
The Niger Delta University's vision is to train Engineers that will be versatile, globally relevant, highly skilled and knowledgeable in applying engineering principles to agriculture mechanization, crop production, crop and food processing preservation, packaging and storage, farm and agricultural business management, irrigation, farm structures, rural electrification, drainage and erosion control for food production. Relevance can be seen in agricultural and biosystems engineers from NDU producing a skilled and innovative workforce that is creative and excellent service providers to transmute Nigeria's natural resources into goods and services.

Overview

Processing and storage of biomaterials designed to address the underperformance of agriculture in Africa remain a concern as this hampers the transformation of the economy of African nations to veritable industrial production systems. The crucial stage in agricultural production is to transform, improve and preserve the nutritional and other uses of crops and livestock production to ensure food security and better industrial utilization.

This course focuses on the importance of preparing students in agricultural and biosystems with the knowledge and skills to process and store biomaterials to reduce postharvest losses and improve the quality of crops to ensure food security. It will also build the capacity of the student in the area of food security. The importance of the course lies in meeting the need to achieve sustainable development goals (SDGs) numbers 1, 2, and 13 in the areas of poverty reduction, zero hunger, and climate action issues, respectively. Therefore, the course's objectives, learning outcomes, and contents are provided to address these needs.

Objectives

The objectives of the course are to:

1. enumerate processing and storage of biomaterials especially grains;
2. discuss the basic principles of cleaning, sorting, grading and separation;
3. explain the cleaning, sorting and grading of common agricultural biomaterials;
4. identify the common techniques of cleaning sorting and grading;
5. describe size reduction process and particle size analysis;
6. enumerate the principles of drying;
7. describe the importance and use of psychrometric chart;
8. identify different types of storage structures and storage environment conditions;
9. explain causes and control of deterioration of produce in storage; and
10. describe environmental control in storage.

Learning Outcomes

On completion of the course, students should be able to:

1. state ten essence of processing and storage of biomaterials especially grain crops;
2. discuss at least four basic engineering principles responsible for cleaning, sorting and grading of agricultural produce;
3. explain at least four cleaning, sorting and grading of at least 6 agricultural produces and be able to state the importance cleaning, sorting and grading of the agricultural biomaterials;
4. identify at least five techniques of cleaning, sorting and grading;
5. describe at least four size reduction and particle size analysis of 4 biomaterials;
6. enumerate six effects of high moisture content on grain storage and the factors affecting drying;

7. describe at least four importance and relevance of psychrometric chart in drying;
8. identify six the environment conditions required for safe storage of grains;
9. explain at least four causes and control of deterioration in grain storage; and
10. describe at least five importance of environmental control in storage.

Course contents

Design of agricultural process machines (cleaners, sorters, dryers, silos etc). Unit operations in small, medium and large-scale processing plants. Flow charting. Theory of drying and EMC. The use of psychrometric chart. Grain drying systems – thin layer, deep bed, batch and continuous flow. Thermodynamics of biological materials: exact differentials, Maxiwell's relations. Definition: Processing and storage. Importance of processing and storage. Principle of cleaning, sorting and grading. Cleaning, sorting and grading techniques. Size reduction. Particle size analysis. Size reduction equipment. Types of dryers. Heat treatment equipment and operations – blanching, baking, sterilization, frying, roasting. Food Dehydration. Importance of drying. Effects of drying on biomaterials. Separation technology: principle and design: distillation, filtration Sedimentation, Centrifugation and crystallization. Storage of agricultural products. Types of storage structures. Design of storage structures. Controlled and modified atmosphere storage. Storage problems in Nigeria. Environmental control in storage.

Minimum Academic Standards

Crop processing laboratory with a NUC-MAS requirement facilities.

NDU-ABE 311 Aquatic Resources Engineering (3 Units; C; LH 30; PH 45)

Senate-approved Relevance:

The vision of Niger Delta University is to produce graduates of creativity, excellence and quality service provider that can launch their careers in Nigeria and overseas with sound knowledge in both practical and theoretical approaches to the art of application of scientific and engineering principles to improve and maintain the environment to protect human health, nature's beneficial ecosystems, and enhance the quality of food and safety and regulations. Relevance is seen in agricultural and biosystems engineers from NDU, capable of designing and selecting such tools and equipment, requiring information regarding various properties and proffering appropriate engineering solutions for sustainable development.

Overview

The knowledge of engineering properties of aquatic resources gives insight into how the materials behave in different conditions and how it affects the final product quality. Quality and properties are interlinked and often complementary to each other in terms of food. Product quality and safety are of utmost concern as they are directly related to human well-being and are not limited to microbial safety. Aquatic resources, especially those

consumed as food or feed, undergo various unit operations from pre-harvest to post-harvest processing, primary, secondary and tertiary processing, formulation, preservation, packaging, storage distribution, retailing, domestic storage and finally, consumption.

This course empowers graduates to know and understand the characteristics of the aquatic resources to be processed, preserved and consumed to solve the problems while designing and selecting the means and modes of preservation, packaging, processing, storage, marketing, and consumption. Each unit operation has unique characteristics and needs special tools and equipment. Designing and selecting such tools and equipment require information regarding various properties.

Objectives

The objectives of the course are to:

1. enumerate fundamental knowledge about aquatic resources engineering;
2. identify the different aquatic resources found in the Niger Delta, South-South, Nigeria;
3. discuss rheological properties of aquatic resources;
4. explain optical properties of aquatic resources;
5. enumerate physical properties like size, shape, density, porosity has great implication in deciding the equipment;
6. describe the heat transfer and mass diffusion rates of aquatic resources;
7. discuss food laws and safety regulations as essential to provide consumer food that is safe to consume;
8. identify acoustic properties of aquatic resources as useful in determining non-destructive quality;
9. describe pretreatment techniques for various thermal processes of aquatic resources; and
10. explain aquatic resources processing and storage engineering.

Learning outcomes

On completion of the course, students should be able to:

1. enumerate six fundamental knowledge about aquatic resources engineering;
2. identify ten different aquatic resources found in the Niger Delta, South-South, Nigeria;
3. discuss seven rheological properties of aquatic resources;
4. explain five optical properties of aquatic resources;
5. enumerate ten physical properties like size, shape, density, porosity etc. and properties have great implication in deciding the equipment;
6. identify at least four heat transfer and mass diffusion rates of aquatic resources;
7. identify eight food laws and safety regulations as essential to provide consumer food that is safe to consume;

8. identify at least seven acoustic properties of aquatic resources as useful in determining non-destructive quality;
9. describe six pretreatments for various thermal processes of aquatic resources; and
10. state seven aquatic resources processing and storage engineering.

Course contents

Definition of aquatic environment. An overview of the aquatic environments. Freshwater environment. Brackish water environment. Marine Environment. Wetlands environment. Definition of aquatic of aquatic resources. An overview of aquatic resources. Phytoplankton. Periphyton. Macrophytes. Zooplankton. Definition of engineering properties. An overview of engineering properties of aquatic resources. Physical properties of the aquatic resources. Mechanical properties of the aquatic resources. Frictional properties of the aquatic resources. Aerodynamic properties of the aquatic resources. Rheological properties of the aquatic resources. Thermal-Combustion properties of the aquatic resources. Processing, preservation, storage, packaging, and marketing of aquatic resources. Processing of aquatic resources for bioremediation.

Minimum Academic Standards

Crop processing and Storage Engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 315 Fundamental Heat and Mass Transfer, (3 Units; C; L 30; P 45)

Senate-approved Relevance

Producing high-quality graduates who are highly skilled and informed in the design of appropriate machinery useful in agricultural processing are desirable areas in Nigeria and agree with NDU's vision to apply technology-driven knowledge to creativity and excellence, thereby meeting socio-cultural needs of the society through the production of competent agricultural and biosystems engineering graduates. Relevance is seen in agricultural and biosystems graduates from NDU being able to identify problems of heat and mass transfer in agricultural process and machine designs and rendering appropriate engineering solutions to meet indigenous sustainable food production needs.

Overview

Mechanisms of heat and mass transfer, with specific applications in biological systems' transport processes, are essential. Introduction to steady state and transient heat conduction and convection, radiation, diffusion, simultaneous heat and mass transfer is paramount to processing and machine designs for food. Most agricultural and food processes involve heat transfer, such as cooking, pasteurization, sterilization, drying, evaporation, distillation, chilling, freezing, etc. In addition, most agricultural processes involve the exchange of materials between different parts (phases) of the system, often combined with heating or cooling.

This course will empower students with heat and mass transfer concepts related to agricultural and biosystem processes. It will also train them to solve heat and mass transfer problems practically while designing equipment for processing operations. The importance of the course lies in meeting the need to achieve sustainable development (SDGs) numbers 1 and 2 in the areas of poverty reduction and zero hunger, respectively.

Objectives

The objectives of the course are to:

1. describe the design, test, and analyze systems and processes that involve transport phenomena;
2. identify four heat and mass transfer processes;
3. explain modern computational and experimental equipment in heat and mass transfer;
4. enumerate the phenomena of heat conduction and convection;
5. state the phenomena of radiation, diffusion, simultaneous heat and mass transfer;
6. discuss principle of heat exchangers and their applications in agricultural processes;
7. describe psychometrics and thermodynamics of biological processes;
8. enumerate appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;
9. explain the basics of heat exchanger; and
10. State different types of insulating materials.

Learning outcomes

Upon successful completion of this course, the students should be able to:

1. describe at least two basic conduction equations;
2. identify four heat and mass transfer processes;
3. explain at least four transient heat conductions and its numerical solution;
4. enumerate at least six internal and external forced convection problems and their numerical solutions;
5. state three design calculations for many agricultural and biological engineering applications;
6. identify at least seven principles of solving heat and mass transfer problems;
7. describe four different types of heat exchangers and their applications in food and agricultural processes;
8. enumerate five psychometrics and thermodynamics of biological processes;
9. explain at least four appropriate experimentations, analyze and interpret data, and use engineering judgment to draw conclusions; and
10. state five performance of heat exchanger.

Course contents

Transport phenomena, basic modes of heat transfer. Mass Transfer. Mechanisms of heat and mass transfer. Fourier's Law of heat Conduction, The Fourier and Fick Laws. Heat Requirements for Vaporization. Heat Exchangers – design and application. Application of heat exchanger in food and agricultural process industry. steady and unsteady-state heat conduction, radiation. free and forced convection. psychometrics and thermodynamics of biological processes. Heat conduction. Convention. Conduction through a plane wall Problems on conduction through homogenous/composite wall, having variable thermal

conductivity, Conduction through a hollow sphere. Thermal radiation. Basic law's of thermal radiation, Plank's law. Stefan-Boltzmann law, Kirchoff's law, Lambert's cosine law. Mass transfer, diffusion process, Fick's law, Concept of permeability, Diffusion co- efficient. Radiant interchange between solids. One- and two-dimensional steady and unsteady heat conduction; internal and external forced convection. engineering principle of radiation. heat exchangers and special topics.

Minimum Academic Standards
Crops processing and storage laboratory with a NUC-MAS requirement facilities.

NDU-GET 371 Engineering Economics (3 Units; C; LH 45)

Senate approved Relevance:
The vision of Niger Delta University is to produce graduates of creativity, excellence and quality service provider that can launch their careers in Nigeria and overseas with sound knowledge of economics and decision theory to evaluate engineering alternatives in planning, developing, constructing, and managing engineering projects. Relevance is seen in agricultural and biosystems graduates from NDU capable of applying their economics theories, analytical tools, knowledge and skills to solve engineering problems for sustainable development.

Overview
The knowledge of engineering economics deals with human behaviour concerning managing engineering scarce resources with the ultimate goal of achieving optimum outcomes. This course will produce graduates with the competencies in fieldwork, data collection, analysis, and analysis and presentation of these coherently and appreciate the importance of economics in engineering growth and developments, especially in maintaining global food security.

Engineering Economics is the process of making rational and intelligent decisions associated with allocating scarce resources in circumstances where alternatives can be enumerated. This course provides engineers with skills to assess the costs and benefits of engineering investments, such as product and technology development programs and capital purchases. It also presents the framework for selecting alternative designs, managing technologies over their lifecycles, and evaluating the finances of new ventures/projects.

Objectives
The objectives of the course are to:
1. identify the principles and concept of engineering economics and their applications;
2. explain the nature of elasticity and its applications, as well as short and long run production functions;
3. discuss pricing factors of production and market structure consisting of perfect competitive market and imperfect competitive markets;
4. state at least three fundamental of cost analysis;

5. define a financial terminology and concepts;
6. state the conceptualizations, and execute/assess projects for small and medium scale enterprises;
7. explain the design cash flow analysis, risks and uncertainty assessment, cost-benefit analysis;
8. identify analytical techniques for evaluating investment proposals in the engineering projects
9. enumerate the economic dimensions of wider socio-economics issues; and
10. explain cash flow series using present worth, annual equivalent worth and internal rate of return methods of assessment.

Learning Outcomes

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

1. identify at least five basic concepts in economics including scarcity, choice and scale of preference; basic laws of demand and supply;
2. explain at least three types of elasticity and their applications, as well as short and long run production functions;
3. discuss at least four pricing of factors of production and market structure consisting of perfect competitive market and imperfect competitive markets;
4. state at least three fundamental of cost analysis;
5. define at least seven financial terminology and concepts;
6. state at least three conceptualizations, and execute/assess projects for small and medium scale enterprises;
7. explain at least four the design cash flow analysis, risks and uncertainty assessment, cost-benefit analysis;
8. identify at least four analytical techniques for evaluating investment proposals in the engineering projects;
9. enumerate at least three methods of selecting the right projects from alternatives; and
10. explain at least four cash flow series using present worth, annual equivalent worth and internal rate of return methods of assessment.

Course contents

The nature and scope of economics. Basic concepts in engineering economics. The interest formulae discounted cash flow. Present worth, Equivalent annual growth. Rate of return, Break even analysis. Replacement analysis, Cost Benefit analysis. Factors of production. Supply and demand. Price and elasticity analysis. Household behaviour theories. Business organization. Production, the market. Income. Employment – classical, non-classical and keynessian approaches. Money expenditure. Taxation. Budget. International trade.

Minimum Academic Standards

Engineering with a NUC-MAS requirement facilities.

NDU-ABE 321 Agricultural Land Surveying and Farmstead Planning
(3 Units; C; L 30; P 45)

Senate –approved Relevance
Producing incredible agricultural Engineers who are extraordinarily skilled and informed in agricultural land survey, development and implementation of survey plans to ensure effective management of agricultural land to minimize or eliminate individual/community land dispute in Nigeria and agrees with NDU's vision to use technology-driven information to excellence, creativity and carrier, thereby meeting socio-cultural wishes of the society via the manufacturing of capable agricultural and biosystems engineering graduates. Relevance is seen in agricultural and biosystems engineers from NDU, capable of understanding land disputes among individuals/communities and proffering appropriate engineering solutions to meet indigenous sustainable meal production desires.

Overview
Land disputes have adverse effects on agricultural productivity and human fatalities. If not resolved amicably, the economic impact is very much devastating. But, with proper land surveying, such catastrophic effects can be mitigated or nipped on the bode. This course empowers students to understand how to develop and implement survey plans to manage farmland disputes and ensure proper farm land layout design.

This course principles of agricultural land survey and farmstead planning with the land use Act and land use systems in Nigeria inside the context of present Nigeria policies and legislation. The course focuses on the Niger Delta region of rural and urban farmland surveying of Niger Delta, Nigeria. The course students get some hands-on skills in the usage of the theodolite, the levelling instrument with its computation and the development of the survey plan of the farmland for the proper utilization of the land.

Objectives
By the end of the course participants will:

1. describe issues of current land use Act and land use systems in Nigeria;
2. identify the term land survey and its relevance to the resolution of land dispute in Nigeria;
3. explain the techniques of measurements and the various ways it is done;
4. enumerate different type of errors, sources and their resolution in land survey;
5. describe the bearing of lines;
6. explain the concept of leveling and its relevance to land survey;
7. describe the concepts of theodolite and it uses in performing land survey;
8. enumerate the concept of Triangulation and plane surveying;

9. describe the farm stead planning and layout designs;
10. identify the concept of land clearing, the machines employed for land clearing and its technique; and
11. state the land reclamation sustainable agricultural development in Nigeria.

Learning Outcomes

On completion of the course, students should be able to:

1. describe at least four land use Act and land use systems in Nigeria;
2. identify four concepts of distance measurement;
3. explain at least five errors of land surveying, their sources and resolution;
4. enumerate at least five purposes of carrying out land surveying;
5. describe at least four information survey books should contained;
6. explain at least three types of leveling and how to take readings with the instrument;
7. enumerate at least three land scapings, earth works and shaping;
8. explain at least five basic knowledge on land clearing techniques with the machineries that are used;
9. describe at least five different earth moving machineries and its operations;
10. identify at least four of basic land reclamation principles; and
11. state at least six concept of farm stead planning and layout design.

Course Contents

Definitions. Measurement of distances. Errors and error arithmetic, resolution of errors. Chain surveying. Bearing of lines. Leveling. Traversing. The theodolite and its uses. Triangulation and plane surveying. Land scaping, earth works and shaping. Topographic surveys (computations). Farm stead planning and layout designs. Land clearing systems. Machinery techniques. Earth moving machinery and the earth moving operation. Land reclamation. The land use Act and land use systems in Nigeria.

Minimum Academic Standards

Farm structures and biosystems engineering laboratory with a NUC-MAS requirement facilities.

400 level

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.

NDU-ABE 411 Farm Power and Machinery (3 Units; E; LH 30; P 45)

Senate –approved Relevance
Training of globally relevant and competitive graduates who are highly skilled and knowledgeable in the profession of Agricultural and Biosystems Engineering, specifically in the design, fabrication, operation, adjustment and maintenance of farm power and machinery systems, is in line with NDU's mission to promote technological advancement of Nigeria through the emphasis on programmes that will engender high-quality graduates that are self-reliant, problem solvers, and effective army of human capital for the nation and vanguard in the war against societal ills. Agricultural engineers are empowered to lead

the agricultural transformation of food production in Africa to address the challenges of meeting the Sustainable Development Goals (SDGs). The University is dedicated to producing quality Agricultural Engineers that are industry compliant to handle sustainable agriculture, food and fibre production, processing, packaging and preservation.

Overview

Farm power and machinery operations equip students with knowledge of the various farm power sources and machinery operations, ranging from land clearing, tillage, planting etc., to harvesting and post-harvest processing and packaging. The course begins with an appraisal of the various farm operations and the types of equipment available to carry them out. Students then look at the different power sources and how they are harnessed and utilized.

The course looks in greater detail at various farm implements, their operation and management. It closes with an appraisal of the factors that are essential for selection. During the course, students get some hands-on skills in tractor driving and operation with equipment, biogas production, solar dryers and solar plates, and visits to industries that manufacture farm implements. The course is essential in reducing the drudgery, low output capacity, wastage/losses, loss of timeliness and underutilization of natural resources inherent in traditional farming methods. It also elucidates the importance o course in mitigating food security challenges.

Objectives

The objectives of the course are to:

1. describe the different sources of farm power and the advantages and disadvantages of each power source;
2. explain farm power and their sources used in crop and livestock;
3. describe the earth moving equipment;
4. define the operational principles, functions, adjustment and management of tractors and implements;
5. explain the power outlet, hitches, controls, systems and instrument panel of the tractor;
6. describe the calculations of the power developed in a tractor engine and types of fuels for tractor engine combustion;
7. explain the forces acting on tractors and implements and the method of analysis;
8. state and describe forces acting on tractors and implements and their methods of analysis;
9. enumerate major classes, five types, and five systems of tractors, and explain chronologically the evolution of tractors in modern agriculture; and
10. explain the tillage requirement and implement selection, row crop planter and grain drills.

Learning Outcomes

On completion of the course, students should be able to:

1. describe four farm power sources; the internal combustion engine; tractor transmissions, hydraulic and electrical system; tractor chassis, wheel and types;

2. explain at least three sources of farm power, two advantages and two disadvantages of each power source;
3. describe at least four tillage requirements and implement selections, row crop planter and grain drills;
4. describe four types of earth moving equipment;
5. discuss four the principles of operation and the factors considered for the selection, of tractors and implements and state at least five functions of the tractor;
6. identify a at least fifteen tractor components and systems, at least five functions, three power outlets, three types of hitches, five controls and five instruments on the panel of the tractor;
7. describe at least ten calculations of power developed in a tractor engine and describe three types of fuels for tractor engine combustion;
8. state and describe at least three forces acting on tractors and implements and their methods of analysis;
9. enumerate at least two major classes, five types, and five systems of tractors, and explain chronologically the evolution of tractors in modern agriculture; and
10. explain three tillage requirements and implement selections, row crop planter and grain drills.

Course Contents

Farm Power Sources. Tillage Operation. Selection and Management of Farm tractors. Farm implements. Development of tractors. Tractor force analysis. Fuels and fuel combustion. Development of tractors. Design of spark ignition and compression ignition engines. Type of Farm machinery. Principles of construction. Operation and adjustment of farm implements. Primary tillage. Secondary tillage. Farm operation planning. Fertilizer application' weed control (cultivation); spraying; harvesting and on-the farm processing.

Minimum Academic Standards

Power and Machinery Laboratory with testing equipment, technical support and an experimental farm equipped with tillage facilities in conformity with NUC-MAS requirement.

NDU-ABE 421 Introduction to Farm structures, Tendering and Estimation
(3 Units; E; LH 30; P 45)

Senate –approved Relevance

Producing incredible agricultural Engineers who are extraordinarily skilled and informed in the importance of agricultural structures, development and implementation of farm structures to ensure effective management of agricultural productivity to minimize or eliminate losses agricultural produce in Nigeria and is in agreement with NDU's vision to use technology-driven information to excellence, creativity and carrier, thereby meeting socio-cultural wishes of the society via the manufacturing of capable agricultural and biosystems engineering graduates. Relevance is seen in agricultural and biosystems engineers from NDU, capable of becoming aware of issues associated with the lack of farm structures among farmers and proffering appropriate engineering solutions to meet indigenous sustainable food production desires.

Overview

The impact of lack or inadequate availability of farm structures can be devastating. However, providing appropriate farm structures within reach of farmers in the south-south region will significantly minimize this economic impact. This course empowers us to understand how the development and implementation of farm structures can reduce damage to farm produce. The course focuses on the Niger Delta region regarding the provision of adequate farm structures for the rural and urban farmers of the Niger Delta, Nigeria.

Some background knowledge of introduction to Agricultural and Biosystems Engineering would be helpful. In addition, the course students get hands-on skills in agricultural architecture, civil drafting and profiling. Farm structures plays a very critical role in sustainable agricultural activities, the economic

Objectives

By the end of the course participants will:

1. describe farm structures in relation to urban structures;
2. explain the various design requirements for different farm structures;
3. enumerate different construction materials available for the farmer;
4. explain agricultural architecture and civil drafting;
5. identify the concept and methods of tendering;
6. describe the role of the tendering board;
7. explain the concepts of contracts bidding;
8. discuss the various contracts documents and their relevance in contracts bidding;
9. identify estimation and its relevance to farm structures provision; and
10. describe how to prepare Bill of Engineering Measurement and Evaluation (BEME).

Learning Outcomes

On completion of the course, students should be able to:

1. describe ten relevance of farm structures in the Nigeria dream of sustainable agricultural development;
2. explain at least three concepts for the establishment of farm structures;
3. enumerate four different types of farm structures;
4. explain at least five readily available different construction materials;
5. identify three different ways of the tendering process;
6. describe three ways the tendering process is done;
7. explain three types of contract documents and their relevance;
8. discuss at least five basic knowledge of agricultural architecture and civil drafting;
9. identify at least four different methods for estimation; and
10. describe at least four ways on how to prepare Bill of Engineering Measurement and Evaluation (BEME).

Course Contents
Definition and introduction of farm structure. Types of structures. Fundamentals of farm structures. Farm construction materials - wood, cement, sand, gravel, steel (other reinforcement materials). Concrete (mixes; grades). Material selection. Materials of construction. Agricultural architecture. Civil drafting. Design codes. Bill of quantities. Load estimation. Tendering procedures and contractual arrangements; open, selective, serial, negotiated tenders. Conditions of contracts with types used in Nigeria. Preparation of tenders; project appraisal, site visits, enquiry for quotations, estimating take-off quantities from plan; tender adjuration by management. Methods of approximate estimates; the unit price method, the cube method, etc. Procurements and regulations.

Minimum Academic Standards
Farm structures and biosystems engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 431 Environmental Engineering (3 Units; C; LH 30; P 45)

Senate –approved Relevance
The vision of Niger Delta University is to produce graduates of creativity, excellence and quality service provider that can launch their careers in Nigeria and overseas with sound knowledge in both practical and theoretical approaches to the art of application of scientific and engineering principles to improve and maintain the environment to protect human health, nature's beneficial ecosystems, and enhance environmental-related enhancement of the quality of human life. Relevance is seen in agricultural and biosystems engineers from NDU, who can become aware of environmental degradation issues and proffer appropriate engineering solutions for sustainable development.

Overview
Environmental Engineers devise solutions to the design and implement waste management technologies for wastewater management, water and air pollution control, recycling, waste disposal and public health. This course is designed for municipal water supply and industrial wastewater systems, preventing waterborne diseases and improving sanitation in urban, rural and recreational areas. It evaluates hazardous waste systems and the severity of such hazards, advises on treatment and containment, and develops regulations to prevent mishaps.

The graduates acquire knowledge to protect the natural environment and the health of people as influenced by the environment by applying principles from all of the natural sciences to understand the natural environment and to build systems that protect that environment and the effect of technological advances on the environment, addressing local (Niger Delta region of rural and urban) of Nigeria and global environmental issues such as acid rain, global warming, ozone depletion, water collection and air pollution from automobile exhausts and industrial sources. In

addition, this course deals with developing and enhancing infrastructure that prevents the contamination and degradation of natural resources like air, water, land, etc.

Objectives

By the end of the course participants will:

1. explain the role of Environmental Engineers in identifying and solving problems; related to the human interaction with the environment (including regulations development);
2. describe the concept of environmental pollution, contamination and its sources particularly in context to water;
3. state causes and preventive measures against air, water and soil pollution;
4. discuss principles of environmental engineering applied to the design and implementation of water supply scheme;
5. state the impact of human activity on the environment (e.g. risk assessment);
6. explain the scientific and engineering principles for the quantitative analysis of environmental systems (e.g. environmental sampling design and data analysis);
7. enumerate design processes and operations aimed to decrease the effects of pollution in air, water and land systems;
8. list the concept of environmental pollution, contamination and its sources particularly in context to water;
9. discuss principles of environmental engineering applied to the design and implementation of water supply schemes;
10. explain the main concepts and principles that are used to understand and analyze problems related to Environmental and Water Resources Engineering (e.g. mass and energy balances, risk assessment, transport processes, water resources, design parameters, etc); and
11. list the impact of engineered systems on the environment and apply current engineering technologies to protect the environment (water, air and soil).

Learning Outcomes

On completion of the course, students should be able to:

1. explain at least five ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts;
2. describe engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors;
3. state at least five the effects of pollution on rivers and lakes and eutrophication;
4. discuss six basic water quality parameters and measurement techniques of these parameters. Six basic principles of water, wastewater and sludge treatment;
5. state at least eight importance of solid wastes in environmental engineering;
6. explain ten important points about solid waste management;
7. enumerate at least six solid waste disposal methods;

8. list at least four effects of the air pollution;
9. discuss five basic methods of air pollution measurement and control;
10. explain at least four relationships between meteorology and air quality;
11. list at least six effects each of the air, water and soil pollution.

Course Contents

Concept of environmental biotechnology. Scope and importance environmental engineering. Environmental stress & environmental disasters, Types of environmental hazards and disasters Environmental stress & environmental disasters, Types of environmental hazards and disasters. Types of bioremediations. Bio augmentation for bioremediation, Bioreactors, Bioremediation of herbicides pesticides, hydrocarbons, oil spills. Novel methods of pollution control – Vermi technology. Biodegradable plastics. Waste water treatment: Aerobic Processes-Activated sludge, Oxidation ditches, Trickling filters, Towers, Rotating discs, Rotating drums, Oxidation ponds, Anaerobic processes: Anaerobic digestion. Anaerobic filters. Up flow anaerobic sludge blanket reactor. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industry. Air pollution and its control through biotechnology. Biotechnology in reduction of CO_2 emission, Bio-scrubbers, Biobeds, Bio-trickling filters and their applications. Decay behavior and degradative plasmids, Hydrocarbons, substituted hydro carbons, Oil pollution. Surfactants. Pesticides. Biological detoxification of cyanide, oxalate, urea, petrochemical industry effluents, toxic organics, phenols. Across South-South, Nigeria.

Minimum Academic Standards

Environmental engineering laboratory with a NUC-MAS requirement facilities

NDU-AEE 441 Soil and Water Conservation Engineering

(3 Units; E; LH 30; PH 45)

Senate-approved Relevance

The mission of Niger Delta University (NDU) is to produce graduates of creativity, excellence and high-performance service providers creativity with highly skilled and knowledgeable soil and water-related concepts as applied to agricultural sciences and engineering fundamentals. The students acquire the basic scientific principles in solving erosion problems of agriculture and food production from the perspective of soil and water application, which agrees with the food security and self-sufficiency concept of NDU. This course develops soil and water conservation strategies to alleviate soil erosion, conserve water and increase crop production.

Overview

Soil and water conservation is a path that is crucial and essential to soil and water specialization in the Agricultural and Environmental Engineering programme. Moreover, it utilizes soil and water without waste to ensure a high level of food production. Therefore, the course will teach students the dangers of soil erosion in agricultural farmlands, the various types of erosion and the factors responsible for them, soil loss estimation using

the Universal Soil Loss Equation and water erosion mitigation strategies, and the implication of erosivity and erodibility of soil loss.

It also teaches soil conservation practices and earthworks for better water erosion control, wind erosion control strategies and dam usage for water and aquatic habitat conservation. The importance of the course is in agreement and actualization of sustainable development goals (SDGs) numbers 1, 2, 6, 11, 13 and 15 in the areas of poverty reduction, zero hunger, sustainable communities/cities, and climate action issues to ensure availability and sustainable management of water and sanitation for all and advance life on land respectively.

Objectives

The objectives of the course are to:

1. identify the different types of soil erosion and the factors responsible for them;
2. list the dangers of soil erosion to agricultural lands;
3. describe the impacts and implications of erosivity and erodibility on soil loss;
4. explain soil detachability and transportability;
5. state the Universal Soil Loss Equation and how it is used to estimate soil loss;
6. describe soil and water management practices that can mitigate erosion;
7. identify the features on an earth dam that distinguishes it from other types of dams
8. describe the role of soil and water conservation practices in Agriculture;
9. enumerate soil and water conservation methods with respect to south-south Nigeria; and
10. describe the operational principles and maintenance of soil erosion control techniques.

Learning outcomes

On completion of the course, students should be able to:

1. identify at least five the different types of erosion;
2. list five difference between erosivity and erodibility;
3. describe at least four methods by which soil losses using the Revised Universal Soil Loss Equation (RUSLE);
4. explain at least four management practices during crop cultivation for soil erosion mitigation;
5. state three different types the Universal Soil Loss Equation and how it is used to estimate soil loss;
6. describe three ways of soil and water management practices that can mitigate erosion;
7. identify at least five desert encroachment mitigation control measures;
8. describe at least four construction of an earth dam and discuss its usefulness;
9. enumerate six soil and water conservation methods with respect to south-south Nigeria; and
10. describe at least seven operational principles and maintenance of soil erosion control techniques.

Course contents

Definition soil erosion. Types of soil erosion. Causes of erosion. Raindrop or splash erosion. Sheet erosion. Rill erosion. Gully erosion. Stream Bank erosion. Soil detachability. Soil transportability. Soil losses and estimation. Universal Soil Loss Equation. Revised and modified versions Universal Soil Loss Equation with their applications, Erosivity. Erodibility. Soil conservation practices for water erosion control. Wind erosion. Mechanic of wind erosion. Control measures. Desertification. Desert encroachment and associated problems and control measures. Soil tillage in relation to conservation. Earthwork and structures used for water erosion control. Sediment check dams. Design and construction of dam. Streambank erosion control measures. Dams. Classification and construction of dam. Definition of Earth dams. Types Earth dams.

Minimum Academic Standards

Soil and water engineering laboratory with a NUC-MAS requirement facilities.

500 Level

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)

Learning Outcomes
The project will enable students to:
1. Synthesis all that was learnt in the programme to develop a technology or obtain data that can be deployed to solving a major agricultural and biosystems engineering problem.

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.

NDU-ABE 501 Agricultural Waste Management (3 Units; C; LH 30; PH 45)

Senate approved Relevance:
Training of graduates that will be globally relevant, highly skilled and knowledgeable in the application of engineering principles to solving agricultural waste menace engendered wealth creation, job creation, unemployment reduction and poverty eradication, which is in agreement with Niger Delta University's vision to produce an innovative workforce that is creative, excellent and service providers to transmute Nigeria's natural resources to goods and services. It is imperative, therefore, to create awareness among local authorities and stakeholders on the menace of indiscriminate generation and disposal of these wastes to the environment and to proffer treatment technologies that will help manage, recycle

and convert waste to wealth.

Overview

This course is primarily concerned with waste generation and the impact of waste generally on the environment and humans in particular. The waste era is becoming a global concern linked to industrial development and population growth. An increase in population has led to waste generation faster than collected and disposed of in many cities and towns. The quantity and diversity of wastes generated by industries and municipalities pose severe risks to human health and the environment. There is ignorance on the part of the populace about the harmful effects of the waste generated, and have resulted in the alarming increase of environmental pollution alongside urbanization, industrialization and changing agricultural practices. The day–to–day activities of human beings, particularly in developing countries, cause more environmental pollution than industrial waste emissions.

The course will focus on managing these wastes from generation to final disposal. The learning outcomes empower students to be well abreast in waste generation; waste handling and separation, storage and processing at source; collection; separation and processing, the transformation of solid waste; transfer and transportation; and disposal.

Objectives

The objectives of the course are to:

1. explain wastes and know its sources;
2. identify effects of waste disposal on human and environments;
3. discuss and describe wastes that are agriculturally based;
4. state different sources of agricultural wastes;
5. identify the wastes that are generated from municipality and how they are managed;
6. list the industrial sources of waste with their associated deleterious impact on environment;
7. enumerate, classify and characterize wastes that are hazardous in nature;
8. discuss the decomposition of organic matter; the series of microorganism involved in the decomposition process;
9. describe the simple way of carrying out the composting of organic wastes and residue;
10. identify the general impact of various waste sources on the environment; and
11. enumerate different waste management strategies to solve waste generation and its impact on environment.

Learning Outcomes

On completion of the course, students should be able to:

1. explain at least four waste generations and its disposal affects the environment and human health;
2. identify at least three wastes are of agricultural origin and do these wastes daunt our immediate environs and ways of making the useful;

3. discuss at least four discharged industrial effluents and emissions pollute our environments and their impacts on human health;
4. state at least three different sources of agricultural wastes;
5. identify at least three organic matter is decomposed in the soil;
6. list at least four organisms responsible for organic matter decomposition;
7. enumerate five ways by which soil organic matter influence the physical, chemical and biological properties of soil;
8. discuss five ways organic residues are composted and put into use
9. explain four impact of waste discharges on our environments and human health;
10. identify four conventional ways of treating and disposing wastes;
11. enumerate five alternatives' techniques in managing and disposing of wastes.

Course contents

Definition of wastes. Types of wastes; agricultural wastes, industrial wastes, domestic wastes, municipal solid, hazardous waste and liquid wastes. Waste generation. Effect of waste on Environment. Characteristics of agricultural wastes. Sources of agricultural wastes. Waste from application of chemicals during cultivation practices. Wastes from livestock production. Wastes from aquaculture. Uses of agricultural wastes. Types of municipal solid waste. Characteristics of municipal solid waste. Treatment and utilization of municipal solid wastes. Sources of industrial wastes. Effect of waste on environment. Characteristics of hazardous wastes. Sources of hazardous waste. Classification of hazardous waste. Household hazardous wastes. Classification of soil organism. wastes treatment and disposal. Waste water flow rates and characteristics. Design of wastewater networks, treatment systems, sludge and sludge treatment. Management of MSW and minimization process. Reuse of solid and liquid wastes; possibilities and processes. Hazardous wastes: generation, handling and management. General waste minimization process.

Minimum Academic Standards

Structure laboratory with a NUC-MAS requirement facilities.

NDU-ABE 508 Indigenous Crops Processing and Storage Engineering

(3 Units; E; LH 30; PH 45)

Senate-approved Relevance

Training of Engineers that will be globally relevant, highly skilled and informed required the application of engineering principles to agriculture production for food security, job creation, postharvest losses, unemployment reduction and poverty eradication, which is in line with Niger Delta University's vision in training the skilled and innovative workforce that are creative and excellent service providers to transmute Nigeria natural resources to goods and services. The graduates can apply engineering principles to agricultural

mechanization, crop production, crop and food processing preservation, packaging and storage, and farm and agricultural business management.

Overview

Processing and storage of indigenous crops are designed to address the underperformance of agriculture in South-South, Nigeria, and this is a significant concern as it hampers the transformation of the economy of Nigeria to veritable industrial production systems. It is a critical stage in agricultural production to transform, improve and preserve crops' nutritional and other uses to ensure food security and better industrial utilization. This course will also build the capacity of the student in the area of food security.

This course focuses on the importance of preparing students in agricultural and biosystems with the knowledge and skills to process and store indigenous crops to reduce postharvest losses and improve the quality of products to ensure food security. Students will therefore learn the fundamental concept and principle of handling, processing, drying, packaging and storage of indigenous crops. The importance of the course lies in meeting the need to achieve sustainable development goals (SDGs) in poverty reduction and zero hunger.

Objectives

The objectives of the course are to:

1. describe the concepts and principle of processing the various indigenous crops in the area;
2. explain the natural composition of such crops and their importance in the Ijaw culture;
3. identify the processing principle in establishing small scale processing units;
4. discuss how to develop business plans on the processing of such crops;
5. explain how to source for processing equipment for such crops;
6. enumerate processing and storage of biomaterials especially grains;
7. describe the basic principles of cleaning, sorting, grading and separation;
8. describe size reduction process and particle size analysis;
9. explain the principles of drying;
10. describe the importance and use of psychrometric chart;
11. identify different types of storage structures and storage environment conditions;
12. explain causes and control of deterioration of produce in storage; and
13. describe eenvironmental control in storage.

Learning Outcomes

On completion of the course, students should be able to:

1. describe five concepts and principle of processing the various indigenous crops in the area;
2. explain six natural composition of such crops and their importance in the Ijaw culture;
3. identify six processing principle in establishing small scale processing units;

4. discuss five ways to develop business plans on the processing of such crops;
5. explain six methods on how to source for processing equipment for different crops;
6. enumerate at least seven reasons of processing and storage of biomaterials especially grain crops;
7. describe six basic engineering principles responsible for cleaning, sorting and grading of agricultural produce;
8. describe at least four size reduction and particle size analysis of four biomaterials;
9. explain the effect of high moisture content on grain storage and the factors affecting drying;
10. describe at least four importance and relevance of psychrometric chart in drying;
11. identify three environment conditions required for safe storage of grains;
12. explain six causes and control of deterioration in grain storage; and
13. describe eight importance of environmental control in storage.

Course contents

Types, structure and nutritional composition of some indigenous crops and their relevance in the economic development of the Niger Delta Region. Plantain processing-production of chips, flakes roasting, frying production, flour production. Cassava processing – production of cassava flakes, flan production, tapioca, garri, starch farina production, cassava beverage (juice) production, fufu production, kpo utara production. Yam processing-production of pounded yam, flour roasting, boiling yam, yam pottage, amala production. Cocoa processing. Yam Processing- flour production, roasting, chips production. Akaikpa Processing. Onunu Processing. Yaga Processing. Kiri-Igana Processing. Opuru Processing. Kpo-Utana Processing

Minimum Academic Standards

Crop processing and storage engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 509 Fundamental of Agricultural Mechanization

(2 Units: C; LH 15; PH 45)

Senate-approved Relevance

The mission of Niger Delta University (NDU) is to produce Agricultural engineers of creativity, excellence and high-performance service providers that globally relevant with sound knowledge in both practical and theoretical approaches to the art of application of the related principles in designing, construction, operations maintenance and marketing of farm equipment/machinery. Agricultural engineers are empowered to lead the agricultural transformation of food production in Africa to address the challenges of meeting the Sustainable Development Goals (SDGs). The University is dedicated to producing quality Agricultural Engineers that are industry compliant to handle sustainable agriculture, food and fibre production, processing, packaging and preservation.

Overview

The underperformance of agriculture in Africa remains a significant concern as this hampers the transformation of the economy of African nations to veritable industrial

production systems. Yet agriculture is the driver of several elements of the needed change. Hence an understanding of the agricultural value chain and the critical importance of agricultural mechanization is vital to the production of agricultural engineers.

This course will produce broad-based engineers, as the content of this course indicates. The learning outcomes will inspire students to be upbeat in dreaming of solutions that will be innovative and enable them to link with other courses. The performance of agriculture in Africa remains a significant concern as this hampers the transformation of the economy of African nations to veritable industrial production systems. Yet agriculture is the driver of several elements of the needed change. Hence an understanding of the agricultural value chain and the critical importance of agricultural mechanization is vital to the production of agricultural engineers. This course produces broad-based engineers, as the content of this course indicates. The learning outcomes will inspire students to be upbeat in dreaming of solutions that will be innovative. In addition, they will be able to see themselves at the intersection of knowledge and practice, expressed through the diligent use of case studies and well-integrated field engagements.

Objectives

1. describe what agricultural mechanization entails in the context of integrated production system;
2. explain the components of an agricultural value chain;
3. identify the various dimensions of integrated agricultural production system;
4. list the various equipment used for livestock managements;
5. state applications of machines in agricultural production;
6. enumerate the different types of machines used in agricultural production;
7. state different types of machines used in agricultural production;
8. identify six different types of machines used in agricultural production;
9. enumerate ways to manage agric-production systems for enhanced production and profitability;
10. explain processing and size reduction equipment: crop drying and dryers; hammer, burr and roller mills, and their uses in farming operation; and
11. describe techniques of increasing yields through better timeliness of operations because of the availability of more power.

Course Learning Outcomes

On completion of the course, students should be able to:

1. describe at least four features of agricultural mechanization in the context of integrated production system;
2. explain at least four components of an agricultural value chain;
3. identify at least three dimensions of integrated agricultural production system;
4. list four equipment used for livestock managements;
5. state five applications of machines in agricultural production;
6. enumerate five different types of machines used in agricultural production;
7. state different types of machines used in agricultural production;
8. identify six different types of machines used in agricultural production;

9. enumerate five ways these machines can be deployed on schedule for profitable agriculture;
10. explain four critical elements in the management agricultural production systems for enhanced production and profitability; and
11. describe ten ways of increasing yields through better timeliness of operations because of the availability of more power

Course Contents
Introduction to agricultural mechanization. Nature and Objectives of agricultural mechanization. Factors affecting agricultural mechanization in the tropics. Farm machinery used for tillage. Equipment used for harvesting and processing. Crop protection equipment. Equipment used for harvesting and processing. Equipment used for livestock management. Analysis of production systems. Agricultural mechanization as a strategy for rural development. Problems of mechanization in Nigeria. Impact on food production and infrastructural development. Linkages with rural and industrialization. Farm power sources. Engine power. Types of renewable energy sources. Wind power. Solar power. Biofuels – biogas, biodiesel, bioethanol. Farm machinery: tractors and types; harrows; ploughs; seed drills; planters; sprayers; combine harvesters. Tillage and types of tillage. Case studies of selected farms.

Minimum Academic Standards
Farm power and Machinery Engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 510 Baking Technology (3 Units; E; LH 30; P 45)

Senate –approved Relevance
Training globally relevant and competitive graduates who are highly skilled and informed in the fundamental baking technology agrees with NDU's mission to address hunger, unemployment and food shortage in Nigeria. Relevance is seen in agricultural and biosystems engineers from NDU who can produce self-reliant graduates, problem solvers, an effective army of human capital for the nation, and a vanguard in the war against hunger.

Overview
Baking techniques are an integral approach to mitigating hunger due to post-harvest losses experienced by farmers, especially in the Niger Delta areas of Nigeria, where most aquatic and agricultural products are being wasted. The Baking technology course is designed to educate students on relevant banking skills. In addition, students will learn the fundamentals of essential ingredients, mixing, shaping, and baking for bread, cakes and doughnuts.

This course will expose students to various baking techniques for storage and processing agricultural and aquatic foods. Also, to build students' capacity to address food shortage and food security in Nigeria. The importance of the course lies in meeting the need to achieve sustainable development goals (SDGs) numbers 1, 2, 11, and 13 in the areas of poverty reduction, zero hunger, sustainable communities/cities, and climate action issues, respectively. The course's objectives, learning outcomes, and contents are provided to address this need.

Objectives

The objectives of the course are to:

1. discuss to how to prepare a list of baking and pastry items for various confectionary;
2. describe the principle of baking bread and cakes;
3. identify and select required baking equipment and how to use them;
4. discuss bake bread and cakes for personal use;
5. describe properties and functions of the basic ingredients used in baked goods;
6. enumerate resize recipes to meet production needs and equipment capacities;
7. explain scale, mix, mold, proof and bake yeast raised goods;
8. identify how to prepare cookies using various common dividing and panning techniques;
9. discuss how to prepare product finishes such as washes, glazes, icings, frostings and fillings; and
10. identify proper storage techniques for all baked products.

Learning Outcomes

On completion of the course, students should be able to:

1. discuss at least seven techniques on how to prepare a list of baking and pastryl items for various confectionary;
2. describe six principle of baking bread and cakes;
3. identify ten baking equipment and how to use them;
4. discuss at least seven different types of bake bread and cakes for personal use;
5. describe seven properties and functions of the basic ingredients used in baked goods;
6. enumerate at least three techniques of resizing recipes to meet production needs and equipment capacities;
7. explain at least ten different types of scale, mix, mold, proof and bake yeast to raise goods;
8. identify eight cookies using various common dividing and panning techniques;
9. discuss six techniques to prepare product finishes such as washes, glazes, icings, frostings and fillings; and
10. identify five methods of storage techniques for all baked products.

Course contents

History of baking. Basic principle. Ingredients and their functions in baking. Techniques used to prepare ingredients. Mixing and blending of ingredient. Baking equipment's and tools. Baking of different types of bread. Baking of different types of cakes. Formula conversions, Functions of ingredients. Mixing in bakeries. Yeast bread and their baking methods. Baking of Biscuits. Pasting dough. Packaging of baked products. Storage of baked products. Hygiene and maintenance of bakery. Economics of establishing a bakery. Location and siting of a bakery. Feasibility report on establishing a small bakery.

Minimum Academic Standards
Crop processing and storage engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 512 Fish and Meat Processing and Storage (3 Units; E; LH 30; P 45)

Senate –approved Relevance
Niger Delta University's vision is to train graduates to apply engineering principles to agricultural mechanization, crop production, crop and food processing preservation, packaging and storage, farm and agricultural business management, irrigation, farm structures, rural electrification, drainage and erosion control to transmute Nigeria natural resources to goods and services, reduction in postharvest losses, unemployment reduction and poverty eradication.

Overview
Fish and meat processing Technology is a postharvest course to train students on handling, processing and preserving fish and meat products. The teaching and practical works on the biochemical properties, handling, processing methods, preservation methods and storage of fish and meat products will be focused on by students. Processing and storage of biomaterials designed to address the underperformance of agriculture in Africa remain a concern as this hampers the transformation of the economy of African nations to veritable industrial production systems. The crucial stage in agricultural production is to transform, improve and preserve the nutritional and other uses of crops and livestock production to ensure food security and better industrial utilization.

This course focuses on the importance of preparing students in agricultural and biosystems with the knowledge and skills to process and store biomaterials to reduce postharvest losses and improve crops' quality to ensure food security. It will also build the capacity of the student in the area of food security. The importance of the course lies in meeting the need to achieve sustainable development goals (SDGs) numbers 1 and 2 in the areas of poverty reduction and zero hunger issues, respectively.

Objectives
The objectives of the course are to:

1. describe at least five the fundamental concepts and principles of fish and meat processing technology;
2. identify principles of fish and meat processing at home and in the establishment of such processing centres;
3. describe business plan and feasibility reports on the establishment of fish and meat processing centre;
4. identify at least seven post-harvest changes that occur in animal flesh after slaughter;

5. describe major meat quality attributes, their measurement and processes used to ensure quality;
6. state at six processes that should be followed to obtain quality meat from animals;
7. identify five skills in processing and preservation of meat, fish and poultry products;
8. discuss structures of fish and composition of meat;
9. explain five post-harvest changes that occur in animal flesh after slaughter;
10. describe major meat quality attributes, their measurement and processes used to ensure quality;
11. explain processes that should be followed to obtain quality meat from animals; and
12. enumerate skills in processing and preservation of meat, fish and poultry products.

Learning outcomes

1. describe at least five the fundamental concepts and principles of fish and meat processing technology;
2. identify five principles of fish and meat processing at home and in the establishment of such processing centres;
3. state five principles of fish and meat processing at home and in the establishment of such processing centres;
4. identify at least seven post-harvest changes that occur in animal flesh after slaughter;
5. describe at least four major meat quality attributes, their measurement and processes used to ensure quality;
6. list at six processes that should be followed to obtain quality meat from animals;
7. identify five skills in processing and preservation of meat, fish and poultry products;
8. discuss at least four structures of fish and composition of meat;
9. explain five post-harvest changes that occur in animal flesh after slaughter;
10. describe seven major meat quality attributes, their measurement and processes used to ensure quality;
11. explain at least four processes that should be followed to obtain quality meat from animals; and
12. enumerate five skills of processing and preservation of meat and fish.

Course contents

Composition of fish and meat muscles. Types, structure and biochemistry of fish and meat. Selection and grading of raw materials. Principles of meat and fish processing Technologies. Equipment for fish and meat processing. Seasoning used in fish and processing. Packaging of fresh and processed fish and meat products. Handling and maintenance of tools and equipment. Fish and meat processing hygiene. Cleaning and sanitation of fish and meat processing. Economics of establishing a small-scale fish/meat processing Centres/plant. Preparation/development of fish/meat processing plant. How to write feasibility reports on

fish/meat processing business. How to source for loans/grants to establish small scale fish/meat processing.

Minimum Academic Standards
Crop processing and storage engineering laboratory with a NUC-MAS requirement facilities.

NDU-ABE 522 Design and Analysis of Farm Structures

(3 Units; C; LH 15; PH 45)

Senate approved Relevance

The Niger Delta University (NDU) has a mission of producing competently innovative Agricultural Engineers with excellence and creative capability who will be globally relevant, highly skilled and knowledgeable in the application of engineering principles to solving the agricultural problem related to structures and environmental control necessary for both the farmer, crops, and animals in the farm and provision good transportation means for the easy movement of the farm products, with the aim of wealth creation, job creation, unemployment reduction and poverty eradication, which is in agreement with Niger Delta University's vision to produce an innovative workforce that is creative, excellent and service providers to enhance comfortability in the farmer to boost productivity.

Overview
The primary concern of this course is to educate the students to become sound farm structures engineers. Farm structures is that branch of Agricultural engineering that deals with the provision and maintenance of built-up facilities within and, occasionally, outside the farm environment. A farm structure engineer is a specialist in the field of agricultural and civil engineering whose interest, education, training and experience have developed the knowledge of scientific principles, construction materials, construction procedures, and economics necessary to direct the design, construction, utilization, and maintenance of farmhouses, barns, shed, silos, and related structures.

This course will create awareness among local authorities and stakeholders on the adverse effect of not having suitable structures in the farm environment and come up with technologies that will help farmers to construct and erect local structures in the farm for crop storage and animals to prevent wastage more quickly. The importance of the course lies in meeting the need to achieve sustainable development goals (SDGs) numbers 1, 2, 11, and 13 in the areas of poverty reduction, zero hunger, sustainable communities/cities, and climate action issues, respectively. Therefore, the course's objectives, learning outcomes, and contents are provided to address this need.

Objectives
The objectives of the course are:
1. describe the concept of farm structures and farm buildings;

2. identify the different type of farm structures;
3. explain the design and analyze trusses in buildings;
4. describe and analyze deflections in beams;
5. discuss design and construct concrete structures;
6. explain different construction materials and their uses (concrete, steel, timber etc.)
7. state the structural design philosophies;
8. enumerate different farm structures such as silo, fishpond etc.;
9. describe the design and analyze plumbing system; and
10. explain the use of building codes.

Learning Outcomes

On completion of the course, students should be able to:

1. explain at least four types farm structures and farm buildings;
2. describe at least six different types of farm structures;
3. state six the various design philosophies;
4. list at least three analyses of determinate and indeterminate trusses/frames;
5. identify at least five advantages and disadvantages of different construction materials;
6. enumerate at least six designs of various components of a building (i.e. beams, column etc) and RCC structures;
7. describe at least two designs and constructions of wood and steel structures;
8. explain at least six applications of locally available materials such as periwinkle shells in construction works;
9. state at least five design and construction of agricultural structures such as silo; and
10. identify at least six building codes in structural design;

Course contents

Structural types in farms; Analysis of trusses; joints and frames. deflection in beams (concrete, wood and steel beams). Structural design philosophy and methods, Load estimations, design loads; Concrete design. Steel and Wood design; use of local materials such as seashells in construction works; Design and construction of fish pond embankments, water tanks, dams, wells, dykes and levees, pens, fences, etc. Design and analysis of plumbing systems. Building laws and codes.

Minimum Academic Standards

Structure laboratory with a NUC-MAS requirement facilities.

NDU-ABE 531 Farm and Rural Electrification (3 Units: C; LH 30; PH 45)

Senate-approved Relevance

The vision of the University is to turn out graduates of creativity, excellence and high-performance service providers to fit into the academic or industrial set-up. This course, therefore, offers in-depth knowledge in designing, installing, maintaining and operating electrically powered equipment for livestock and crop conservation and storage to help overcome weather hazards at harvest time and reduce labour requirements to a minimum. Relevance is seen in agricultural engineers from NDU being able to address the electric energy crises resulting from inadequate, epileptic, unreliable, unsafe and uneconomical electric power generation and supply. This course empowers graduates to lead the agricultural transformation of food production in Africa to address the challenges of meeting the Sustainable Development Goals (SDGs).

Overview

The principles of electrical power generation, distribution and transmission will expose students to various powered equipment and machinery for livestock and crops processing, packaging and storage technology. Therefore, selecting appropriate farm electric motors and equipment such as barn machinery, chaff cutters and root cutters, cattle cake and grain crushers, and water pumps and their installation, maintenance, operation, and control is imperative. Furthermore, the impact of electric power on modern agriculture is significant because electricity, in its nature, is far more versatile than the earlier power sources.

Agricultural engineering students will have good knowledge of applying electrically powered equipment for crop threshing, winnowing, handling and processing, and other crop-processing equipment pest control, livestock production, packaging, storage and environmental management. In addition, electricity's ease of operation and low maintenance showed savings in time and labour.

Objectives

The objectives of the course are to:

1. describe the principle of generation, transmission and distribution of electricity;
2. state the prospects and limitations of farm and rural electrification;
3. explain the electricity power consumption on the farm and rural setting and selection of appropriate transformer;
4. describe working principle of operation of a transformer;
5. state how power is generated in a magnetic field;
6. explain the principles of standby power generation systems;
7. describe the safety steps recommended to prevent electrical hazards on the farm;
8. enumerate the steps to take in designing for the main service switch;
9. identify one-way and two-way switches and socket outlets;

10. describe electronic applications to agricultural production, processing and storage technology;
11. state the prospects and challenges of photovoltaic power generation in Nigeria;
12. identify the prospect of information and communication Technology to food production in Nigeria;
13. describe different types of renewable energy; and
14. enumerate the causes, effect and control of stray voltage to livestock production;

Learning outcomes

On completion of the course, students should be able to:

1. discuss three methods of generation, transmission and distribution of electricity;
2. state ten prospects and limitations of farm and rural electrification;
3. explain and calculate power consumption on the farm and rural setting and recommend appropriate transformer;
4. describe at least four working principles of operation of a transformer;
5. state three methods of power is generated in a magnetic field;
6. explain five principles of standby power generation systems;
7. describe at least four safety steps recommended to prevent electrical hazards on the farm;
8. enumerate five steps require in designing for the main service switch;
9. identify one-way and two-way switches and socket outlets;
10. describe at least four electronic applications to crops and livestock production, processing and storage;
11. state five ways electricity is used in sustainable engineering applications;
12. identify six contributions of information and communication Technology to food production in Nigeria;
13. state at least five types of renewable energy; and
14. enumerate seven causes, effect and control of stray voltage to livestock production.

Course Contents

Generation, transmission and distribution of electricity. Prospects and limitations of farm and rural electrification. Rationalization of electricity consumption on the farm and rural setting. Farmstead distribution systems. Electric codes and regulations, locations and types of distribution systems. Electricity for light. Farm electric motors and equipment selection, installation, maintenance and controls. safety steps recommended to prevent electrical hazards on the farm. Selecting feeder conductors. Electric central and circuit protection. Transformer. Application of electricity for food and crop handling and processing, pest control, livestock production and environmental control. Power factor, energy conservation. Renewable energy: types and sources, prospects and challenges. Basic electronic applications to farm and rural processes. Care and maintenance of electrical farm installations and machines –hatcheries, milking machines, feed mills, etc. Stand-by power units; purpose and importance, stand-by power. generator types, selection, maintenance and operation.

Minimum Academic Standards

Structural Engineering laboratory with NUC-MAS requirement facilities.

NDU-ABE 534 Refrigeration and Air Conditioning Systems

(3 Units: C; LH 30; PH 45)

Senate-approved Relevance

Niger Delta University (NDU) 's vision is to produce graduates of creativity, excellence and inestimable service providers who are highly skilled and knowledgeable in designing, installing, maintaining and operating refrigeration and air conditioning systems. Relevance is seen in agricultural engineering graduates from NDU being able to annex the knowledge gathered and best practices for sustainable development resulting from the increase in food productivity in Nigeria. Agricultural engineers are empowered to lead the agricultural transformation of food production in Africa to address the challenges of meeting the Sustainable Development Goals (SDGs).

Overview

There must be a fine collection, handling, storage, and distribution of fruits and vegetables so that, in this way, the crops and livestock products reach the final consumer in the best conditions. Refrigeration and air conditioning explore temperature control in fruit cooling systems to delay of maturation and ageing of tissue cells in the products, power of the attack of microorganisms and reduction of global quantitative and qualitative losses of products.

Refrigeration is essential to guarantee the product's freshness and increase its commercial lifetime.

This course empowered graduates to design, install, maintain and operate refrigeration and air conditioning systems to guarantee the freshness of the products and increase their commercial lifetime. Therefore, food products' production, processing, packaging and storage reached markets in good condition. The importance of this course is that it prepares the graduates to meet the need for sustainable development goals (SDGs) numbers 1, 2, 11, and 13 in poverty reduction, zero hunger, sustainable communities/cities, and climate action issues, respectively.

Objectives

The objectives of the course are to:

1. describe the fundamental principles and different methods of refrigeration and air conditioning;
2. state various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables;
3. enumerate at least five differences between refrigerants with respect to properties, applications and environmental issues;
4. state various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems;
5. describe the concept of refrigeration;

6. state different methods of refrigeration;
7. explain air refrigeration system;
8. enumerate vapour compression and vapour absorption refrigeration system;
9. identify of refrigerants;
10. explain psychrometric properties & processes; and
11. describe air Conditioning Systems.

Learning outcomes

On completion of the course, students should be able to:

1. describe at least four fundamental principles and applications of refrigeration and air conditioning system;
2. state at least four cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems;
3. enumerate at least four properties, applications and environmental issues of different refrigerants;
4. state at least five equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems;
5. describe at least six concept of refrigeration and its unit;
6. state at least four different methods of refrigeration;
7. explain at least four air refrigeration cycle and its application in air craft;
8. enumerate at least four compression and absorption vapour refrigeration system;
9. identify at least seven properties of refrigerants;
10. define at least five air properties and psychrometric processes; and
11. describe at least three air conditioning systems

Course contents

Brief history of refrigeration and air conditioning. Practical refrigeration and air conditioning cycles and elements. Vapour compression, gas and water absorption cycles. Refrigerants. Definition and classification of refrigerants. Properties of refrigerants Refrigeration load. Heat engine, heat pump and refrigerating machine. Coefficient of performance, unit of refrigeration. Reversed Carnot cycle. Classification of refrigeration systems. Primary and secondary refrigerants. Properties of some commonly used refrigerants. Selection of equipment. Air Conditioning processes; analysis using psychrometric charts. Fundamentals of refrigeration: basic refrigeration cycle and concepts, standard rating of refrigerating machines. What is Air Conditioning. Importance of Refrigeration in Dairy Industry. Methods of Refrigeration: natural methods and artificial methods. basic vapour compression refrigeration cycle. Refrigeration plant components. Refrigeration plant controls. Multi-evaporator and compressor systems. Vapour absorption refrigeration system. Psychrometry Cooling load calculations and cold storage design. Cold storage.

Minimum Academic Standards

Crop processing laboratory with a NUC-MAS requirement facilities.

NDU-AEE 542 Flood and Drainage Engineering (3 Units; C; L 30; P 45)

Senate Approved Relevance

The mission of Niger Delta University (NDU) is to produce graduates of creativity, excellence and high-performance service providers creativity with highly skilled and knowledgeable in flood and drainage engineering. In addition, the students acquire the fundamental scientific principles in solving flood and drainage-related problems of agriculture and food production, which agrees with the food security and self-sufficiency concept of NDU. Flood is now perennial in the Niger Delta and many places along the flood plains of the River Niger, causing untold hardship in most states. Therefore, this course is relevant as it seeks to address this climate change challenge. Furthermore, the graduates can use their training to provide solutions associated with flooding and drainage.

Overview

The course focuses on rural and urban flooding of the Niger Delta, Nigeria. Some background knowledge of hydrology and hydraulics would be helpful. It is prepared to develop flood and drainage management strategies, from flood forecasting to knowing when flooding is expected, warning the community of an eminent flood, preparing for the flood by temporarily evacuating lives and properties to higher grounds and flood mitigation using a combination of measures. These are to reduce the loss of crops, animals, lives and valuable properties.

The application of flood and drainage engineering is to assist students in resolving flooding issues. Students will be exposed to different methods for estimating flood peaks, and know where and when to use and explain different flood control measures. This course will enable students to be knowledgeable on the effects of poor drainage on farming (waterlogging) and salt accumulation. The importance of this course is that it prepares the graduates of Agricultural and Biosystems Engineering for the challenges of contemporary times, and the future in the fight food shortage.

Objectives

The objectives of this course are to:

1. enumerate flooding and the causes;
2. describe design flood;
3. identify how to estimate and design flood and flood flows;
4. list flood forecasting techniques;
5. explain different flood control measures;
6. enumerate flood preparedness and emergency evacuation;
7. identify waterlogging and salt accumulation;
8. explain different types of drainage systems;
9. enumerate three basic open channel flow principles; and
10. enumerate different methods for estimating flood peaks, and know where and when to use.

Learning Outcomes
On completion of the course, students should be able to:

1. state at least five causes of flood;
2. describe three techniques of estimating design flood and its importance;
3. identify five basic flood forecasting techniques for flood risk analysis and management;
4. list six flood mitigation strategies and possible combinations;
5. explain six different flood warning methods if there is an eminent flood for effective flood risk management;
6. enumerate five different means of evacuation before, during and after flooding.
7. identify four effects of poor drainage on farming;
8. explain six subsurface and shallow drainage systems;
9. state three basic open channel flow principles; and
10. enumerate five different methods for estimating flood peaks, and know where and when to use.

Course Contents
Definition of flood and drainage. Causes of floods and drainage problems. Flood and its causes and effects. Design flood and flood forecasting techniques. Flood control measures and structures, embankments, dykes and levees, design and construction. Design and installation of drains, maintenance. Flood risk assessment and management, flood preparedness, relief and recovery. Flood losses and economics of flood control. Variation of flood behaviour across South-South, Nigeria. Drainage. Effects of poor drainage on farming (waterlogging) and salt accumulation. Causes and remedies of waterlogging. Type of drainage systems Factors affecting drainage, types of land requiring drainage, benefits of drainage. Subsurface drainage systems. Layout patterns Singular and composite system, Type of drain pipes, pipe envelope, pipe size design. Shallow drainage system, hydraulic design of drainage canal. Environmental impacts of floods. Estimation of flood flows. Introduction to fluvial hydraulics. Flow resistance and roughness. Impacts of flooding on the community

Minimum Academic Standards Soil and water engineering laboratory with a NUC-MAS requirement facilities.

NDU-AEE 543 Farm and Rural Water Supply (3 Units; C; LH 30; PH 45)

Senate-Approved Relevance
The vision of the University is to produce creative graduates with the mindset of excellence for service to humanity. The mission is to employ all available resources to achieve productivity in the graduates. The Department is to train production-oriented graduates for the practical application of engineering skills. Relevance is seen in agricultural and biosystems engineering graduates from NDU being able to annex the knowledge broad-based practical and functional concepts of engineering theory, methodology and practice for sustainable development.

Overview

A community requires water for several needs, such as the survival of humans, farm animals and crops. However, this water should not only be in sufficient quantity but also be good quality. This course teaches students the fundamental concept of water prospecting, treatment and water supply to the farm and community. In addition, the course will enable students to acquire sound knowledge of providing water in any environment for farm animals, cultivated crops and the community. Students will be expose to different techniques of managing a water supply scheme in a rural community.

The course also teaches hydrologic cycle with the view to sourcing for water in reliable quantities and water purification techniques such as filtration, water conveyance and distribution systems within a community, using combined gravity and pumping system. In addition, the university water works department will be visited, where the students will see a practical demonstration of water supply operations and management.

Objectives

The objectives of the course are to:

1. describe the prospect for water and the best option to choose, with the understanding of the hydrologic cycle;
2. explain how water is harvested from rain, surface water, groundwater and effluent;
3. state how boreholes are constructed in the farm and elsewhere;
4. describe water purification, conveyance and distribution systems;
5. explain desalination of brackish water and recycling of effluents as a sources of water;
6. state water quality parameters in relation to potability;
7. discuss the essentials in a water supply system and management;
8. identify efficient ways of run a water supply facility;
9. state difference types of water treatment techniques; and
10. identify different methods of managing a water supply scheme in a rural community.

Learning outcomes

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

1. describe at least four prospects for water and the best option to choose, with the understanding of the hydrologic cycle;
2. explain at least three ways water can be harvested from any preferred source;
3. state at least three techniques on how boreholes are constructed and developed;
4. describe at least four water purification methods, conveyance and distribution systems;
5. explain at least three methods of desalination of brackish water and recycling of effluents as a source of water;
6. state at least five water quality parameters and different water treatment methods.

7. discuss at least three ways treated water is stored, transmitted and distributed within a community;
8. identify at least four different types of pipes for water transmission and practically know how they can be connected;
9. state at least five different types of water treatment techniques; and
10. identify at least seven methods used in managing a water supply scheme in a rural community.

Course contents
Types of rural water supply. Types of rural water sources. Dams and reservoir. Water intake structures. Groundwater hydrogeological properties and hydraulics. Types of aquifers. Borehole construction, Methods and pumping test. Desalination and recycled effluent. Water purification methods. Water quality. Water conveyance and distribution systems. Water demand and quantity. Managing a water supply scheme in a community. Water for improved rural livelihoods. Rural water supply in Nigeria. Policy gaps and future directions. Challenges of water supply. Water supply system in villages. Visit to the university water works department.

Minimum Academic Standards Soil and water engineering laboratory with a NUC-MAS requirement facilities.

NDU-GET 571: Principles of Engineering Management (**2 Units; C; LH 30)**

Senate approved Relevance:
The vision of Niger Delta University is to produce graduates of creativity, excellence and quality service provider that can launch their careers in Nigeria and overseas with sound knowledge in planning, designing, and overseeing projects, as well as managing finances and supervising one or more engineering teams. Relevance is seen in agricultural and biosystems graduates from NDU capable of applying their management theories, analytical tools, knowledge and skills to solve engineering problems for sustainable development.

Overview
Engineering management is applying the practice of management to the practice of engineering. Engineering management is a career that combines the technological problem-solving ability of engineering and the organizational, administrative, legal and planning capabilities of management to oversee the operational performance of complex engineering-driven enterprises. Students will be taught on different appropriate tools of analysis to tackle issues and problems of management policy as affected in engineering

This course relates management concerned with the engineering sector for industrial growth. The course will help to develop the knowledge and skills needed for industrialization. The engineering management course, will empower students to develop industrial engineering skills, knowledge

and expertise, alongside knowledge of business and management techniques, strategies and concerns. More importantly students will acquire knowledge on how engineering processes interact with aspects of business management.

Objectives

The objectives of the course are to:

1. explain the engineering management theories, methods, practices and strategy;
2. describe business practices, organizational behavior and management skills;
3. discuss how engineering processes interact with aspects of business management;
4. explain current global markets and issues within engineering management;
5. identify the health and safety, economic, environmental and ethical concerns of the work place;
6. describe appropriate tools of analysis to tackle issues and problems of management; policy as affected in engineering;
7. discuss the management to engineering in order to solve day-to-day engineering issues in a range of transferable skills that will be of value in employment and self- employment;
8. identify the analytical skills and the ability to develop simplified frameworks for studying managerial techniques;
9. state skill base requires for to understand engineering management;
10. discuss the technical oral presentations and write technical and performance reports;
11. explain the analytical and quantitative skills, including ability to interpret data; and
12. discuss the engineering drawing and computer-aided design (CAD).

Learning Outcomes

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

1. explain at least five engineering management theories, methods, practices and strategy;
2. describe at least five business practices, organizational behavior and management skills;
3. discuss at least five on how engineering processes interact with aspects of business Management;
4. explain at least four current global markets and issues within engineering management;
5. identify at least three health and safety, economic, environmental and ethical concerns of the work place;
6. describe at least five appropriate tools of analysis to tackle issues and problems of management policy as affected in engineering;
7. discuss at least five techniques used in management to engineering in order to solve day-to-day engineering issues in a range of transferable skills that will be of value in employment and self-employment;
8. identify at least five analytical skills and the ability to develop simplified frameworks for studying managerial techniques;
9. state at least five skill base requires for to understand engineering management;
10. discuss three technical oral presentations and write technical and performance reports;
11. explain at least three analytical and quantitative skills, including ability to interpret data; and
12. discuss at least four engineering drawings and computer-aided design (CAD).

Course contents

Management; meaning, principles and practice. Organization; principles, span of controls, delegation of authority, structure, formal and informal. Industrial ownership; partnership and joint company. Personnel management; objectives and functions, recruitment and selection personnel development. Financial management; sources of financial, accounting and book keeping, cost planning and control. Concept of management tasks. Leadership Patterns. The concept of motivation, control and delegation of authority. Organization theories and concepts. Industrial relations. Operational research – history, definitions, theories, structure; Models, art of modeling and simulations, Linear programming (graphical solution), basics of the simplex method, sensitivity analysis, decision theory and queuing models. Applications in Engineering practice.

Minimum Academic Standards

Engineering with a NUC-MAS requirement facilities.

APPENDIX

List of Reviewers

Title	Surname	First Name	Institution	Programme
Professor	FABORODE	Michael O.	Obafemi Awolowo University, Ile-Ife	**Discipline Chairman**
Professor	OLOCHE	O. B.	University of Abuja, Abuja	Mechanical Engineering
Professor	EKECHUKWU	Onyemaechi Valentine	University of Nigeria, Nsukka	Mechanical Engineering
Engineer	ALI	Kashim	COREN	Mechanical Engineering & General Discipline
Professor	OLORUNMAIYE	Adesiji	University of Ilorin,	
Lt. Col. Dr	IMAM	A.S.	Nigerian Defence Academy, Kaduna	Mechatronics Engineering
Professor	ASERE	Abraham	Elizade University, Ilara-Mokin.	Automotive Engineering
Professor	EDOKPAI	Ralph	University of Benin, Benin-City	Industrial and Production Engineering
Professor	FUBARA-MANUEL	Isoteim	Rivers State University of Science and Technology, Port Harcourt	Marine Engineering
Professor	FAKINLEDE	O. A.	University of Lagos, Lagos	Systems Engineering
Professor	OGBONNA	Chibueze Achimba	Babcock University, Ilishan Remo	Computer Engineering
Professor	BOYI	Jimoh	Ahmadu Bello University, Zaria	Electrical Engineering
Professor	ADEDIRAN	Yinusa Ademola	University of Ilorin	Electrical and Electronics Engineering

Title	Surname	First Name	Institution	Programme
Professor	AZOBUOGU	Augustine Chukwuemeka	Nnamdi Azikiwe University, Awka	Electronics Engineering
Professor	NYITMEN	Dominic Saaityo	Nigerian Defence Academy, Zaria	Telecommunication Engineering
Professor	LETON	Tambari Gladson	University of Port Harcourt	Environmental Engineering
Professor	ITODO	Isaac Nathaniel	Joseph Sarwan Tarka University, Makurdi	Agricultural and Biosystems Engineering
Professor	OKAFOR	Gabriel	University of Nigeria Nsukka	Food Science and Technology
Professor	HASSAN	Suleimon Bolaji	University of Lagos, Lagos	Materials and Metallurgical Engineering
Professor	AJAYI	Ade	Federal University of Technology, Akure	Metallurgical Engineering
Professor	AJAKA	Ebenezer O.	Federal University of Technology, Akure	Mining Engineering
Professor	IKHU-OMOREGBE	Daniel	Benson Idahosa University,	Chemical Engineering
Professor	ADEMILUYI	Falilat Taiwo	Rivers State University of Science and Technology, Port Harcourt	Petrochemical Engineering
Professor	ONYEKONWU	Mike	University of Port Harcourt	Petroleum Engineering
Professor	IKIENSIKIMAMA	Sunday	University of Port Harcourt	Petroleum and Gas Engineering
Professor	OGBONNA	Friday Joel	University of Port Harcourt	Petroleum and Gas Engineering
Professor	YELEBE	Zakiene Robert	University of Port Harcourt	Natural Gas Engineering
Professor	WAZIRI	Baba Shehu	University of Maiduguri	Water Resources Engineering

Title	Surname	First Name	Institution	Programme
Professor	AYESIMOJU	Kola Oluyomi	University of Lagos	Civil Engineering
Professor	OGUNTI	Erastus O.	Federal University of Technology, Akure	Structural Engineering
Professor	BABATOLA	Olufemi	Federal University of Technology, Akure	Wood Products Engineering
Professor	AISIEN	Felix A.	University of Benin, Benin-City	Biomedical Engineering
Professor	ODETUNDE	Christopher	Augustine University, Illara, Epe.	Aerospace Engineering
Professor	ATEYERO	A.A.A.	Covenant university, Ota	Information and Communication Engineering
Professor	AIBINU	Musa Abiodun	Federal University of Technology, Minna	Information and Communication Engineering

List of NUC Representatives

Title	Surname	First Name	Programme
Mr	MALLAM	Gambo	Electronics Engineering & Industrial and Production Engineering; **Discipline Representative**
Mr	WACHUKWU	Obinna	Mechanical Engineering
Mr	OHANME	Bartholomew	Mechatronics Engineering & Petrochemical Engineering
Mrs	MICHEAL-AUGUSTINE	Chinenye	Automotive Engineering & Agricultural and Biosystems Engineering
Mr	EMENEM	Chinweokwu	Marine Engineering
Mrs	AKAUBA	Vivian	System Engineering
Mr	AKINOLA	Akinlabi	Computer Engineering
Mr	NWAGWU	James Chile	Electrical Engineering
Miss	ADENIJI	Yemisi	Electrical and Electronics Engineering
Mr	WADA	Arome J.	Telecommunication Engineering
Mrs	ABIMBOLA	Oni	Environmental Engineering
Mrs	OKPEKU	Omoh	Food Science and Technology
Mr	OSEMEKE	Bright	Materials and Metallurgical Engineering
Mr	ZAMUNA	Musa	Metallurgical Engineering
Mr	IBRAHIM	Adebayo	Mining Engineering/ Aerospace Engineering
Mrs	ZANG	Aara A.	Chemical Engineering
Mrs	EYO	Esther	Petroleum Engineering
Mr	IBRAHIM	Adam Mohammed	Petroleum and Gas Engineering(Oil and Gas)
Mr	AHMED	Nakaka	Petroleum and Gas Engineering(Oil and Gas)
Mr	ABORELE	Gabriel	Natural Gas Engineering
Mr	OGUNNUSI	Afolabi	Water Resources Engineering
Mrs	OZICHI	Happiness Madu	Civil Engineering
Mrs	AGBAJI	Stella Ene	Structural Engineering
Mrs	OPARAUGO	Lilian N.	Wood Products Engineering
Mrs	EFFIONG	Itoro	Biomedical Engineering
Mr	NKESHITA	Valentine	Information and Communication Engineering