ENUGU STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL AND BIORESOURCE ENGINEERING

B. ENG, AGRICULTURAL AND BIORESOURCE ENGINEERING

OVERVIEW

Agricultural and Bioresource Engineering is the application of engineering knowledge and services in solving technical and environmental problems in agriculture and agro-industries. It utilizes all branches of engineering and technology in the art, science and business of crop and animal production as well as in the processing, preservation, storage, handling, manufacture, distribution or marketing of agricultural products.

The primary mission of Agricultural and Bioresource Engineering is to mechanize agriculture, agro-based industries and to protect the environment of man, plants and animals as well as rural water supply and development.

PHILOSOPHY

The philosophy of Agricultural and Bioresource Engineering department is to achieve the following;

1. Exploitation and solving of problems associated with all agricultural operations and facilities starting from planting to packaging of processed food; livestock and forestry resources production, utilization and storage.
2. Design, manufacture, use and maintenance of agricultural implement and machines.
3. Harnessing of energy resources and conversion of these into any desired end-use in agricultural production.
4. Designing of systems relating to any one or combination of the above and several other Engineering professional practices.

In the concept of Enugu State University of Science and Technology, Agricultural and Bioresource Engineering Department has to be well associated with all the other Departments in the Faculty of Engineering and Technology as well as the Departments in Faculty of Agriculture Sciences, Health Sciences and Environmental Sciences.

OBJECTIVES

The primary objective of setting up an Agricultural and Bioresource Engineering unit is to train individuals who could combine the knowledge of Engineering and basic Sciences to solve

problems associated with all Agricultural operations and facilities utilized from the planting of seed to the packaged processed foods. Specifically, the objectives are;

1. To enable the University offer to all interested students of the University, the Technological and other phases of Agriculture, including Agricultural Mechanics, Power and Machineries, Processing, Soil and Water, and Surveying.
2. To enable the University contribute its quota in the training of manpower needed to support the growth of Agriculture through highly automated methods of operation which is becoming increasable important in our society
3. To create the enabling environment for the University to maintain and manage fleet of Agricultural and construction equipment for instructional and farm use.

CAREER OPPORTUNITIES

The Agricultural and Bioresource Engineer can pursue careers in different areas of the economy. Career opportunities in Agricultural and Bioresource Engineering exist in the following; Ministries of Agriculture, Water Resources, Science and Technology, as well as most government parastatals.

In the private sector, Agricultural Engineers find opportunities in companies that manufacture, market or service agricultural machines, food processing companies and consultancy outfits. It is deeply rooted in Civil and Mechanical Engineering-based industries as well as Agriculture and Agro- industrial processing. The career opportunities are therefore as wide as exists in Mechanical and Civil Engineering, Agriculture, Environment, Rural Development and Agro Industrial manufacture

ADMISSION REQUIREMENTS

The Department offers five and four year's degree programme leading to Bachelor in Agricultural and Bioresource Engineering (B.Eng). The Students admission policy is in compliance with the NUC and COREN minimum standard at UTME, Direct Entry and Post-Graduate Diploma levels. The minimum admission requirements are as outlined below:

UTME Candidates

Applicants who take the University Matriculation Examination (UME) may be admitted into the first

Year degree course provided that:

1. They have completed a full course training in a secondary school or in an approved institution of Equivalent status

2. They have attained sixteen (16) years of age or above on the first day of October, in the year of their candidature.
3. They reach the appropriate standard in the examination for entry to their in-view degree programme.

They possess one or more of the following qualifications

a. Senior School Certificate (SSC)
b. National Examination Council (NECO)
c. General Certificate of Education (GCE)

O'Level with passes at credit level in at least five credits passes, including English Language, Mathematics, Physics and Chemistry in not more than two sittings. **Note:** SSC/GCE can be combined with NECO.

Direct Entry Candidates

Applicants with one of the following qualifications may be considered for admission by direct entry:

1. Possess at least two passes at the principal or advanced level, plus five credit passes at the
2. GCE A' level in not more than two sittings.
3. Other qualifications acceptable to the Senate of the University, and being equivalent to (a) above.
4. Candidates with Higher National Diploma (HND) or Ordinal National Diploma (OND) in the appropriate discipline may be admitted for a Four Years Programme.

STAFF OF AGRICULTURAL AND BIORESOURCE ENGINEERING DEPARTMENT

	Academic Staff			
S/N	**Name**	**Qualifications**	**Area of Specialization**	**Designation**
1	Engr. Prof. Ike S. Oluka	B.Eng, M.Eng, Ph.D	Bio-Process and Storage Engineering	Professor
2.	Engr. Prof. Brendan Ekete Eje	B.Eng, M.Eng, Ph.D	Food and Post Harvest Engineering	Professor
3	Engr. Prof. Boniface O. Ugwuishiwu	B.Eng, M.Eng, Ph.D	Farm Structures and Environmental Engineering	Adjunct Professor
4	Engr. Prof. Louis. C. Orakwe	B.Eng, M.Eng, Ph.D	Soil and Water Conservation Engineering	Adjunct Professor
5	Engr. Dr. Paul C. Eze	B.Eng, M.Eng, Ph.D	Bio-Process and Storage Engineering	Senior Lecturer
6	Engr. Dr. Kenneth C. Ugwu	B.Eng, M.Eng, Ph.D	Farm Power and Machinery Engineering	Senior Lecturer

7	Engr. Dr. Jenice U. Chiwetalu	B.Eng, M.Eng, Ph.D	Soil and Water Conservation Engineering	Senior Lecturer
8	Engr. Dr. Glory C. Okeke	B.Eng, M.Eng, Ph.D	Bio-Process and Storage Engineering	Senior Lecturer
9	Engr. Christopher C. Okafor	B.Eng, M.Eng,	Soil and Water Conservation Engineering	Lecturer I
	Non- Academic Staff			
10	Engr. Bill-Julian A. Chiawa	B.Eng, M.Eng,	Farm Power and Machinery Engineering	Asst. Chief Technologist
11	Engr. Chikaodili N Eze	B.Eng, M.Eng	Soil and Water Conservation Engineering	Principal Technologist
12	Engr. Patrick E. Ide	B.Eng, M.Eng	Bio-Process and Storage Engineering	Technologist I
13	Engr. Bonfilus C Offor	B.Eng, M.Eng	Soil and Water Conservation/Environmental Engineering	Technologist I
14	Mrs. Agatha C. Nebechukwu	B.Eng,	Soil and Water Conservation Engineering	Technologist II
15	Mr. Luke L. Ozochi	FSLC TradeTest 1,2, & 3		Chief Driver/Mechanic
16	Mrs. Josephine Enemba	FSLC		Senior Lab Supervisor
	Executive /Administrative Staff			
17	Mrs. Beatrice N. Ugwu	B.Sc.		Chief Executive Officer
18	Mrs. Rose I. Eze	B.Sc.		Chief Executive Officer
19	Mr. Joseph E. O. Alaku	B.Sc.		Principal Executive Officer
20	Rev. Sr. Gloria Ugwunwangwu	B.Sc., M. Sc		Senior Typist
21	Mrs. Cecilia N. Eneoma	FSLC		Chief Caretaker

VISION STATEMENT OF THE DEPARTMENT

To continually improve the educational environment in order to develop professionals and experts with high technical and research backgrounds

MISSION STATEMENT OF THE DEPARTMENT

To mechanize agriculture, agro-based industries, processing and storage of food and to protect the environment of man, plants and animals as well as rural water supply and development.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS) OF AGRICULTURAL AND BIORESOURCE ENGINEERING

The programme aims at imparting quality education to agricultural and Bioresource Engineering students that will position them for effective contribution to the society by the use of modern technologies and practices. The graduates of Agricultural and Bioresource Engineering will

1. Be positively engaged in problem-solving using Engineering principles in addressing the evolving needs in Agriculture, Biosystems, Environment and the society at large.
2. Be actively involved in innovative application of Technology in the transformation of Agricultural sector to meet up with the emerging challenges in food production and environmental control.
3. Be able to coordinate and manage the interpersonal skills of various professionals involved in technological advancement in the area of Agriculture and Environmental control.
4. Conduct professional practice considering the socio-economical, environmental, ethical, health and safety implications

PROGRAMM OUTCOMES OF AGRICULTURAL AND BIORESOURCE ENGINEERING

At the end of the program, the graduates will be equipped with the ability to:

1 Exploit and solve various degrees of problems associated with all Agricultural operations and facilities starting from planting to packaging of processed foods applying the knowledge of mathematics, science and general Engineering principles.

2 Proffer solutions to the design, production, use and maintenance of machines and implement that enhances aggressive production of agro and industrial products without compromising the associated health, safety, cultural, societal and environmental factors.

3 Design and conduct experiments, analyze and interpret data, make inferences from the resulting data and apply the research skills to provide valid conclusions.

4. Work as an individual, member or leader of team of professionals working together in a multidisciplinary setting
5. Apply research tools in investigating Bioengineering problems in the bid to proffer conclusive solutions that enhances better living conditions in a very conducive environment.
6. Communicate results of various research activities in Bioengineering, environmental and need such information.
7. Apply the general knowledge of contemporary societal needs and responsibilities in providing engineering solutions for sustainable development of the society and its environment.
8. Engage in independent and life-long learning while continuously improving the Engineering skill in them applying the modern Engineering tools and ICT where necessary in solving the evolving societal needs.
9. Coordinate and manage diverse Engineering projects as a member or leader of a team of multidisciplinary environment.

10 Solve diverse Engineering problems while strictly adhering to the ethical principles guiding Engineering practice in Nigeria.

COURSE LEARNING OUTCOME (CLOs) OF AGRICULTURAL AND BIORESOURCE ENGINEERING

1. **GST 111 Communication in English I.**

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

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

2.GST 113 Nigeria People and Culture.

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

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

3. GST 115: Use of Library Study Skills & ICT

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

- concisely discuss the main branches of philosophy symbolic logic;
- the special symbols in symbolic logic conjuction, negation, affirmation, disjunction, equivalent and conditional statements;
- Use rules of inference and bi-conditionals qualification theory as ways of deduction;
- Analye the techniques for evaluating arguments;
- Distinguish inductive from deductive inferences.

4. ICH 111 General Chemistry I.

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

- define atom, molecules and chemical reactions;
- discuss the modern electronic theory of atoms;
- write electronic configurations of elements on the periodic table;
- rationalise the trends of atomic radii, ionisation energies, electronegativity of the elements,
- based on their position in the periodic table;
- identify and balance oxidation–reduction equation and solve redox titration problems;
- draw shapes of simple molecules and hybridised orbitals;
- identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;

- ❖ 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;
- ❖ analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy;
- ❖ determine rates of reactions and its dependence on concentration, time and temperature.

5. ICH 197: General Practical Chemistry I:

- ❖ Upon completion of this course, students will be able to:
- ❖ state the general laboratory rules and safety procedures;
- ❖ collect scientific data and correct carry out chemical experiments;
- ❖ identify the basic glassware and equipment in the laboratory;
- ❖ state the differences between primary and secondary standards;
- ❖ perform redox titration;
- ❖ record observations and measurements in the laboratory notebooks; and
- ❖ analyse the data to arrive at scientific conclusions.

6.MTH 111: Elementary Mathematics I :

Upon completion of this course, students will be able to:

- ❖ define and explain set, subset, union, intersection, complements, and demonstrate the use of venn diagrams;
- ❖ solve quadratic equations;
- ❖ solve trigonometric functions;
- ❖ identify various types of numbers; and
- ❖ solve some problems using binomial theorem.

7. MME 122 Engineering Materials

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

- ❖ list the main classes of engineering materials.
- ❖ enumerate the important properties of each of the main classes of engineering materials.
- ❖ calculate the total energy of an electron in nth orbit.
- ❖ describe the four quantum numbers
- ❖ explain electronic configuration and the aufbau principles.
- ❖ describe the different types of bonding, both primary and secondary bonding, with sketches.
- ❖ name the three most common metal crystal structures and give examples of metals which have each of these crystal structures.
- ❖ sketch the unit cells of bcc, fcc and hcp crystal structures and calculate the packing efficiency of each of them.
- ❖ distinguish between a metal, an alloy and a composite material.
- ❖ explain different fabrication methods in engineering and give examples of products made from each of them.

8. PHY 111: General Physics I :

Upon completion of this course, students will be able to:

- ❖ identify and deduce the physical quantities and their units;
- ❖ differentiate between vectors and scalars;

- describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
- apply newton's laws to describe and solve simple problems of motion;
- evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
- explain and apply the principles of conservation of energy, linear and angular momentum;
- describe the laws governing motion under gravity; and
- explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

9. PHY 197: GENERAL PRACTICAL PHYSICS I

Upon completion of this course, students will be able to:

- conduct measurements of some physical quantities;
- make observations of events, collect and tabulate data
- identify and evaluate some common experimental errors
- plot and analyse graphs
- draw conclusions from numerical and graphical analysis of data
- prepare and present practical reports.

10.CEE 121 Computer Programming.

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

- describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
- 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++;
- Use widely available libraries to prepare them for machine learning, graphics and design simulations;
- develop skills in eliciting user needs and designing an effective software solution;
- Recognize human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalization of services;
- Acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas.

11. GST 112: Communication in English II

Upon completion of this course, students will be able to:

- advance paragraphs in a logical and coherent manner;
- change outlines and create supporting
- identify and write topic sentences and attain coherence in written english; sentences
- mark various forms of essays (narrative, descriptive, expository and persuasive;
- distinguish and produce as accurately as possible, the english vowels and consonants;
- distribute an effective public speech.

12. GST 114: Social Sciences

Upon completion of this course, students will be able to:

- understand the concepts of geography as a scientific discipline;
- examine the sense of location specification, including an appreciation of forms and structure of nigerian settlement pattern, economic activities and challenges
- provide understanding on the relationships in economic and political geography of both in history and in the contemporary with the aim of creating environmental consciousness.

13. GST 118: PEACE AND CONFLICT RESOLUTION

Upon completion of this course, students will be able to:

- Define and explain the meaning and nature of conflict;
- Discuss the causes and types of conflicts;
- Discuss issues on conflict analysis, management, resolution and transformation;
- Explain the processes of conflict resolution – mediation negotiation, arbitration, litigation, conciliation and so on;
- Give detailed explanation of peace education;
- Examine the role of communication and language in conflicts;
- Explain the importance of the rules of conflict intervention;
- Determine the latent stage of conflict and possible responses;
- Discuss and be familiar with global issues and peace-building.

14.MEC-122 Basic Engineering Drawing.

Upon completion of this course, students will be able to:

- elucidate drawing as a means of communication;
- construct borderlines and dimensioning.
- illustrate drawing, measuring, lettering and dimensioning of objects in various views/positions;
- identify the various types of lines, their applications and geometry;
- demonstrate the geometrical construction of parallel and perpendicular lines, bisection and division of lines,
- draw construction and bisection of angles.
- construct triangles, inscribed, ascribed and circumscribed circles of triangle, quadrilaterals, polygons, circle and geometrical construction on circle
- demonstrate freehand sketching, symbols, conventions an scales

15. ICH 112: General Chemistry II.

Upon completion of this course, students will be able to:

- state the importance and development of organic chemistry;
- define fullerenes and its applications;
- discuss electronic theory;
- determine the qualitative and quantitative of structures in organic chemistry;
- state rules guiding nomenclature and functional group classes of organic chemistry;
- determine the rate of reaction to predict mechanisms of reaction;
- identify classes of organic functional group with brief description of their chemistry;
- discuss comparative chemistry of group 1a, iia and iva elements; and
- describe basic properties of transition metals.

16. **ICH 198: General Practical Chemistry II.**

Upon completion of this course, students will be able to:

- state the general laboratory rules and safety procedures;
- collect scientific data and correctly carry out chemical experiments;
- identify the basic glassware and equipment in the laboratory;
- identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
- carry out solubility tests on known and unknown organic compounds;
- carry out elemental tests on known and unknown compounds; and
- carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.

17. M**AT 112: Elementary Mathematics II.**

Upon completion of this course, students will be able to:

- identify the types of rules in differentiation and integration;
- recognise and understand the meaning of function of a real variable, graphs, limits and
- continuity;
- solve some applications of definite integrals in areas and volumes;
- solve function of a real variable, plot relevant graphs, and identify limits and idea of continuity;
- identify the derivative as limit of rate of change;
- identify techniques of differentiation and perform extreme curve sketching;
- identify integration as an inverse of differentiation;
- identify methods of integration and definite integrals;
- perform integration application to areas, volumes.

18. PHY 112 General Physics II.

Upon completion of this course, students will be able to:

- explain the general properties of waves;
- describe the general properties of sound;
- describe what static electricity is and how it originates;
- demonstrate an understanding of electrical potential;
- analyse electrical circuits;
- define the properties of magnetic fields;
- clarify how light interacts with lenses and mirrors;
- label optical phenomena associated with the wave properties of light;
- designate quantum theory and how it relates to the model of the atom.

19. PHY 198 General Practical Physics II

Upon completion of this course, students will be able to:

- Be able to prepare a written laboratory report that effectively interprets and communicates their results;
- Be able to effectively use computers as a tool for communication, data collection, data analysis.
- Perform at least 10 laboratory activities where students collect, organize and analyse data demonstrating concepts from the 8 major objectives listed in PHY 112 above

20. MME 122 Engineering Materials.

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

- list the main classes of engineering materials;
- enumerate the important properties of each of the main classes of engineering materials.
- calculate the total energy of an electron in nth orbit.
- describe the four quantum numbers
- explain electronic configuration and the aufbau principles.
- describe the different types of bonding, both primary and secondary bonding, with sketches.
- name the three most common metal crystal structures and give examples of metals which have each of these crystal structures.
- sketch the unit cells of bcc, fcc and hcp crystal structures and calculate the packing efficiency of each of them.
- distinguish between a metal, an alloy and a composite material.
- explain different fabrication methods in engineering and give examples of products made from each of them.

21. EEE 221: Applied Electricity.

On completion, the students will be able to:

- solve the electrical networks mathematically.
- apply the elementary knowledge of electromagnetism.
- distinguish between DC and AC circuits and analyse them.
- explain the basic principles of Electric machines.

22. CEE 221: Introduction to Modeling and Simulation.

Students should be able to:

- demonstrate the fundamental concepts and principles of modeling and simulation
- apply mastery of use of MATLAB;
- develop skills in MATLAB scripts, MATLAB arrays, linear models, graphing data in MATLAB, MATLAB array math, advanced graphing in MATLAB, nonlinear functions, nonlinear modeling examples, curve fitting;
- analyze and optimize designs using simulation tools link Simulink;
- optimize and recognize/understand the practical link to excite their creativity;
- perform and institute a concept in modeling and simulation for creative innovation;

23. MEC 223: Engineering Drawing II.

On completion, the students will be able to:

- apply computer skill in drafting.
- use conventional practices like electronic drawing packages;
- apply principle and use of computer in engineering design;
- Simulation packages in engineering design.

24. CHE 225: Fundamentals of Fluid Mechanics.

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

- discuss the elements of fluid static, like density, pressure, surface tension, viscosity, compressibility etc.
- use the principles of hydrostatic forces on submerged surfaces due to incompressible fluid in solving problems..
- applyconservation laws in fluid dynamics for solving problems in industries.
- use the fundamentals of viscous flow in certain engineering applications.

25. CVE 227: Applied Mechanics.

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

- apply different coordinate systems and position vectors to analyze the position and orientation of particles and rigid bodies.
- analyze the kinematics of particles in plane motion in different coordinate systems, including calculating displacement, velocity, and acceleration.
- apply newton's laws of motion to analyze the kinetics of particles in plane motion, including understanding different types of forces and their effects on individual particles and systems of particles.
- determine the center of mass of a system of particles and apply it to solve problems related to the equilibrium and motion of systems.
- analyze simple harmonic motion, including calculating displacement, velocity, and acceleration, and understand the concept of impulse and momentum.
- analyze the kinematics of a rigid body in plane motion, including different types of motions, relative motion between two points on a rigid body, and constructing velocity diagrams.
- apply newton's laws of motion to analyze the kinetics of a rigid body in plane motion, including calculating forces, moments, and understanding equilibrium conditions.
- apply the principles of work and energy to analyze the motion of a system of particles, including calculating work, kinetic energy, and potential energy.
- apply general energy principles, including the conservation of energy, to analyze and solve problems related to the motion of particles and rigid bodies.
- understand and apply the concept of virtual work and d'alembert's principles to analyze the equilibrium and motion of particles and rigid bodies under the influence of constraints and forces.

26.FEG 227: Engineering Mathematics I.

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

- solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
- describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
- solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;

- 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;
- 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.
- 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.

27.FEG 221: Engineer-in-Society.

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

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

28. FEG 293: Student Workshop Experience.

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

- demonstrate practical knowledge and skills in general engineering, including the operation of hand and powered tools for wood and metal cutting and fabrication;
- demonstrate a strong understanding of safety protocols and guidelines for using tools and machines, ensuring a safe working environment for themselves and others;
- apply their knowledge and skills in using tools and machines to complete selected engineering tasks;
- develop familiarity with various techniques and practices involved in general engineering, demonstrating the ability to select appropriate tools, cut materials, and fabricate components.
- developed problem-solving abilities in real-world engineering scenarios.

29. ENS 222: Introduction to Entrepreneurship.

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

- explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking;
- state the characteristics of an entrepreneur;
- analyse the importance of micro and small businesses in wealth creation, employment generation and financial independence;
- engage in entrepreneurial thinking;

- identify key elements in innovation;
- describe the stages in enterprise formation, partnership and networking, including business planning;
- describe contemporary entrepreneurial issues in nigeria, africa and the rest of the world; and
- state the basic principles of e-commerce.

30. EEE 222: Applied Electricity II:

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

- demonstrate the concept of electrical basic machines, DC, synchronous alternators, transformers, equivalent circuits;
- exhibit the understanding of converting electronic schematic circuit into printed circuit board (PCB) layout and vice versa using computer aided design (CAD) software;
- demonstrate the operation of three phase balanced circuits;
- Read and interpret and test various functional, PN junction Diode, transistors, FRTs, Zener, Rectifiers.
- demonstrate the skills to basic control systems, open/close loop systems...
- exhibit the understanding of the principles of electrical power generation, transmission, distribution as well as the utilization.
- exhibit the understanding of the communications fundamentals, introduction of TV, Radio Telephone systems.

31.MEC 224: Engineering Drawing II.

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

- apply projection techniques to accurately project points, lines, planes, and solids onto different views, demonstrating proficiency in graphical representation;
- analyze and determine intersections of solids, effectively representing complex geometric relationships and providing comprehensive engineering drawings;
- interpret and represent cam profiles, showcasing an understanding of cam mechanisms and their applications in mechanical systems;
- develop surfaces accurately, utilizing appropriate methods such as ruling and triangulation to represent curved and irregular shapes in engineering drawings;
- create detailed drawings of mechanical components, including belts, chains, gears, bearings, lubrication arrangements, couplings, brakes, flexible shafts, universal joints, etc., incorporating appropriate dimensions, tolerances, and annotations to convey design specifications.

32. FEG 294: Student Workshop Experience.

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

- demonstrate competency in operating hand and powered tools for wood and metal cutting and fabrication, ensuring accurate and efficient execution of engineering tasks;

- ❖ apply theoretical knowledge to practical scenarios, effectively utilizing tools and machines to accomplish selected engineering tasks with precision and attention to detail;
- ❖ exhibit proficiency in executing practical tasks related to general engineering, showcasing an understanding of fundamental principles and practices;
- ❖ adhere to safety protocols and practices when operating tools and machines, prioritizing personal and workplace safety in all engineering activities;
- ❖ collaborate effectively in a team environment, demonstrating problem-solving and communication skills through supervised hands-on experiences, fostering an environment of mutual support and shared learning.

33. CHE 226: Fundamental of Thermodynamics.

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

- ❖ demonstrate a comprehensive understanding of the basic concepts and principles of thermodynamics, including the Zeroth, First, Second, and Third Laws of Thermodynamics;
- ❖ apply mathematical relationships and equations to solve thermodynamics problems, including calculations involving heat, work, energy, and entropy;
- ❖ analyze and predict the properties and changes in state of pure substances using thermodynamic principles, including phase diagrams, heat capacities, and enthalpy calculations.
- ❖ apply thermodynamic principles to analyze and predict the behavior of perfect gases, including the ideal gas law, specific heat capacities, and gas power cycles;
- ❖ analyze and evaluate the performance of ideal gas cycles, including efficiency calculations, optimization techniques, and the impact of different cycle parameters.

34.CVE 228: Strength of Materials.

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

- ❖ recognise a structural system that is stable and in equilibrium;
- ❖ determine the stress-strain relation for single and composite members based on Hooke's law;
- ❖ estimate the stresses and strains in single and composite members due to temperature changes;
- ❖ evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
- ❖ determine bending stresses and their use in identifying slopes and deflections in beams;
- ❖ use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
- ❖ evaluate the stresses and strains due to torsion on circular members; and
- ❖ determine the buckling loads of columns under various fixity conditions at the ends.

35. FEG 228: Engineering Mathematics II.

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

- ❖ describe physical systems using ordinary differential equations (ODEs);
- ❖ explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types;

- numerically solve differential equations using MATLAB and other emerging applications;
- 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;
- solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem, and perform operations with complex numbers;
- 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
- Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula.

36. FEG 290: Students Industrial Work Experience (SIWES I).

SIWES should provide opportunity for the students to:

- acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;
- learn and practise basic engineering techniques and processes applicable to their specialisations;
- build machines, devices, structures or facilities relevant to their specific engineering programmes and applications;
- acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

37. ENS 311: Entrepreneurship Practicum.

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

- define entrepreneurship and give a detailed explanation of its origin as well as its relationship with economic growth;
- Develop entrepreneurship spirit, generate and develop business ideas;
- Develop business decision making techniques and business ideas;
- Identify varying business opportunities.

38.FEG 321: Engineering Mathematics III.

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

- apply Laplace transforms to find solutions for a variety of common functions and use them to solve differential and simultaneous equations in engineering problems.
- analyze and apply Fourier series to study periodic phenomena, enabling the understanding and prediction of periodic signals in engineering applications.
- utilize the Jacobian tensor and transformation techniques to describe and analyze the behavior of multidimensional systems in engineering problems.
- apply numerical analysis methods, including operational methods and special functions, to approximate solutions for complex engineering problems, ensuring accuracy and efficiency.

- use Euler and Runge-Kutta techniques to numerically solve differential equations, demonstrating the ability to model and simulate engineering systems accurately.

39.ABE 301: Basic Agricultural &Bioresource Engineering.

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

- outline the components of Agricultural and Bioresource Engineering;
- discuss the diverse role and relevance of the agricultural engineering profession;
- identify the career opportunities and appreciate the strategic importance of agricultural engineering in supporting and sustaining agricultural production;
- identify tractors and other farm power sources, various types of farm implements, their uses and maintenance;
- use of tractors for various field operations.

40.ABE 311: Machine Drawing & Design.

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

- describe the philosophy and practice of machine design and drawing process; factors affecting design; design for manufacture; standard machine elements;
- produce detailed drawing of machine systems, Part assembly, and machine components.
- undertake Special design and drawing projects to be presented by the students at the end of the course

41.ABE 321: Hydraulics.

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

- describe the basics of open channel flow, its classification and analysis of uniform flow in steady state conditions with specific energy concept and its application;
- analyze steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades;
- derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges;
- design turbines and explain the working principle;
- differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.

42.ABE 313: Theory of Machines I.

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

- solve problems relating to the stability mechanics and balance of machines;
- Identify the design factors in reciprocating and rotating machine,
- effectively explain the vehicular mechanics, brake and clutch systems, kinetics of rotating and reciprocating masses.

43. ABE: 323Engineering Geology.

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

- describe the earth geological processes;
- determine the engineering properties of rocks stereograph;
- determine the mineralogy, petrology and geology of an area..

44.ABE 325: Land Surveying

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

- Identify the use of survey plans in farmstead planning;
- Plan land levelling operations.
- Apply survey data in planning irrigation, drainage and tillage operations.

45. ABE 361: Soil Science.

- effectively discuss the Chemical and physical properties of soils;
- discuss the origin and formation of soil and the meaning of the soil to an Engineer and Agriculturist;
- interpret soil map and relate it to soil capability;
- analyse the nutrient requirement of the soil.

46.FEG 322: Engineering Mathematics IV.

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

- use Mathematical tools in solving complex Engineering mathematical problemes.
- employ Simple approach in Solving Numerical integration, Laplace transformation , various level of differential equations.
- explain and Calculate Sturm-Liouville Boundary value problems and Fouries Series Partial Differential Equation.
- discuss and Solve Linear, Homogenous and Partial differential equations of 9^{th} order with Constant Coefficients.
- explain and use different techniques in solving Integral Transforms .

47. ABE 314: Metallurgy for Agric Engineers.

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

- Identify the nature, origin, uses of metals and its alloys, their production;
- effectively explain the transformation of metals, hardening, and treatment;
- identify the mechanical properties of metals, for building of engineering structures.

48. ABE 322: Hydrology

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

- explain the hydrologic cycle, solar and earth radiation and precipitation;
- explain Evapotranspiration; infiltration: rainfall run-off over agricultural land;
- discuss groundwater hydraulics; watershed management; flood control.

49. ABE 324: Soil Physics & Mechanics

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

- discuss the physical and physico-chemical properties of soils;
- relate soil properties and salinity to the basic principles of drainage, irrigation and erosion;
- effectively discuss Cauchy stress principles, stresses under uniformly loaded rectangular area and apply them in various calculations relating to soil stress;
- concisely explain flow through tubes, surface tension, capillary rise;
- explain Darcy's law, terzanghi effective stress and their applications in calculation.

50. **ABE 362: Animal Production.**
At the end of this course, the students should be able to:

- classify livestock according to their uses;
- design different categories of livestock housing;
- identify various types of livestock processing equipment;
- evaluate various methods of assessing carcass quality;
- explain ways of preservation and storage of different categories of meat products.

51.ABE 401: Engineering Communication, Technical Writing and Presentation:
At the end of the course, the student should be able to:

- demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
- 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;
- 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.

50.ABE 411 Farm Power & Machinery Engineering:
At the end of this course, the students should be able to:

- identify farm power sources undertake selection and management of farm tractors and equipment;
- analyze the forces on the tractor and power measurement on tillage tools;
- carryout field performance evaluation of crop production equipment;
- carryout adjustment, maintenance and repair of a farm tractors and equipment.

51. ABE 421 Irrigation & Drainage Engineering:
At the end of this course, the students should be able to:

- analyse key irrigation and drainage issues;
- describe and design irrigation and drainage system;
- determine crop water requirements of different indigenous crops;
- predict the amount and frequency of irrigation water for a particular types of soil and crop;
- evaluate different irrigation systems;
- determine the effects of poor drainage on agricultural crops and soils.

52.ABE 441: Farm Structures and Environmental Control Engrg I.
At the end of this course, the students should be able to:

- Identify environmental requirements of crops , man and animal structure and their control;
- discuss heat transfer through structures, general environment requirement of farm structures;
- identify Causes of environmental pollution, management and control.
- design structural members of buildings, water supply and sewage disposal.

53. ABE 431: Properties and Handling of Agric. Materials.

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

- give a good narrative of engineering properties of agricultural materials and its application in food handling, processing and storage;
- identify handling methods for biomaterials;
- design and construct appropriate equipment for material handling.

64.ABE 461: Farm Management, Rural Sociology &Agric Extension.

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

- explain the Management processes and procedures of agricultural machines and equipment, staffing, directing and controlling;
- discuss means of management and procurement of agricultural inputs and produced materials;
- discuss the Principles of extension, diffusion, adoption and rejection of innovations: communication between the engineer and the rural farmer.

65. ABE 433: Processing and Storage of Biomaterials.

Upon completion of the course, students will be able to :

- design the shapes and structure of storage materials , facilities and discuss how the activities of micro organism,pest,weight of grains and force affect them;
- explain the design features of storage materials, especially grain storage equipment and the principles of storage design;
- Perform the unit operations in processing of biomaterials
- explain the traditional and advanced Technologies involved in food preservation.
- discuss the role of process Engineering in national development.

56.ABE 435: Food Engineering I

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

- appreciate the shapes and structures of microorganisms important to food products and how their activities affect various categories of food;
- explain the unit operations in food processing and the principles of process calculations;
- discuss the traditional and advanced Technologies involved in food preservation;
- appreciate the role of process Engineering in national development;
- explain the design features of food processing equipment.

57. ABE 463: Crop Production Engineering

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

- appreciate the various farming systems in agriculture;
- describe the various farm machinery used in crop production;
- carryout mechanical operations in crop production;
- establish small, medium and large-scale mechanize farms;
- undertake the application of fertilizer types for different crops;
- plan and implement irrigated agriculture;
- undertake some post-harvest crop processing activities.

58.ABE 511: Farm Electrification.

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

- discuss the Importance, generation,transmission and distribution of electricity in farm and home;
- Discuss Applications of Electricity in food processing and advanced Technologies involved in food preservation and farm stead
- Explain the principles of earthing/Grounding and equipment.
- explain the role of Engineers in Power generation, transmission, distribution and their contributions in Nation Building.
- Calculate load distribution in a farm building

59.ABE 521: Soil & Water Conservation.

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

- explain the importance of soil and water conservation and suitable measures for effective soil and water conservation in our environment.
- demonstrate various techniques of soil and water conservation.
- illustrate various types of erosions common in our environment.
- describe various approaches used in erosion control.
- explain the concept of wind erosion and identify different ways of controlling wind erosion.
- discuss the importance of soil and water conservation structures in agriculture.

60.ABE 523: Land Clearing & Development.

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

- identify the land resources available for arable, land use act and objectives for agriculture;
- select equipment and machinery for land clearing, reclamation and development;
- cost land clearing operations.

61. ABE 513: Agricultural Mechanization.

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

- explain the nature, strategies, factors and objectives of agricultural and industrial mechanization in the tropics;
- iidiscuss the Impact of mechanization on food production and infrastructure development;
- identify mechanization as linkage with rural industrialization using selected establishments as case study.

62.ABE 501: Engineering Project Management.

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

- explain the principles of management;
- discuss the ethics and law guiding Industrial group and organization;
- identify the Law of contract and breach of contract and liability for industrial Injuries;
- describe the integrated approach to machinery selection, usage, management and ownership;
- discuss agricultural production sequence, scheduling of operation and seasonality factor.

63.ABE 503: Engineering Law.

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

- explain the basic concept, sources and aspects of law;
- discuss the major differences between the various categories of law, courts and legal jurisdictions;
- explain the legal principles and their application in professional engineering design and management services and their professional liability implications;
- 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 as an expert witness.

64.ABE 515: Human Factors in Machine Design.

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

- explain the concepts of ergonomics as applied to engineering, history and formation;
- describe human energy sources, formation, measurement, techniques and factors affecting human energy requirement of a task;
- describe man as a control system, effects and tolerance limits of noise and vibration;
- explain anthropometry, biomechanics and design of hand tools.

65.ABE 502: Energy Systems & Applications.

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

- explain the thermodynamic principles of energy conversion.
- describe photosynthesis, biomass production, yield, energy plantation and solar energy conversion by algae multipliers and applications
- identify atmospheric effects of Raleigh and Mie scattering effects, turbidity, winds and clouds.
- describe irradiation measurement and applications of wind energy, energy from wastes, and fossil energy sources.
- Explain the design features of Hydro Plants, Solar Panels, Bio-digester etc as Sources of Energy;

66.ABE 504: Biomedical Engineering.

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

- describe Elements of human anatomy, physiology, respiratory mechanism, lung functions, homeostasis principles, and control systems;
- discuss gross anatomy and microscopic structures of organs and Systems with emphasis on design and functional relationships.
- analyse the membrane biophysics and equations for membrane transport, Anatomy and Physics of respiration;
- explain the physiology of vision and hearing; neurophysiology of learning and memory; pathophysiology of pain.

67. ABE 542: Environmental Control Engineering.

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

- explain basic water and wastewater quality parameters and measurement techniques of these parameters;

- discuss the basic principles of water, wastewater, and sludge treatment;
- discuss the importance of solid wastes in environmental engineering;
- classify solid wastes and their disposal methods;
- explain important points about solid waste management;
- define basic terms of air pollution and tells the meaning of the primary and secondary pollutants;
- recognize the basic methods of air pollution measurement and control;
- express the relationship between meteorology and air quality;
- define the terms related to horizontal and vertical dispersion;
- describe the movement of air parcels at these conditions.

68. ABE 512: Agricultural Power and Tractor Units.

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

- Identify Farm power sources, Farm tractor selection, use, maintenance and hitch systems.
- discuss the design considerations of single-axle, two-wheel drive, four-wheel drive and crawler tractor;
- explain tractor mechanics, power requirement and measurement, tractor testing and test codes.

69. ABE 514: Agricultural Machinery.

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

- carry out force analysis and discuss design consideration of various farm machinery;
- describe hitching methods, power requirements for operating farm equipment and machines.
- discuss the cost of operation and maintenance of various farm machinery, field evaluation, criteria for replacement of agricultural machines.

70. ABE 516: Design of Agricultural Machines.

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

- Identify machine design processes, procedures and selection materials of construction;
- discuss the methods of design and construction of low cost of machine elements;
- Identify the problems and prospects of agricultural machinery development and commercial manufacture.

71. ABE 518: Operation and Management of Farm Power and Machinery.

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

- apply the integrated approach to agricultural machinery usage, ownership and management;
- optimize machinery input combinations;
- discuss management of farm enterprise and scheduling of operations.

72.ABE 522: Irrigation Engineering.

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

- determine pumping power requirements;
- design and evaluate different irrigation systems;
- determine the quality of irrigation water;

- ❖ reclaim saline and alkaline soils;
- ❖ design irrigation projects.

73.ABE 524: Agricultural Land Drainage Engineering.

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

- ❖ design drainage system like canals and other structures;
- ❖ determine the effects of poor drainage on agricultural crops and soils;
- ❖ analyse key drainage issues;
- ❖ discuss the method of pumping, construction, installation and maintenance of drains.

74.ABE 528: Rural Water Supply & Sanitation.

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

- ❖ describe water requirements, quality standards, diseases and treatment methods;
- ❖ discuss methods of water transportation, lifting, distribution systems, treatment and disposal of sewage from rural homes.
- ❖ undertake septic tanks and digestion ponds design and installation.

75. ABE 537: Bioprocess Engineering.

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

- ❖ carry out unit operation activities in food processing;
- ❖ discuss the principles of cleaning, sorting, grading;
- ❖ discuss the traditional and advanced technologies involved in bio processing, preservation and storage;
- ❖ explain the design features of food processing equipment;
- ❖ Carry out process calculations in unit operations;
- ❖ discuss the role of bio-process engineering in nation building.

76. ABE 534: Food Engineering II.

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

- ❖ explain the role of heat exchangers in food preservation and packaging;
- ❖ design food processing machines and equipment and solve heat and mass transfer problems;
- ❖ effectively discuss the effect of heat and cold preservation as well as microbial activities on food quality;
- ❖ evaluate thermal process quality control and packaging of food.

77. ABE 536: Engineering Properties of Agricultural Materials II.

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

- ❖ evaluate the engineering properties of solid and fluidized foods and their application in development of processing machines;
- ❖ characterize liquid bio-materials and discuss the types of flow curves, behaviour index, viscosity indeces in processing and storage;
- ❖ evaluate the texture, quality and shelf life of food materials.