**COLLEGE OF ENGINEERING (COLENG)**

The College of Engineering, University of Agriculture, Abeokuta offers M.Eng. and PhD Degree in the following areas:

1. Agricultural Engineering Department
   - (i) Farm Power and Machinery
   - (ii) Soil and Water Engineering
   - (iii) Processing and Storage Engineering
   - (iv) Farm Building and Structures

2. Civil Engineering Department
   - (i) Water Resources and Environmental Engineering
   - (ii) Hydraulics Engineering
   - (iii) Highway and Traffic Engineering
   - (iv) Structural Engineering

3. Electrical/Electronic Engineering Department
   - (i) Electrical Machines and Power Systems
   - (ii) Electrical and Electronic Control Systems
   - (iii) Communication and Digital Signal Processing Systems

4. Mechanical Engineering Department
   - (i) Mechanical Engineering
   - (ii) Production Engineering
   - (iii) Materials and Metallurgical Engineering
   - (iv) Power and Process Engineering

**DEPARTMENT OF AGRICULTURAL ENGINEERING**

**POSTGRADUATE (M.Eng. & PhD) PROGRAMME COLENG**

## 1. INTRODUCTION

The postgraduate programmes of the Department of Agricultural Engineering are directed towards providing basic and applied research opportunities relevant to the processing of Agricultural Mechanization and related activities.

Consequently, the department's higher degree programmes have the twin objectives of offering postgraduate courses and basic research in specialized areas of Agricultural Engineering and updating, as the need arises, the knowledge of practicing engineers and applied scientists in specialized field of Agricultural Engineering, through industry-oriented and application-specific research programmes.

## 2. AREAS OF SPECIALIZATION

Programmes shall be offered for courses and research in the following areas of specialization:

- (i) Farm Power and Machinery
- (ii) Soil and Water Engineering

(iii) Processing and Storage Engineering
(iv) Farm Building and Structures

**3. ADMISSION REQUIREMENTS**

All the prevailing university regulations governing postgraduate degree shall apply.

**A. MASTER OF ENGINEERING (M.Eng.) IN AGRICULTURAL ENGINEERING**

**Introduction**

This programme is designed to last for a minimum of 24 calendar months for full-time students. It consists of eight courses, one of which shall be a research project. The units for each course are as laid down below. The research project shall be four units. Apart from the research project which shall last throughout the calendar year a number of courses shall be available during the first semester while the rest shall be available in the second semester.

**Admission requirements**

(i) The programme shall be open to candidate with a Bachelor's degree or the equivalent in Agricultural Engineering of the University of Agriculture, Abeokuta or any other approved University.

(ii) Candidates may be required to satisfy the department in a selection process- in addition to possessing a minimum of Second class lower Division (2-2).

Degree Requirements

To obtain an M.Eng. in Agricultural Engineering, candidate must:

(iii) Satisfy the examiners in a minimum of 30 units, made up as follows:
   a. 18 units of the compulsory courses (common and core courses)
   b. 6 units from the optional courses
   c. 6 units of the "Research Project" course

(iv) Satisfy all other requirements as stipulated in the Regulations of the School of Postgraduate Studies.

**B. DOCTOR OF PHILOSOPHY (Ph.D.) IN AGRICULTURAL ENGINEERING**

**Introduction**

These programmne are designed for candidates wishing to do advanced postgraduate research in Agricultural Engineering. Candidates are expected to take and pass 1st year coursework of a minimum of 24 units unless they already possess the M.Eng. or equivalent in Agricultural Engineering of the University of Agriculture, Abeokuta or any other approved University.

**Admission Requirements**

(i) The Ph.D. programme shall be open only to candidates having an M.Eng of the University of Agriculture, Abeokuta or any other approved University.

(ii) Candidates for the Ph.D. programme may be required to satisfy the department in an interview or written examination or both.

**Ph.D. Degree Requirements**

To obtain a Ph.D. in Agricultural Engineering, a candidate may be allowed to pursue the programme wholly by dissertation or by dissertation and course work following the later option, or candidate must:

(i) Satisfy a minimum of six units of the 'Research Seminars" at the 700 level

(ii) Satisfy all other requirements as stipulated in the regulations of the School of Postgraduate Studies.

**COURSE STRUCTURE**

*A. FARM POWER AND MACHINERY OPTION*

| **Common Courses** | | **CU** |
|---|---|---|
| AGE 740 | Seminar | 2 |
| AGE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**First Semester**

| **Core Courses** | | **CU** |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| AGE 731 | Farm Equipment Design and Evaluation | 3 |
| AGE 733 | Farm power and Machinery Management | 3 |
| STS 703: | Sampling Tech. & Design of Experiments | 3 |
| | **Total** | **13** |
| Option Courses (Any 1 from the following) | | |
| AGE 735 | Equipment and Techniques for Land Development | 3 |
| AGE 737 | Handling and Storage of Agricultural Products | 3 |
| AGE 739 | Simulation and Modeling of Engineering Systems | 3 |
| | **Total (Maximum of 3 CU)** | |

*Second Semester*

| **Core Courses** | | |
|---|---|---|
| AGE 732 | Traction and Trafficability on the farm | 3 |
| AGE 742 | Advanced Farm Power | 3 |
| | **Total** | **6** |
| Option Courses (Any 1 from the following) | | |
| AGE 736 | Soil – Plant Machine Dynamics | 3 |
| AGE 743 | Crop Protection Equipment | 3 |
| **AGE 738** | **Instrumentation and Measurement in Agric. Systems** | **3** |
| | **Total (Maximum of 3 CU)** | |

*B. SOIL AND WATER OPTION*

| **Common Courses** | | **CU** |
|---|---|---|
| AGE 740 | Seminar | 2 |
| AGE 799 | Thesis Research | 6 |
| | Total | 8 |

**First Semester**

| *Core Courses* | | |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| AGE 701 | Agricultural Drainage | 3 |
| AGE 703 | Advanced Hydrology | 3 |
| AGE 705 | Open Channel Hydraulics | 3 |
| | Total | 13 |

*Elective*

SOS 702 Soil Physics 3

**(Additional support courses may be incorporated to a candidate's programme on the recommendation of his advisory committee).**

*Second Semester*

| Core Courses | | |
|---|---|---|
| STS 703: | Sampling Tech. & Design of Experiments | 3 |
| AGE 700 | Irrigation | 3 |
| AGE 702 | Soil and Water Conservation | 3 |
| AGE 704 | Geohydrology | 3 |
| | Total | 12 |

*Elective*

AGE 738 Instrumentation and Measurement in Agric. Systems 3

(Additional support courses may be incorporated to a candidate's programme on the recommendation of his advisory committee).

*C. CROP PROCESSING AND STORAGE*

| *Common Courses* | | *CU* |
|---|---|---|
| AGE 740 | Seminar | 2 |
| AGE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**First Semester**

| *Core Courses* | | |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| AGE 751 | Heat and Mass Transfer | 3 |
| AGE 737 | Processing and Storage | 3 |
| AGE 755 | Principles of Environmental Control | 3 |
| | **Total** | **13** |

**Second Semester**

| **Core Courses** | | |
|---|---|---|
| STS 703: | Sampling Tech. & Design of Experiments | 3 |
| AGE 752 | Engineering Properties of Biological Materials | 3 |
| AGE 754 | Process Dynamics and Controls | 3 |
| **AGE 760** | **Design of Farm Structures** | **3** |
| | Total | 12 |

| *Elective (Any 2 from the following)* | | *CU* |
|---|---|---|
| AGE 738 | Instrumentation and Measurement in Agric. Systems | 3 |
| AGE 756 | Electronics in Agricultural Engineering | 3 |
| AGE 757 | Analysis and Synthesis of Linear Control Systems | 3 |
| AGE 758 | Solar Energy Fundamentals and Applications | 3 |
| AGE 761 | Advanced Heat and Mass Transfer | 3 |
| AGE 762 | Principles of Air- Conditioning | 3 |
| AGE 764 | Food Refrigeration and Cold Storage Engineering | 3 |
| AGE 765 | Materials Handling Engineering | 3 |
| AGE 766 | Engineering Economy, Optimization and Management | 3 |
| AGE 770 | Selected Topics in Agricultural Engineering | 3 |
| AGE 767 | Engineering Similitude | 3 |
| | **Total (Maximum of 6 CU)** | |

| | | |
|---|---|---|
| AGE 740 | PhD Seminar | 6 |

**Course Content**

**AGE 738**

**Instrumentation and Measurement Systems: 3 units**

Generalized configurations and functional descriptions of measuring instruments, Generalized performance characteristics of Instruments-Shaft power, pressure, sound, flow, temperature, heat-flux, time humidity and other miscellaneous measurements. Data manipulation, computing, compensation transmission, and recording.

**AGE 739**

**Simulation and Modeling of Engineering Systems: 3 units**

Mathematical review, dynamic and steady-state system elements, Modeling of physical systems, system equation and graphs formulation, transfer functions, system excitation, numerical techniques in solution of system equations, transient response of simple linear systems, sinusoidal steady-state analysis, digital computer modeling and simulation of engineering systems.

**AGE 740**

**M.Eng. Seminar 2 units**

In the first seminar to be delivered, each student is expected to select a recent topic in Agricultural Engineering, review literature and deliver a seminar to staff and postgraduate students. The seminar will be followed by critical discussion by staff and students.

The second seminar is presented at an advanced stage of the student's research work before his/her oral examination. In this seminar the research methodology and results are presented by the student and is also followed by critical discussion by staff and students.

**AGE 700**
**Irrigation: 3 units**
Theory of infillation. Water requirement of crops. Quality of irrigation water pumps and pumping. Design of irrigation system, surface, sprinkler, trickle/drip, sub-irrigation. Irrigation of selected crops. Irrigation canals. Economics of irrigation. Irrigation project feasibility studies. Problems of irrigation: Drainage, salinity, plant diseases, public health.

**AGE 701**
**Agricultural Drainage: 3 units**
Drainage requirement of crops. Theory of land drainage: Steady state, non-steady state, drainage of homogeneous soils, drainage of stratified soils, drainage by pumping, drainage analogues and models. Drainage methods and materials. Designs and installation of drainage systems. Filter materials and their design. Salinity and their control.

**AGE 702 Soil and Water Conservation: 3 units**
Review of the principles of soil erosion by water and wind. Review of the control of water and wind erosion. Rainfall simulation for erosion studies. Soil conservation structures. Design of earth embankments.

**AGE 703**
**Advanced Hydrology: 3 units**
Overland flow and numerical flood routing; Linear approaches to hydrograph synthesis; unit hydrographs, instantaneous unit hydrograph, linear reservoirs; Distributions, frequency, regression and correlation techniques; time series; streamflow simulation techniques; Recent advances in deterministic, stochastic, and hydrology; hydrology of agricultural lands; hydrology soils, land treatment, agricultural models, empirical relationships.

**AGE 704**
**Geohydrology: 3 units**
Theory of surface water hydrology as it relates to groundwater flow; geologic formation and properties of the porous media general theory of ground-water flow including Darcy's Law streamlines and equipotential surfaces; Steady state flow including properties and numerical synthesis of flow nets, unsaturated flow, seepage rates and agricultural dams, method of images, unsteady flow, including boundary effects fully and partially penetrating wells, salt water intrusion, well recharge, storage coefficients and transmissibility, recovery theory, construction of wells.

**AGE 705**
**Open Channel Hydraulic: 3 units**
Theory and applications of flow in open channels, including dimensional analysis, energy – momentum principles, kinematic and dynamic wave approximations, gradually varied flow, spillways, channel transitions, free overfall and other controls, steam flow routing, model studies, sediment transport.

**SOS 702**
**Soil Physics: 3 units**
Composition of the soil; soil primary particles, particle size distribution, aggregation of primary particles, soil pore space; Soil and Water in Equilibrium; the state of water in soil, soil, suction water content curve, availability of

soil water, retention by swelling soils; Soil water movement; Soil water potential, water flow in saturated and unsaturated soil, Darcy's Law, hydraulic conductivity of soils, infiltration, principles of field drainage, water vapour transfer in soil; Soil Air; composition of soil air, gas transfer in soil by mass flow and diffusion, Fick's Law soil aeration; Heat in Soil; energy balance at the soil surface, thermal properties of soils; heat transfer in soil, soil temperature profiles.

**AGE 731**

**Farm Equipment Design and Evaluation: 3 units**

General approach to problem formulation and solution; Farm machine systems and design of machine elements, synthesis of unit, reliability criteria, research reviews on design and analysis of farm equipment, Test types and evaluation, integrated system approach to machinery evaluation.

**AGE 732**

**Traction and Trafficability on the Farm: 3 units**

Tractor transport mechanisms, evaluation of soil values related to traction, soil-vehicle models and prediction of tractor performance, Compaction due to machine traffic, design of traction and transport devices, research review.

**AGE 733**

**Farm Power and Machinery Management: 3 units**

System approach in farm machinery management, application of programming techniques to problem of equipment selection, maintenance and scheduling of operations, equipment replacement criteria and inventory control for spares.

**AGE 734**

**Principles and Applications of Ergonomics: 3 units**

Human factors in system development, energy liberation and transfer, mechanical efficiency of human body; Authroprometric limitations in equipment design, biomechanics of motion, man-machine system concept, performance, case studies on ergonomics in agriculture.

**AGE 737**

**Equipment and Techniques for Land Development: 3 units**

Engineering planning of developing lands for agricultural purposes, Types and Selection of land development machinery, cost analysis and feasibility studies.

**AGE 736**

**Soil Plant Machine Dynamics: 3 units**

Soil environment needs of plant, dynamics properties of soil and design consideration for tillage tools, similitude approach to tillage mechanics. Tillage edaphic environment relationship.

**AGE 742**

**Advance Farm Manpower: 3 units**

Modern trends in Farm Power Sources, limitations in use of solar, wind and other non-conventional power units, Design and development of power units for farm operations, Hydraulic motors and their usage. Power measurement and optimizing usage. Testing procedures and critical review of reports.

**AGE 743**

**Crop Protection Equipment Design: 3 units**

Diversity of crop protection measures, specifications of various formulations and dosage, principles of spray applications, droplet size, influence of materiological factors, limitation of hydraulic sprayers, Dusters and their usage, concepts of CDA, recent trends in design and application efficacy, review of crop protection equipment in Nigeria.

**AGE 751**

**Heat and Mass Transfer: 3 units**

Steady and transient heat conduction. Convective heat transfer processes and heat transfer coefficients. Heat exchanger design. Radiant heat transfer.

Mass diffusion, Mass transfer coefficient, convective or Eddy Mass Transfer, and distillation. Parallel treatment of heat and mass transfer in turbulent and laminar flows, and also boiling and condensation modes of heat transfer with applications to the field of air conditioning and refrigeration, and drying of agricultural products.

**AGE 752**

**Engineering Properties of Biological Materials: 3 units**

Recent advances in physical characteristics of biological materials. Rheological behaviour of solids and fluids derived from plant and animal materials. Concepts of visco-elasticity and visco-plasticity with its application. Characterization of solid and liquid materials. Contact stresses between bodies in compression Hertz and Bousinessq techniques. Texture of food materials. Mechanical damage under static, and transient conditions. Thermal, electrical, optional and sonic properties. Review of current Literature.

**AGE 737**

**Processing and Storage Engineering: 3 units**

Pumps and piping, fans and air duct design. Heat and moisture transfer related to crop drying or dehydration and refrigeration. Crop drying methods and analysis.

Methods of process engineering used to achieve the best overall processing systems. Process economics. Optimization applications and methods. Simulation approach to processing situations. Systems for materials handling, grain cleaning and grain size reduction. Pre-storage techniques for handling and storage requirements of agricultural materials. Types of storage facilities for short-term and long-term storage of agricultural materials. Refrigerated cold storage methods and analysis.

Research reviews on processing handling and storage of agricultural materials: A design project on processing or storage of any tropical product will be assigned. A term paper on the design project will be submitted at the end of the course.

**AGE 754**

**Process Dynamics and Controls: 3 units**

Introduction (definition of control, levels, aims, and tools of control): Systems analysis (response to forcing functions, characteristics – time constants, resistance, capacitance – linearsation techniques, system coupling); instrumentation (flow, level, pressure, temperature, composition); controller types and modes of operation (on/of, proportional, proportiona/integral/ proportional/derivative, proportional/integral/derivative); control valves 'types, characteristics, positioners); transmutters and transducers; controller timing); overall process control (control schemes and modes for main process variables and unit operations, overall plant process control schemes).

**AGE 755**

**Principles of Environmental Control: 3 units**

Thermodynamics and Pyschrometrics – forms of energy, review of Thermodynamic laws, basic Thermodynamic equations, Psychrometric charts. Systems Design Conditions – indoor design conditions (comfort considerations), outdoor design conditions (weather data), and other factors affecting design conditions. Estimation of Moisture, Cooling, and Heating Loads – humidification and dehumidication, infiltration and ventilation, heat and mass transfer coefficients, heating load, coefficients, heating load, cooling load, and equipment size and energy requirement. Air conditioning systems – air and water systems, panel heating and cooling systems, heat pump systems, energy recovery systems, and energy estimation method. Environmental control equipment – air processing, refrigeration, heating, distribution equipment. Principles of Animal and Plant Environment – homeostasis and homeothermy of animals, effect of humidity, temperature, and light (radiation) on animal and plant product, heat and moisture production, and air exchange in livestock and poultry structures, greenhouse structures and environment for plant production, principles of energy conservation.

**AGE 756**

**Electronics in Agricultural Engieering: 3 units**

Basic operation of transistors. Transistor equivalent circuits and use of transistor in linear circuits. The basic amplier circuits and biasing. Digital logic circuits and multi-stage amplifers. Linear operational amplifiers. Regulated power suppliers including multi-phase rectifiers and inverters. Characteristics of electronic devices and their application in measurement, automatic control and agriculture.

**AGE 757**

**Analysis and Synthesis of Linear Control Systems: 3 units**

Linear feedback control system. Representation of Control Components and systems. Steady State analysis – Proportional, Integral, and Proportional plus integral control systems. Laplace Transform and Control System analysis. Transfer functions for mechanical, hydraulic, pneumatic and electrical systems. Transient and frequency analysis and responses. Basic feedback theory applied to physical systems. System Stability – Roth Hurwtz, Root-Locus and Nvquist stability criteria. Feedback system performance. Control system compensation, and design using various stability methods. Introduction to Non-Wear control systems.

**AGE 758**

**Solar Energy Fundamentals and Applications: 3 units**

Fundamentals of solar radiation – terrestrial and extra-terrestrial solar radiation intercepted by surfaces, solar radiation geometry, measurement of solar radiation, methods of predicting solar radiation on horizontal and titled surfaces, transmission of radiation through partially transparent media. Method of solar collection and thermal conversion – Flat-plate and focusing collectors, collector overall heat transfer coefficient, short-term and long term collector performance, collector optimization for maximum energy delivery.

Solar Heating Systems and Economics, Solar Cooling and Dehumidification, and Solar Process Heat and Electric Power, Discussions on Solar Energy applications in agriculture.

**AGE 759**

**Experimental Stress Analysis: 3 units**

Experimental stress analysis methods in machine design. Photoelastic method, photo stress, brittle lacquer and electrical resistance strain – gauge rosettes. Machine testing techniques. Modern trends in Farm Power sources, limitation in use of solar, wind and other non-conventional power units, Design and development of power units for farm operations, Hydraulic motors and their usage. Power Measurement and optimizing usage. Testing procedures and critical review of reports.

**AGE 760**

**Design of Farm Structures: 3 units**

Construction materials for farm structures – concrete, steel and wood materials. Stress analysis in structural members. Allowable stresses in structural members.

Concrete and reinforced concrete design. Limit state design concepts. Properties of structural concrete. Design of concrete columns and beams and different structural sections for strength and stability. Design of concrete water tanks reservoir and manure tanks. Structural classification of steel rolled section. Members in tension, compression and bending, Design of steel connections. Design of steel columns, beams, and trusses.

Structural classification and properties of wood. Design of wood columns, beams, and trusses. Estimation of loads in farm buildings. Design and construction of farm buildings – Poultry housing, Dairy building, storage sheds. Design and construction of food storage structures.

**AGE 761**

**Advanced Heat and Mass Transfer: 3 units**

Introduction – Basic concepts of heat and mass transfer (Types of heat transfer mechanisms; G equations for momentum mass, and heat transfer; Laminar and turbulent fluid flows; Flow separation; and Thermophysical properties). Conduction heat transfer (Body temperature response – Differential equations of the temperature field Boundary conditions; solutions of heat conduction – Transient heat conduction, Steady heat conduction). Convection heat transfer (Free convection boundary – layer heat transfer in Laminar and turbulent flows; Forced convection heat and mass transfer with internal flow in ducts and external flows). Film condensation and Boiling. Thermal radiation transfer (Radiation from blackbody; Radiation properties of non-black surfaces or real materials, Radiative exchange, The monte Carlo approach to radiant – interchange problems; Thermal radiation in the presence of other modes of energy transfer; Energy transfer by radiation combined with conduction and or convection). Mass transfer (Steady – state and unsteady mass diffusion in gases and liquids; Mass transfer in laminar and turbulent flow, Mass transfer in cooling).

**AGE 762**

**Principles of Air - Conditioning: 3 units**

Flow in confined spaces (Boundary layers; Flow in ducts; Changes in area and direction; Centrifugal fans; Design of duct systems). Flow in unconfined spaces (Potential – flow theory; Applications of potential – flow theory; Free – Stream jets). Heat and mass transfer Processes (Heat and mass transfer; Psychrometry; Enthalpy potential; Cooling Towers and Spray Washers; Cooling and Dehumidifying Coils; Air – Conditioning calculations). Air – conditioning cooling load. Infiltration and ventilation.

**AGE 764**

**Food Refrigeration and Cold – Storage Engineering: 3 units**

Commercial freezing methods. Microbiology of foods. Methods of pre-cooling fruits and vegetables. Thermal properties of foods. Processing and storage of chilled and frozen food – meat products, dairy products, tropical fruits (oranges, bananas, etc.), vegetables, fruit juice concentrates, bakery products, eggs. Cooling and freezing times of foods. Refrigeration load and Refrigerated warehouse of Cold-storage room design. Food Storage requirements. Distribution of chilled and frozen food in trucks and containers, and air transport. Retail food store refrigeration. Industrial application of refrigeration to ice manufacture. Refrigeration in agricultural industry.

**AGE 765**

**Materials Handling Engineering: 3 units**

Introduction – Types of materials handling equipment. Components and theory of hoisting equipment – Flexible hoisting appliances (chains and ropes); Pulleys and Pulley systems, sprockets and drums; Load handling attachments, Crane frame structures and stability. Elevators and Conveyors design and selection. Crop drying and Storage bins design and Construction. Electrical Power and equipment – Electric motors and motor management; Electrical Control; Electric power costs and management. Dairy equipment – Heaters, Coolers, heat exchangers and milk storage tanks; Homogenizers; Pasteurizing equipment; Evaporating and drying equipment; Can Washing and Sterilizing equipment; Dairy Plant design, materials and utilization.

**AGE 766**

**Engineering Economy, Optimization, and Management: 3 units**

Mathematics of Cost Comparisons – Equivalence and cost comparisons; Depreciation and taxes, Continuous interest and discounting; Profitability; Technological advances and inflation. Optimization Engineering – Break-even and minimum-cost analysis; Probability, Uncertainty and simulation; Optimization (one variable and multivariable optimization); Linear and dynamic programming. Cost estimation and Control – Capital investment cost estimation; Operating cost estimation; Cost control; Total cost and profit.

**AGE 767**

**Engineering Similitude: 3 units**

Theory of similitude and its applications to models – observations and measurements; Dimensional analysis; Development of Prediction equations; Theory of Models; Structural models; Distorted Models – General analysis of distorted models; Distorted Structural models; Thermal models; Fluid flow models. Dissimilar models – Principles of analogies; Analogies from second-order ordinary and partial differential equation. Application of dimensional analysis and similitude to the analyses of problems in Agricultural Engineering.

**AGE 770**

**Selected Topics in Agricultural Engineering: 3 units**

Supervised investigation and design in selected aspects of advanced Agricultural Engineering topics. Each student's work will be limited to his / her own area of specialization.

**AGE 740**

**Ph.D Seminar: 6 units**

Postgraduate students are required to register in the departmental seminar, to participate in it, and to present at least two papers based on their own research during the course of their Ph.D degree programmes

**ACADEMIC STAFF LIST**

| Name | Rank | Qualification | Area of Specialisation |
|---|---|---|---|
| Ukatu, A. C | Senior Lecturer & Ag. HOD | B.Sc.,M.Sc., PhD | Farm Power and Machinery |
| Adewumi, J. K | Senior Lecturer | B.Sc., M.Sc., PhD | Soil and Water |
| *Igbeka, J. C | Professor | B.Sc., M.Sc., PhD | Farm Power and Machinery |
| *Sangodoyin, A. Y | Professor | B.Sc., M.Sc., PhD | Soil and Water |
| Olayanju, T.M.A | Senior Lecturer | B.Sc., M.Sc., PhD | Processing and Storage |

***Associate**

**DEPARTMENT OF CIVIL ENGINEERING**
**POSTGRADUATE (M.Eng. & PhD) PROGRAMME, COLENG**

## 1. INTRODUCTION

The postgraduate programmes of the Department of Civil Engineering are directed towards providing basic and applied research opportunities relevant to the advancement in the building industry of the country and related activities.

Consequently, the department's higher degree programmes have the twin objectives of offering postgraduate courses and basic research in specialized areas of Civil Engineering and updating, as the need arises, the knowledge of practicing engineers and applied scientists in specialized field of Civil Engineering, through industry-oriented and application-specific research programmes.

## 2. AREAS OF SPECIALIZATION

Programmes shall be offered for courses and research in the following areas of specialization:

(i) Water Resources and Environmental Engineering
(ii) Hydraulics Engineering
(iii) Highway and Traffic Engineering
(iv) Structural Engineering

## 3. ADMISSION REQUIREMENTS

All the prevailing University regulations governing postgraduate degree shall apply.

## A. MASTER OF ENGINEERING (M.Eng.) IN CIVIL ENGINEERING

**Introduction**

This programme is designed to last for a minimum of 24 calendar months for full-time students. It consists of eight courses, one of which shall be a research project. The units for each course are as laid down below. The research project shall be four units. Apart from the research project which shall last throughout the calendar year a number of courses shall be available during the first semester while the rest shall be available in the second semester.

Admission requirements

(i) The programme shall be open to candidate with a Bachelor's degree or the equivalent in Civil Engineering of the University of Agriculture, Abeokuta or any other approved University.

(ii) Candidates may be required to satisfy the department in a selection process- in addition to possessing a minimum of Second class lower Division (2-2).

**Degree Requirements**

To obtain an M. Eng. in Civil Engineering, candidate must:

(iii) Satisfy the examiners in a minimum of 30 units, made up as follows:
   a. 18 units of the compulsory courses
   b. 6 units from the optional courses
   c. 6 units of the "Research Project" course

(iv) Satisfy all other requirements as stipulated in the Regulations of the School of Postgraduate Studies.

## B. DOCTOR OF PHILOSOPHY (Ph.D.) IN CIVIL ENGINEERING

**Introduction**

These programmnes are designed for candidates wishing to do advanced postgraduate research in Civil Engineering. Candidates are expected to take and pass 1st year coursework of a minimum of 24 units unless they already possess the M.Eng. or equivalent in Civil of the University of Agriculture, Abeokuta or any other approved University.

**Admission Requirements**

(i) The Ph.D. programme shall be open only to candidates having an M.Eng of the University of Agriculture, Abeokuta or any other approved University.

(ii) Candidates for the Ph.D. programme may be required to satisfy the department in an interview or written examination or both.

**Ph.D. Degree Requirements**

To obtain a Ph.D. in Civil Engineering, a candidate may be allowed to pursue the programme wholly by dissertation or by dissertation and course work following the later option, or candidate must:

(iii) Satisfy a minimum of six units of the 'Research Seminars" at the 700 level

(iv) Satisfy all other requirements as stipulated in the regulations of the School of Postgraduate Studies.

**COURSE STRUCTURE**

**1. Water Resources/Environmental Engineering**

**M. Eng. Program:**

**First Semester**

| **Common Courses** | | **CU** |
|---|---|---|
| CVE 740 | Seminar | 2 |
| CVE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**Core Courses**

| **Course Code** | **Course Title** | **CU** |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| CVE 741 | Environmental Resources Management | 2 |
| CVE 743 | Advanced Surface Water Hydrology | 2 |
| CVE 747 | Water and Wastewater Engineering | 2 |
| CVE 745 | Waste Management | 2 |
| | **Total** | **12** |

**Second Semester**

| **Core Courses** | | |
|---|---|---|
| CVE 742 | Water Resources Management | 2 |
| CVE 744 | Groundwater Hydrology and Hydraulics | 2 |
| CVE 746 | Environmental Pollution and Control | 2 |
| CVE 748 | Advanced Hydraulics Engineering | 2 |
| CVE 750 | Water Resources Systems Planning | 2 |
| | **Total** | **10** |

**Elective/Optional Courses: 2 units**

| **Course Code** | **Course Title** | **Units** |
|---|---|---|
| CVE 749 | Water Distribution Systems | 2 |
| CVE 751 | River and Coastal Engineering | 2 |
| CVE 752 | Groundwater and Solute Transport Modeling | 2 |
| CVE 753 | Irrigation and Drainage Engineering | 2 |
| CVE 754 | Urban Hydrology | |

**Course Code/Outline:**

**CVE 741 - Environmental Management (2units)**

Introduction to environmental science and ethics. Sustainable development and environmental economics. Environmental Risk Assessment and Management. Concept of environmental assessment (EIA, EA, EIS, EER, etc, with case studies)Evaluation of the techniques of environmental assessment

**CVE 742 - Water Resource Management (2units)**

Sources of water supply, considering both conventional and non-conventional sources of supply. Factors influencing quality and sufficiency of supply. Water quality standards. Water treatment systems Nature, significance and impact of water pollutions. Water quality fundamentals and processes. Assessment of surface- and groundwater quality. Water quality and health

**CVE 743 Advanced Surface Water Hydrology (2units)**

Outlines and fundamental elements of the hydrological cycle. Aspects of collection and analysis of rainfall and stream flow. Run-off processes, use of models in flood estimation and in low flow hydrology. Flood hydrology and problems in engineering flood hydrology. Analytical and numerical solution to non-linear processes in hydrology i.e. evapo-transpiration, non-steady flow, infiltration, moisture movement in the unsaturated zone, watershed modeling. Statistical analysis in hydrology with emphasis on probability and time series analysis use of time series models for data Generation

**CVE 744 - Groundwater Hydrology and Hydraulics (2units)**

Fundamental of flow in porous media, various theories of infiltration, exact solutions to various conditions. Nature of groundwater flow and distribution under varied geological conditions. Types and properties of aquifers and hydraulic characteristics of aquifers. Flow equations for confined and unconfined aquifers Well hydraulics (exact and approximate solutions)

**CVE 745 Waste Management (2units)**

Waste & Waste characterization. Private/Public sector involvement. Waste Management Planning and Strategies Waste minimization, reuse, recycling and pre-treatment of wastes. Design and operation of the collection and storage system Landfilling, incineration. Selected waste streams with case studies Contaminated land policy, site investigation and remediation

**CVE 746 Environmental Pollution and Control (2units)**

Sources of environmental pollution. Industrial Wastewater pollution. Selected industrial wastewaters and their characteristics (i.e. manufacturing, oil/gas sectors, etc) Strategies for industrial wastewater management. Noise Pollution. Noise parameters, measurement and assessment. Noise prediction techniques, technical and engineering controls.Air Pollution. Nature and significance of contemporary air pollution problems.

Overview of ambient air quality monitoring. Introduction to combustion technology.Principles of gaseous and particulate pollution control techniques. Chimney heights calculations.Review of industrial emission sources and relevant controls: vehicular pollution, energy management and air pollution control.

Legislative controls and regulatory framework for environmental pollution and control in Nigeria

**CVE 747 - Water and Wastewater Engineering (2units)**

Relevant techniques and standards in the design, maintenance and operation of water and wastewater treatment and disposal systems in different settings.* Design concept of water and wastewater facilities.* Conceptual, process and detailed engineering design of water and wastewater facilities.* Land treatment of wastewater, groundwater remediation and industrial & hazardous wastewater management.* Laboratory work.

**CVE 748 Advanced Hydraulics Engineering (2units)**

Advanced hydraulics: Physical and mathematical basis for unsteady processes in hydraulic engineering such as: unsteady open channel flow, unsteady flow in pipes, flow over moveable bed, etc. Numerical solution methods of flow profile in channels; step method of analysis of longitudinal profiles. Laboratory work.

**CVE 749 Water Distribution systems (2units)**

Steady state and transient hydraulics of pipe network.Review of hydraulics of pipe Flow. Formulation of steady state equations for analysis of flow in pipe networks solution techniques, valves and pumps.Components of water supply systems Flow measurement, layout and protectories, water hammer, analysis of pipe systems Computer applications and pipe network optimization

**CVE 750 - Water Resources Systems Planning (2units)**

A multi-objective approach to water resources planning is considered. Economic, environmental and social factors of resources planning, optimization and modeling techniques in water resources planning. Non-structural alternatives to water resources planning. Use of operational research methods such as linear and non-linear programming, dynamic programming to solve problems

**CVE 751 - River and Coastal Engineering (2units)**

Introduction to river engineering. Sediment transport in river channel: suspended and bed load. Stable channels, meandering processes, and river improvement for navigation, canalization and revetment. Linear wave theory, Tides, Forces on coastal structures, reakwaters. Refraction and Diffraction. Harbour agitation

**CVE 752 -Groundwater and solute Transport Modeling (2units)**

Basic introduction to groundwater flow and solute transport modeling * Flow in layered aquifer systems* Hydrogeological mapping in resource evaluation. Aquifer testing and flow net analysis* Methods of groundwater prospecting Application of models to groundwater flow contaminant transport in groundwater and their role in hydrologic planning and managementThe course shall focus on the hands-on application of groundwater flow and solute transport models.

**CVE 753 Irrigation and Drainage Engineering (2units)**

Scope, type and methods of irrigation* Water requirement for crops by Penman and Blaney-Criddle and Lipernete methods* Design of canals, embarkment headworks. Regulations, siphons, losses in canals and canal linings Drainage canals, water logging and salinity control* Economic analysis (Benefit-Cost-Ratio, Internal-Rate-Return)

**CVE 754 Urban Hydrology (2units)**

Conventional urban storm drainage design* Stormwater management: source control for flow reduction and pollution minimization and also for stormwater harvesting and promotion of environmental flows* Description of a number of pollution control devices and systems

**CVE 799 M. Eng. Project (6units)**

Candidates shall be taught the basic principles, objectives and nature of research design and techniques; communication of research findings using appropriate statistical tools during the first semester.

**Course Code/Outline:**

**CVE 731 - Water resources management problems in coastal environments (2 units)**

Selected case studies. Water conservation. Holistic approach to water resources management. Special topics on salinization, industrial pollution and remediation

**CVE 732 Environmental hydrology and hydraulics (2 units)**

Surface water-groundwater interaction. Hydraulic structures in environmental problems with case studies. Groundwater and solute transport modeling

**CVE 733 Advanced water and wastewater engineering (2 units)**

Problem studies and design of appropriate solutions

**Ph.D. Program:**

| Course Code | Course Title | Units |
|---|---|---|
| CVE 771 | Research seminar I | 3 |
| CVE 772 | Research seminar II | 3 |

## 2. HIGHWAY AND TRAFFIC ENGINEERING OPTION

### COURSE STRUCTURE

**First Semester**

| Common Courses | | CU |
|---|---|---|
| CVE 740 | Seminar | 2 |
| CVE 799 | Thesis Research | 6 |
| | Total | 8 |

**Core Courses**

| Course Code | Course Title | CU |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| CVE 721 | Highway Design | 2 |
| CVE 723 | Highway Construction and Maintenance | 2 |
| CVE 725 | Highway Economics and Finance | 2 |
| CVE 729 | Bituminous Materials 1 | 2 |
| | Total | 12 |

**Second Semester**

| Core Courses | | |
|---|---|---|
| CVE 720 | Traffic Studies and information Management | 2 |
| CVE 722 | Pavement Design | 2 |
| CVE 724 | Traffic Safety | 2 |
| CVE 726 | Traffic Control and Management | 2 |
| CVE 730 | Traffic Flow Characteristics | 2 |
| | **Total** | **10** |

| Optional Courses | |
|---|---|
| CVE 727 Applied Soil Mechanics | 2 |
| CVE 728 Quantitative Methods | 2 |
| CVE 787 Bridge Design | 2 |
| CVE 788 Concrete Materials | 2 |
| CVE 761 Modern Survey Techniques | 2 |

**(d) Ph.D Courses**

| | |
|---|---|
| CVE 771 Research Seminar I | 3 |
| CVE 772 Research Seminar II | 3 |

### 2. COURSE DESCRIPTION

### 2.1 M. Eng. Courses

**CVE 720 Traffic Studies and Information Management (2)**

Various traffic studies including volume, speed, travel time and delay, origin-destination, pedestrian, parking, accidents, etc; Statistical treatment and presentation of traffic data; Computer application to traffic studies and analysis; information storage and retrieval; actual conduct of selected traffic studies.

**CVE 721 Highway Design (2)**

Analysis and evaluation of current geometric design criteria for streets, highways and expressways; Considerations for developing new design standards for roads for the future;

Design of low-cost roads in urban and rural areas; Drainage design; Computer aided design and drafting of highways; A design project incorporating transportation corridor design, route location, traffic studies, geometric features related to grades, curvature, profile, cross-section, drainage pavement surface characteristics and intersections, including interchanges.

**CVE 722 Pavement design (2)**

Pavement types; Wheel load and gear load characteristics; Theories of stresses and deflections in flexible and rigid pavements; Empirical and rational pavement design procedures; Computer-aided design and drafting of pavements.

**CVE 723 Highway Construction and Maintenance (2)**

Locating and testing of construction materials; Earthmoving and compaction, rock excavation, quarrying, drilling, etc; Construction of embankments over different ground conditions; Construction procedure, standards and specifications; quality control and control tests; Construction management, application of CPM and PERT techniques; Highway and pavement evaluation methods for serviceability and performance; present serviceability index rating, and their use in conceptual design strategies for pavements; Pavement overlay methods and design; Organization and management of maintenance teams and budget.

**CVE 724 Traffic Safety (2)**

Legislation and regulation applying to the design and operation of transport vehicles; The vehicle and user interaction; Design factors in traffic safety; traffic enforcement methods; accident studies.

**CVE 725 Highway Economics and Finance (2)**

Basic principles of economics; Economic effects of highway development; Approaches to resource allocation decisions; Highway investment appraisal; Discounted cash-flow methods; Cost-benefit analysis of highway projects; Sources of funds for highway projects and methods of recovering cost of highway projects.

**CVE 726 Traffic and Control Management (2)**

Economic, social, physical, environmental and human factors affecting traffic flow and safety; Traffic control devices such as signals, signs, markings and channelisation, etc; Management of highway use; Traffic routing techniques (along corridor and area-wide): Techniques of space and time-sharing of highway between competing demands.

**CVE 727 Applied Soil Mechanics (2)**

Locating and testing highway construction materials; Earthworks; Site investigation and testing procedures during construction; Earth moving and compaction; Rock excavation, quarrying and drilling; Design and construction of embankments over different ground conditions; Geological properties of road construction materials.

**CVE 728 Quantitative Methods (2)**

Data collection and analysis; Types of data and errors; Sampling survey design and implementation; Presentation, analysis and interpretation of results; Creating databases; Application of civil engineering studies, e.g., traffic, highways, structures, hydrology, etc., Applied probability and statistics; Types of distributions, frequencies, sampling distribution, estimates and standard errors; Statistical inferences and hypothesis testing; Regression,

analysis of variance, time series analysis; Simulation and optimization of different types of models-definition and estimation; Linear models and linear programming; Graphs and networks.

**CVE 729 Bituminous Material I (2)**

Nature, sources and use of asphalt; Asphalt, bitumen and tar; Production and classification of asphalts; Chemical and Physical properties of asphalt; Tests on asphalts; Classification and properties of mineral aggregates; Aggregate calculations; Types of asphalt-aggregate combinations and their applications; Properties of asphalt paving mixtures; mixture calculations; Asphalt mixture design.

**CVE 730 Traffic Flow Characteristics (2)**

Capacity analysis; Car-following and macroscopic flow; Other flow-density models; Queuing theory; Headways and gap acceptance; Other probabilistic models; Computer simulation techniques.

**CVE 787 Bridge Design (2)**

Bridge deck analysis; Design of pre-cast bridge deck and composite bridge deck; Stiffened plates and box girders; Bridge abutments; Cable stayed bridges and suspension bridges; Bridge hydraulics; Design exercise.

**CVE 788 Concrete Materials (2)**

Properties and methods of testing concrete materials; Specifications for aggregates; Statistics and quality control in the field; Concrete mix design; Construction techniques, including formwork, joints, water retaining structures, repairs and maintenance; Rheological properties of fresh concrete; Engineering properties of concrete including time-dependent behaviour and climate effects; Methods of testing.

**CVE 761 Modern Survey Techniques (2)**

Route location and surveys including aerial and geological survey techniques; remote sensing and seismic surveys; Planning, implementation and costs; Land and property survey for acquisition including land laws.

**CVE 799 Master of Engineering Project (2)**

Candidates will be required to prepare a Project Report based on the application of research techniques to solving civil engineering problems in their field of specialization. The Project may also involve a civil engineering design work. Candidates will also be required to make an oral presentation and defence of their projects before a panel constituted by the Department.

**2.3 Ph.D. Courses**

**CVE 771 Research Seminar I (3)**

Candidates will be required to write a major seminar paper in the usual journal format on topics under investigation for presentation to the course group and assessment by a panel of internal examiners. The paper may consist of the literature review and/or development of relevant mathematical models related to thesis topics.

**CVE 772 Research Seminar II (3)**

The format of this course will be similar to that of CVE 971. Students will be required to include the actual results of their research work.

**3. STRUCTURAL ENGINEERING OPTION**
**COURSE STRUCTURE**

**First Semester**

| **Common Courses** | | **CU** |
|---|---|---|
| CVE 740 | Seminar | 2 |
| CVE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**Core Courses**

| **Course Code** | **Course Title** | **CU** |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| CVE 701 | Foundation Engineering | 3 |
| CVE 781 | Structural Analysis | 3 |
| CVE 783 | Concrete Design | 3 |
| | **Total** | **13** |

**Second Semester**

**Core Courses**

| **Course Code** | **Course Title** | **CU** |
|---|---|---|
| CVE 782 | Finite Element Methods I | 3 |
| CVE 784 | Steelwork Design | 3 |
| CVE 728 | Quantitative Methods | 2 |
| CVE 788 | Concrete Materials | 2 |
| | **Total** | **10** |

**ELECTIVES**

| | |
|---|---|
| CVE 785 Design of Industrial Buildings | 2 |
| CVE 786 Design of Tall Buildings | 2 |
| CVE 787 Bridge Design | 2 |
| CVE 789 Theory of Plates and Shells | 2 |
| CVE 790 Theory of Elasticity | 2 |

**(c) Ph.D COURSES**

| | |
|---|---|
| CVE 771 Research Seminar I | 3 |
| CVE 772Research Seminar II | 3 |

**8. Course Description**
**8.1 M. Eng. COURSES**

**CVE 701 Foundation Engineering (3)**
Bearing Capacity, Stress distribution and Deep Foundations. Lateral and pull out loading of deep foundations, Pile group behaviour, foundations for offshore structures and pile driving dynamics.

**CVE 702 Foundation Construction Techniques (2)**
Excavation, Compaction and site preparations, Seepage and de-watering of foundation excavations.

**CVE 703 Earth Retaining Structures and Slopes (2)**
Earth Pressure theories. Design of rigid, flexible braced tied back, slurry and reinforced earth walls. Stability of excavations, cut and natural slopes.

**CVE 704 Engineering Behaviour of Soils (2)**
Detailed study of physiochemical nature of soil. Stress state and stream, strain-time behaviour. In-depth evaluation of the strength, compressibility and permeability of natural soils.

**CVE 705 Embankment Dam Engineering (2)**
Principles of analysis and design of earth and rock-fill dams. Materials construction methods, internal and external stability, seepage and drainage. Performance monitoring, abutment and foundation evaluation.

**CVE 706 Site Investigations (2)**
Soil exploration; Sampling methods; In-situ and Laboratory testing techniques; Report writing; Fieldwork.

**CVE 707 Applied Engineering Geology (2)**
Principles of Engineering Geology. Site Investigation Planning. Assessment of rock masses and materials. Rock excavation, quarrying, drilling and Exploratory Techniques. Engineering Geology of Reservoirs and Dam Foundations. Engineering Geology in Road Construction. Construction Materials.

**CVE 708 Soil Dynamics (2)**
Principles of vibration under harmonic and transient loading. Wave propagation. Dynamic response of soils and its measurements. Analytical models for harmonic, transient and earthquake loading. Design examples of foundations and embankment.

**CVE 712 Applied Geophysics (2)**
Potential Theory and its application in selected topics. The earth's gravity field: its representation, measurement and evaluation. Geodetic measurements and computations involving gravity information and analysis of Geophysical data as applied in seismology, gravimetry, electrical methods (resistivity) and magnetism.

**ACADEMIC STAFF LIST**

| Name | Rank | Qualifications | Area of Specialization |
|---|---|---|---|
| Adebisi, O | Professor | B.Sc., M.Sc., PhD | Highway and Transportation |
| Sadiq, M. O | Professor | B.Sc., M.Sc., PhD | Structural Analysis |

**POSTGRADUATE (M.Eng & PhD) PROGRAMME COLENG**

**DEPARTMENT OF ELECTRICAL/ELECTRONICS ENGINEERING**

## 1. INTRODUCTION

The postgraduate programmes of the Department of Electrical/Electronics Engineering are directed towards providing basic and applied research opportunities relevant to the processing of electrical energy and information.

Consequently, the department's higher degree programmes have the twin objectives o\f offering postgraduate courses and basic research in specialized areas of Electrical and Electronics Engineering and secondly, updating, as the need arises, the knowledge of practicing engineers and applied scientists in specialized field of Electrical and Electronics' Engineering, through industry oriented and application-specific research programmes.

## 2. AREAS OF SPECIALIZATION

Programmes shall be offered for courses and research in the following areas of specialization:

(i) Electrical Machines and Power Systems
(ii) Electrical and Electronic Control Systems
(iii) Communication and Digital Signal Processing Systems

## 3. ADMISSION REQUIREMENTS

All the prevailing University regulations governing postgraduate degree shall apply.

## A. MASTER OF ENGINEERING (M. Eng.) IN ELECTRICAL ENGINEERING

### Introduction

This programme is to last for 24 calendar months for full-time students. It consists of eight courses, one of which shall be a research project. The units for each course are as laid down below. The research project shall bee four units. Apart from the research project which shall last throughout the calendar year a number of courses shall be available during the first semester while the rest shall be available in the second semester.

Admission requirements

(i) The programme shall be opened to candidate with a Bachelor's degree or equivalent in Electrical or Electronic Engineering of the University of Agriculture, Abeokuta or any other approved University.

(ii) Candidates may be required to satisfy the department in a selection process - in addition to possessing a minimum of Second class lower Division (2-2).

**Degree Requirements**

To obtain an M.Eng. in Electrical Engineering, candidate must:

(iii) Satisfy the examiners in a minimum of 30 units, made up as follows:
- a. 12 units of the compulsory courses
- b. 12 units from the optional courses
- c. 6 units of the "Research Project" course

(iv) Satisfy all other requirements as stipulated in the Regulations of the School of Postgraduate Studies.

**B. DOCTOR OF PHILOSOPHY (Ph.D.) IN ELECTRICAL ENGINEERING**

Introduction
These programmnes are designed for candidates wishing to do advanced original postgraduate research in Electrical Engineering. Candidates are expected to take and pass 1st year coursework of a minimum of 30 units unless they already possess the M.Sc/M.Eng.. or equivalent in Electrical Engineering of the University of Agriculture, Abeokuta or any other approved University.

**Admission Requirements**

(i) The Ph.D. programme shall be opened only to candidates having an M.Eng. or equivalent in Electrical Engineering.

(ii) Candidates for either the M.Eng. or Ph.D. programme may be required to satisfy the department in an interview or written examination or both.

**Ph.D. Degree Requirements**

To obtain a Ph.D. in Electrical and Electronic Engineering, a candidate may be allowed to pursue the programme wholly by dissertation or by dissertation and course work following the later option, or candidate must:

(i) Satisfy a minimum of six units of the 'Research Seminars" at the 700 level

(ii) Satisfy all other requirements as stipulated in the regulations of the School of Postgraduate Studies.

**PROGRAMME STRUCTURE**

**First Semester**

| **Common Courses** | | **CU** |
|---|---|---|
| ELE 740 | Seminar | 2 |
| ELE 799 | Thesis Research | 6 |
| | **Total** | **8** |

***Core Courses***

| Course Code | Course Title | CU |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| MTS 731 | Mathematical Method I | 3 |
| ELE 701 | Mini-Project | 3 |
| ELE 705 | High Voltage Engineering | 3 |
| | **Total** | **13** |

**ELECTIVES**

Specializing in Electrical Power Engineering and High Voltage Engineering

| | | |
|---|---|---|
| ELE 707: | Rotating machines | 3 |
| ELE 709: | Active Networks | 3 |
| ELE 711: | Speech Analysis and Synthesis | 3 |
| ELE 713: | Information Theory and Coding | 3 |
| ELE 715: | Microwave Engineering and Antennas | 3 |

**Specializing in Electronics and Control Engineering**

| Course Code | Course Title | CU |
|---|---|---|
| ELE 719: | Classical Control Theory: Analysis and Design of control Systems | 3 |
| ELE 721: | Analysis and Design and Linear Multi-Variable Control Systems | 3 |

***Second Semester***

***Core Courses***

| Course Code | Course Title | CU |
|---|---|---|
| ELE 700: | Numerical Methods in engineering | 3 |
| ELE 702: | Computer-Aided Design Techniques | 3 |
| ELE 704: | Electrical Power System s and Control | 3 |
| ELE 706: | Projective Systems | 3 |
| | **Total** | **12** |

**ELECTIVES**

Specializing in Electrical Power Engineering and High Voltage Engineering

**Specializing in Electronics and Communication Engineering**

| Course Code | Course Title | No of Units |
|---|---|---|
| ELE 708: | Electronic Device Models & Circuit Design | 3 |
| ELE 710: | Analysis and Synthesis of Active Network | 3 |
| ELE 712: | Digital Signal Processing | 3 |
| ELE 714: | Electromagnetic Theory | 3 |
| ELE 716: | Radio Wave Propagation | 3 |
| ELE 718: | Biomecial Electronics | 3 |

**Specializing in Electronics and Control Engineering**

| Course Code | Course Title | CU |
|---|---|---|
| ELE 720: | Sampled Data and Digital Control Systems: Analysis and design | 3 |
| ELE 722: | Introduction to Stochastic and Adaptive Control | 3 |

**Ph.D. Courses**

| Course Code | Course Title | CU |
|---|---|---|
| ELE 761: | Selected topics in current Electrical and Electronics Engineering | 4 |
| ELE 762: | Research Seminar I | 3 |
| ELE 763: | Research Seminar II | 3 |

| Course Code | Course Title | CU |
|---|---|---|
| ELE 799 | Research Seminar III | 6 |

## 6. DESCRIPTION OF COURSES

**ELE 700: Numerical Method in Engineering I 3 units**

Methods for obtaining numerical Solutions to problems arising in Engineering. Linear and Nonlinear Mechanical Systems. Ordinary and partial Differential equations, Initial value and extreme value problems.

**MTS 731: Mathematical Method I 3 units**

Revision of complex analysis. Many valued functions and Riemann surfaces. Analytical continuation and asymptotic expansions. Ordinary differential equations with a large parameter. First order linear differential equations. General first order equations. Second order linear equations. Partial Differential Equations; Green's Functions; Fourier and Laplace Transforms; Complex Variables; Tensor Analysis Applications.

**ELE 701: Mini-Project 3 units**

In this course, all; M.Eng. students are encouraged to undertake laboratory design oriented mini-project in the first semester under the supervision of done or more members of the academic staff of the department.

**ELE 702: Computer-Aided Design Techniques 3 units**

Computer aided analysis of electrical and electronics ecesis and components. Network topology, compute formulation of Kirchhoffs Laws, Nodal analysis of linear and non-linear networks; computer formulation of the frequency domain solutions, stability and sensitivity evaluation. Computer-Aided numerical analytical tools for electronic and electrical Engineering.

**ELE 703: M. Eng. Research Project 3 units**

Application of research techniques to the solution of current electrical and electronic engineering problems as directed by a competent supervisors. Projects bordering on development of research methodologies. Projects

on the problems of local industry and materials as well as of tropical environmental importance. Student is expected to give a seminar on the M.Sc. research project.

**ELE 704: Electrical Power Systems and Control 4 units**

Network Analysis, load flow analysis, Optimal Systems Operation, Techniques of power of systems control, Power System Stability, Power System Economy, Load Forecasting, Commutation Methods and Programming.

**ELE 705: High Voltage Engineering 3 units**

Properties of dielectrics, Ionization processes and gas breakdown of Solid and Liquid Dielectrics, Electrostatic fields, Surge phenomena, Insulation Coordination, Insulation in Polluted atmospheres. Corona and interference from power Systems, Techniques of H.V. tests and specifications, H.V. dc Conversion and transmission.

**ELE 706: Protective Systems 3 units**

Voltage and current transducer Power fault analysis construction and characteristics of protective relays Protection of A.C Machinery, Feeder Protection, Bus-zone protection, Back-up Protection, static relays, Over voltage protection, Theory of Interruption. Switchgear design, Recovery Voltage transients.

**ELE 707: Rotating Machines Analysis 3 units**

The idealised machine, sign convictions and the per unit System. MMF Flux in the Rotating Machine. Assumption in the General theory of Electrical Machines. Methods of Analysis of Machines. The D. C. Machine Interpole, compensating and series windings Transient performance of the D.C. Machine. Steady State Vector Diagrams for A. C., Machine. General Equations for A. C. Machine Steady State Operation and characteristics. Symmetrical short circuit of Alternator. Synchronising phenomena and sustained Oscillations in synchronous Machines.

**ELE 708: Electronic Device Models and Circuit Design 3 units**

The principles, structure and characteristics of semiconductor Devices; simple-frequency models for transistor: small signal and wide-band models for general non-reciprocal devices hybrid – PI and Tee models for transistors; relationship of models to transistor physics. Comparison of bipolar and field effect transistors; detailed frequency response of simple and multistage amplifiers, design of feedback amplifiers, D.C. coupling techniques, design of multistage tuned amplifiers selected digital and analogue circuits Operational Amplifiers and applications. Integrated circuit design.

**ELE 709: Active Networks**

Active network modeling. The complex frequency plane, Conventional feedback and sensitivity, theorems for feedback Circuits, stability and physical reliability of electrical networks, Nyquist's and Routh's criteria for stability: Activity and Passivity Criteria. Examples using Op-Amps, FDNR's converters, grators, Nullators, etc.

**ELE 710: Analysis ad Synthesis of Passive Networks 3 units**

Geometrical and analytical description of networks. State Variable characterizations: scattering matrics, signal flow graphs: Sensitivity. Design of driving- point and transfer impedance Functions with emphasis on the transfer loss and phase of minimum Phase networks, flow diagram, physical network characteristics, Including relations existing between real and imaginary components of network functions, modern methods of network synthesis.

**ELE 711: Speech Analysis and Synthesis 3 units**

Acoustic theory of speech production; speech signals processing, Digital models and time domain models of speech signals; Digital speech processing for man-machine communication. Realization of voice response and Speaker recognition systems.

**ELE 712: Digital Signal Processing 3 units**

Sampling as a modulation process, the sampling theorem: the Z-transform anddiscrete-time system analysis, direct and computer-Aided design of recursive and non recursive digital filters: the Discrete Fourier transform (DFT) and the Fast Fourier transform (FFT), digital filtering using the FFT, analogue-to-digital and digital-to-analogue conversion; effects of quantization and finite-word-length arithmetic. Correlation functions and power spectral densities for discrete time filters, methods for discrete time whiner filters, methods for designing digital filters to meet precise frequency domain specification.

**ELE 713: Information Theory 3 units**

Information measure, entrophy, mutual information, source encoding; noiseless coding theorem, noisy coding theorem; exponential error bounds; introduction to probabilistic error correcting codes, block and convocational codes, block and convocational codes and error bounds; channels with memory; continuous channels, rate distortion function. Introduction to coding and brief review of modern algebra (vectors, spaces and Galois fields); theory of linear codes; decoding hamming, cyclic and Bose-Chandhuri codes, error detecting and correcting coded; simple automatic fault diagnosing techniques.

**ELE 714:**

Theoretical analysis and engineering applications of Maxwell's Equations. Boundary value problems of electro statistics and Magneto statistics. The homogeneous wave equation. Plane wave propagation. The interaction of place waves and material media. Retarded potentials. The Hertz potential. Simple radiating systems. Relativistic covariance of Maxwell's equations.

**ELE 715: Microwave Engineering and Antennas 3 units**

Mathematical methods for the solution of wave equation; Transmission lines andwaveguides, selected topics in the Theory of wave guide structures, surface guides and artificial Dielectrics. Introduction to the concepts of radiation, generalized for field Formulas. Antenna theorems and fundamentals. Radiative Networks. Antenna arrays, linear and planner arrays; aper Antennas; terminal impedance, propagation. Selected advance Topics.

**ELE 716: Radio Wave Propagation 3 units**

General Solutions of Maxwell's equations, geometrical optics Approximations, propagation above a place earth, effects of surface irregularities and stratified atmospheres, scattering by turbulence.

**ELE 717: Digital Computer Design 3 units**

Essential elements of the hardware design of digital computers. Arithmetic and logic units, adders, multipliers, dividers, logic and shifting operations, floating point arithmetic. Memory organization, digital memories. Hard-wired control unit, micro Programmed control unit, index registers. Organization of commercially available computers. Design of basic computer.

**ELE 718: Biomedical Electronics 3 units**

Introduction to the generation and processing of bio-electric Signals including structure and function of the neuron Generation and propagation of nerve impulses, electronic Neutral-type systems and heir realization. Biological and Medical instruments and equipments. Application in the Design of hearing aids for the deaf and of cardinal pace makers, or a similar case study.

**ELE 719: Classical Control Theory: Analysis and Design of Control Systems 3 units**

Survey of basic principles of linear control theory. Feedback Control. Stability criteria. Performance criteria. Principles of Servos and controllers, equations of a basic servo; specifications and their implications. Graphical methods of design: Root locus, Bode diagrams Nicholas chart compensation in time and Frequency Domain. Non-linearities and their effect on system performance. Describing function principles; examples illustrating stability situations, stable and unstable limit cycles, methods to eliminate oscillations, frequency response calculations. Phase plane principles; application to control systems, relay operated systems; optimum switched and dual mode systems. Popov stability criteria.

**ELE 720: Sampled Data and digital Control Systems Analysis and Design 3 units**

Sampling analogue conversion. Z-transformation and modified Z-transformation, frequency analysis of sampled data systems. Discrete system state space representation poles of discrete. System transfer function. Z-transfer function of discrete systems from the transfer function of the continuous system. Stability analysis of sample data systems. The bilinear transformation. Application of Routh-Hurwitz stability criterion to sampled-data Systems. Root-locus method, Realization of compensation networks.

**ELE 721: Analysis and Design of Linear Multivariable Control Systems 3 units**

Systems representation. Problems of interaction in control system Design. Design on a single loop basis. Non-interacting. Control Diagonal dominance. Assessment of MIMO system stability. Characteristic loci, Nyquist and Inverse Nyquist methods, Gershgorin and Ostrowski Circles MIMO Control system design approach. Industrial Application examples.

**ELE 722: Introduction to Stochastic and Adaptive Control 3 units**

Stochastic processes in discrete and continuous time. Stationary Processes:- auto correlation and cross correlation. Spectral density functions, with noise. Linear operations, on stationary processes. Difference equation models for discrete-time processes. Identification of linear discrete-time systems from input-output data; Parameter Estimation, Identification of model structure, general Diagnostic methods. Adaptive control; Minimum Variance. Self-Turning Control (Astrom). Self-turning controllers for deterministic Systems. Model reference adaptive controllers applications.

**ELE 761: Selected Topics in Current Electrical and Electronics Engineering**

Selected topics of current research in power, high voltage, Electronics, control, communication and antennas, etc will be presented by senior academic members of staff. The format will include lecturers and student preparation and presentation of two major review papers for evaluation.

**ELE 762 & 763: Research Seminars I & II 4 units**

Candidates will be required top make at least two seminar presentations on their M.Phil. Research Topic. Each candidate will be required to produce a manuscript in the usual journal formal on the topic under investigation. For these candidates, literature review and/or development or relevant mathematical models related to dissertation topics will be acceptable.

**ELE 751 & 752: Research Seminars III & IV 3 units**

The format will be similar to the Research seminars I and III for the M.Phil., except that more emphasis will be on the actual Results of the student's Ph.D.
research work.

**ACADEMIC STAFF LIST**

| Name | Rank | Qualifications | Area of Specialization |
|---|---|---|---|
| Adejumobi, I. A | Senior Lecturer & Ag. HOD | B.Sc., M.Sc., PhD | Power and Machine |
| *Fakolujo, O | Senior Lecturer | B.Sc., M.Sc., PhD | Computer and Electronics |
| *Adekola, S. A | Professor | B.Sc., M.Sc., PhD | Communication and Electronics |
| *Adegboyega, G. A | Professor | B.Sc., M.Sc., PhD | Electronics |

**Associate Lecturers*

**MECHANICAL ENGINEERING DEPARTMENT**

**M.ENG. POST GRADUATE CURRICULUM**

## 1. INTRODUCTION

The M. Eng. Postgraduate course in Mechanical Engineering is designed to fulfill the need for well – qualified graduates in the traditional and modern mechanical engineering areas of industry, and in local and national government both at home and abroad as well as provide the much needed manpower for research and development in the industries, higher institutions and research center.

The lectures, tutorials, laboratories, seminars etc offered aims to introduce students to actual and potential engineering problems and to generate the confidence necessary to analyze, assess and resolve these issues.

The Mechanical Engineering Programme offers Postgraduate research leading to the award of Ph.D (Doctor of Philosophy) (for M.Eng degree holders in Mechanical Engineering and / or other related fields of Mechanical Engineering) and also offers post-graduate programme of course work and research leading to the award of M. Eng. (Master of Engineering) in any of the following specialization:

1. Mechanical Engineering
2. Production Engineering
3. Materials and Metallurgical Engineering
4. Power and Process Engineering

For the time being only the above areas of specialization can be offered.

### 1.1 OBJECTIVES OF THE M. ENG. COURSE

Mechanical Engineering is both traditional as well as modern in terms of machinery operations, drive of prime movers, control techniques diversifications and drastic changes in materials usage and applications.

For those who aim to contribute responsibly to future developments it is insufficient merely to study the techniques of the present day; it is also necessary to develop a critical and creative attitude in order to instigate future developments in the field. Any study in depth must be accompanied by a broad understanding of the relevance of other fields.

The student will attain an academic mastery in his specialization field while still having a broad knowledge of other relevant fields. The M. Eng. Degree may be earned on either full time or part-time basis.

## III REGULATIONS

All M. Eng. Courses in Mechanical Engineering are subject to the General University Postgraduate Regulations for Higher Degrees and the General Regulations for Higher Degrees of the College of Engineering.

## IV DURATION OF PROGRAMME

The Duration of advance coursework and research for the degree of Master of Engineering is a minimum of two calendar years for full-time candidates. (i.e. 2 academic sessions).

## V COURSE REQUIREMENTS

The courses are chosen from a wide range of resources to suit the needs of the students having different backgrounds, the industries and the research institutes.

A student must complete a minimum of 30 units of examined course; two seminars (one on the students Research Project and the other on an engineering topic of his choice in his field of specialization) and he will submit a dissertation based upon a research project (6 units).

The programme shall continuously recommend to the College of Engineering the review of the formal lecture, laboratory and research activity, as befits the changing nature of the course. Each field of specialization has a set of seven or eight core courses with MAN 701 (Management); MEL 702 (Mechanical Engineering Laboratory Course) and PST 701 (Project, Seminar and Thesis) common to all.

Other elective courses, from the specialization field or from other fields are recommended depending on the field of specialization.

Where necessary, candidates may be required to remedy specific weakness at undergraduate level. Written examination papers, each of two to three hours duration are held at the end of each semester (10 - 12 weeks) for most of the core courses and electives. The Mechanical Engineering Laboratory course is assessed by written reports to be submitted during the second semester.

Find below the course content and syllabus for the M. Eng. Specialization fields in Mechanical/Production Engineering.

## I. M. ENG. COURSE IN MECAHNICAL ENGINEERING

### MECHANICAL ENGINEERING OPTION

**PROGRAMME STRUCTURE**

| **Common Courses** | | **CU** |
|---|---|---|
| MCE 740 | Seminar | 2 |
| MCE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**First Semester**
*Core Courses*

| Course Code | Course Title | CU |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| MCE 701 | Theory of Elasticity | 2 |
| MCE 703 | Computers, Optimization and Design | 3 |
| MCE 705 | Advanced Thermodynamics | 2 |
| MAN 701 | Management | 2 |
| | **Total** | **13** |

**ELECTIVE COURSES**

| | | CU |
|---|---|---|
| MCE 711E | Experimental Stress Analysis | 2 |
| MCE 713E | Introduction to Finite Element Analysis | 2 |
| MCE 715E | Nonlinear Mechanics | 3 |
| MCE 717E | Mechanics of Composite Materials | 3 |

*Second Semester*
*Core Courses*

| Course Code | Course Title | CU |
|---|---|---|
| MCE 702 | Advanced Dynamics | 3 |
| MCE 704 | Advanced Fluid Dynamics | 2 |
| MEL 702 | Mechanical Engineering Laboratory Course (one each semester). | 2 |
| | **Total** | **7** |

**ELECTIVE COURSE**

| | | CU |
|---|---|---|
| MCE 712E | Advanced Theory of Vibrations | 2 |
| MCE 714E | Advanced Engineering Mathematics | 2 |
| MCE 716E | Theory of Plasticity | 2 |
| MCE 718E | Advanced Tribology | 2 |
| | | **8** |

Candidates taking the M. Eng. (Mechanical Engineering) have to offer the eight (8) core course listed above plus three (3) Electives from the option (with a minimum of 6 units) giving a total minimum of 30 units

**THIRD AND FOURTH SEMESTERS**
*Thesis Research and Seminar* *8*

ANY OTHER COURSE TO BE REMEDIED.

**SYLLABUS**

**MCE 701: THEORY OF ELASTICITY (2 units)**

General analysis of deformation, strain and stress. Elastic stress-strain relations and formulation of elasticity problems. Solutions of elasticity problems by potentials. Simple beams. The torsion problem. Thick cylinders, disks and spheres. Energy principles and introduction to variation methods. Elastic stability. Matrix and tensor notations gradually introduced and then used throughout the course.

**MCE 702 ADVANCED DYNAMICS (3 units)**

A comprehensive development of the principle of virtual work, Hamilton's principle and the Lagrange equations for homonymic and nonoholomic system. Applications of Lagrange equations to systems of particles and of rigid bodies. Impact problems.

**MCE 711E: EXPERIMENTAL STRESS ANALYSIS (2 units**

Electric gauge and brittle lacquer methods of stress determination. Variation electric gauges, their placement, circuit design and attendant equipment, brittle models and coatings. Photo-elasticity and analog methods of stress analysis. Introduction to Moiré technique.

**MCE 712E: ADVANCED THEORY OF VIBRATIONS (2 units)**

Review of mathematical foundations and advanced principles of dynamics. Multi-degree of freedom discrete systems, modeling, formulation and computational schemes. Continuous media systems and their equivalent finite-element discrete systems. Model analysis, steady state and transient response. Introduction to nonlinear systems and random vibrations

**MCE 713E: INTRODUCTION TO FINITE ELEMENT ANALYSIS (2 units)**

Review of mathematical foundations of the finite element analysis – variation methods. Plane stress and plane strain problems. Axisynmetric and plate and fluid structures. Field problems – heat transfer and fluid flow problems. Problem solving using the digital computer.

**MCE 703: COMPUTERS, OPTIMIZATION AND DESIGN (3units)**

Application of commuter methods to engineering design with emphasis on optimization and automated design methods. Introduction to the use of linear and nonlinear programming methods for engineering design and related problems. Unconstrained minimization, penalty functions, feasible directions. Practical solution of problems on the digital computer.

**MCE 704: ADVANCED FLUID DYNAMICS (2units)**

Derivation and discussion of the general equations for conservation of mass, momentum and energy using tensors. Several exact solutions of the incompressible Newtonian viscous equations. Kinematics and dynamic of invicid, incompressible flow including free streamline theory developed using vector, complex variable, and numerical techniques.

**MCE 705: ADVANCED THERMODYNAMICS (2units)**

Basic ideas of thermodynamics and dominant methods of their development: operational, postulation, and statistical. Energy and information theory. Irreversible thermodynamics. Applications.

**MCE 714E ADVANCED ENGINEERING MATHEMATICS (2 units)**

Partial differential equations of mathematical physics. Variational methods: Raleigh Ritz and finite element methods, variational calculus, Euler equations. Finite difference methods. Advanced numerical techniques:

solving systems of differential equations, partial differential equations and matrix methods. Additional topics when appropriate.

**MCE 715E: NONLINEAR MECHANICS (3 units)**

Nonlinear oscillations including the equations of Duffing, Mathieu, van der Pol, and Hill Nonlinear limit cycles and subharmonics. Theorems of Poincare and Bendixor. Bifurcation theory. Stability of Multi-degree of freedom system.

**MCE 716E: THEORY OF PLASTICITY (2units)**

Laws of plastic flow; general stress-strain relation. Applications to spheres, tubes and rotating disks in the clasto-plastic range with strain hardening. Torsion. Introduction to slip line theory and limit analysis……Creep.

**MCE 717E: MECHANICS OF COMPOSITE MATERIALS (3units)**

Introduction to composite materials. Mechanical properties. Statistic and dynamic characteristics. Design Properties. Manufacturing methods. Mechanical testing. Applications in aerospace and other fields. Future potentials of composites in a developing country.

**MCE 718E: ADVANCE TRIBOLOGY (2units)**

Introduction: Some properties of solids and liquids. Contact of two solid surfaces. Nature of surfaces friction and its theories. Kinds of wear. Hydrodynamic Lubrications. Calculation and design of hydrodynamic bearings. Bearing materials. Hydrostatic bearings. Elasto hydrodynamic lubrication. Experimental methods in Tribology.

**MAN 701: MANAGEMENT (2units)**

Operations Management:

Organization of industrial company: description of various departments and their functions. Financial resources, statements, rate, and return on investment appraisal of performance and cash requirements. Cost control; Cost accounting breakeven charts and budgets. Marketing objectives, pricing, new products development. Production, process planning and scheduling; inventory control. Work-study motion study. Project planning; Network analysis viz PERT, CPM, and other techniques.

Practical management problems encountered by Engineers. Investment in Research and Development; Purchasing function; marketing; personnel Management; Industrial relations. Production Management; Project Management and Corporate Planning.

**Operation Research:**

Statistics, computing; Allocation – LP; economics; digital simulation; network; case studies: OR techniques: Decision theory and sequential analysis; Forecasting and time series Multivariate analysis: systems analysis.

**MEL 702: MECHANICAL ENGINEERING LABORAORY COURSE (2units )**

(A) A series of Lectures and Practical on techniques of measurements; setting up of and experiment, design and calibration of measuring equipments; Trial run experiments; Data analysis etc.

(B) A total of 8 – 10 Laboratory experiments to be performed over the first 2 semesters with at least 2 each coming from the various specialization fields.

(C) Students are to write up 4 detailed Lab. Reports with two coming from their field of specialization.

**PST 701: PROJECT, SEMINAR, AND THESIS (8 units)**

Each student (in any area of the M. Eng specialization is required to carry out an experimental and/or Theoretical examination of selected problem over 2 semesters (minimum and continuous) in his field of specialization.

This may be from a List of projects available in the Programme or if he is industry based, his firm may have a suitable task, which can be supervised by a Programme staff member. Theoretical part of most research projects rely heavily on (1) Computer Programming and Engineering numerical analysis and (2) Finite element Methods.

The result of this research work must be presented in a bound report (Project Thesis). Each student is also required to present two seminars over the 4-semester period and one of these must be on his project and the other on a topic of his choice in his field of specialization.

Experimental on projects should be completed by end of April and four copies of the Project Thesis should be submitted by end of July.

## II M.ENG. COURSES IN PRODUCTION ENGINEERING

**PRODUCTION ENGINEERING OPTION**
**PROGRAMME STRUCTURE**

| **Common Courses** | | **CU** |
|---|---|---|
| MCE 740 | Seminar | 2 |
| MCE 799 | Thesis Research | 6 |
| | **Total** | **8** |

*First Semester*
*Core Courses*

| **Course Code** | **Course Title** | **CU** |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| MPE 701 | JOINING TECHNOLOGY | 2 |
| MPE 703 | METAL CUTTING & MACHINE TOOL CONSTRUCTIONS | 2 |
| MPE 705 | MEASUREMENT & CONTROL IN INDUSTRY | 3 |
| MAN 701 | MANAGEMENT | 2 |
| | **Total** | **13** |

**ELECTIVE COURSES**

Students for production Engineering is to make up a total of 8 Units from the Mechanical Engineering Specialization elective courses. Students are strongly advised to offer MCE 716E – THEORY OF PLASTICITY.

| | |
|---|---|
| MCE 713E | 2 units |
| MCE 717E | 3 units |
| MCE 711E | 2 units |
| MCE 715E | 3 units |

*Second Semester*
*Core Courses*

| Course Code | Course Title | CU |
|---|---|---|
| MPE 702 | METAL FORMING & INDUSTRIAL FINISHING | 2 |
| MPE 704 | DESING FORPRODUCTION | 3 |
| MEL 702 | MECHANICAL ENGINEERING | 2 |
| | LABORATORY COURSE | 7 |
| | **Total** | **14** |

**ELECTIVE COURSES**

| | |
|---|---|
| MCE 716E | 2 units |
| MCE 718E | 2 units |
| MCE 712E | 2 units |
| MCE 714E | 2 units |
| | 8 |

Candidates taking the M. Eng. (Mechanical Engineering) have to offer the eight (8) core course listed above plus three (3) Electives from the option (with a minimum of 6 units) giving a total minimum of 30 units

**THIRD & FOURTH SEMESTERS**

| | |
|---|---|
| Thesis Research and Seminar | 8 units |

**ANY COURSE TO BE REMEDIED.**

**MPE 701: JOINING TECHNOLOGY (2 UNITS)**

Choice of processes, Metallurgical aspects of welding, Gas welding processes, Plasma methods welding of ferrous and on0ferrous materials, friction welding, fatigue and brittle fracture etc.

**MPE 702 METALS FORMING & INDUSTRIAL FINISHING (2 UNITS)**

Hot and cold rolling, defects in rolled metals, forging and defects in forgoing, casting in metallic moulds, moldings and core making materials, solidification of metals and alloys, Riser design and placement, Casting design, casting design consideration, Casting defect, Metal melting, Sheet and wire drawing, shearing processes, Coining, bending, Polishing, Burnishing, diamond tools, wire brushing, barreling, vibratory finishing, electro-mechanical etc. Abrassive blast treatment, roughening and blasting etc. Plating; Copper, nickel, chromium and zinc. Pickling and dipping, Converting Coasts, Paintings.

**MPE 703: METAL CUTTING & MACHINE TOOL CONSTRUCTIONS (2 UNITS)**

Theory of chip formation, Angle of tool surfaces, Types of tool materials available and their applications, cutting conditions for economics for economics tool life, Machinability of work piece materials, cutting action of milling cutters, drills broaches, etc Grinding processes, selection of grinding wheels and quality of surface produced, lapping and honing, New metal removal processes, electro-chemical machine and spark erosion. Principles of design of machine frames, gearboxes, spindles, bearings and slideways, factors limiting the performance of machine tools, Economic selection of machine tools, Mechanical devices for automatic control, Electrical control with Feedback and digital programming.

**MPE 704: DESIGN FOR PRODUCTION (3 UNITS)**

Design of machine components, viz classification of jigs and fixtures, Main elements in jigs and fixtures, clamping and locating, locating errors, Mandrels, Principles of clamping, claming elements, power drives for clamping, continuous action clamping devices. Tool guiding elements for jigs, indexing and rotary element, Bodies and frames, Standardization of jigs and fixtures, Economy.

**MPE 705: MEASUREMENT & CONTROL IN INDUSTRY (3 UNITS)**

Basic considerations of measurements the wave length as standard of length, slip-gauges, Tolerance and limit system, Screw thread tolerance, gauge tolerance, Measurement of straightness, flatness, roundness, profile measurement. Measuring machines and comparators, Screw thread measurement, Gear measurement, surface texture assessment Inspection and gauging in manufacturing, Quality control charts for variables. Acceptance sampling and design of acceptance sampling. Generalized smeasurement system, first state device and elements. Intermediate modifying systems and application of microcomputers in control system, design of control system.

**MAN 701 MANAGEMENT (2 UNITS)**

**MEL 702: MECHANICAL ENGINEERING LABORATORY COURSE (2 UNITS, I UNIT EACH SEMESTER)**

**PST 701: PROJECT, SEMINARS & THESIS (8 UNITS)**

Note: FOR REQUIRED ELECTIVE COURSES, SEE MECHANICAL SPECIALIZATION OPTION

## III. M. ENG. COURSE IN MATERIALS & METALLURGICAL ENGINEERING

**PROGRAMME STRUCTURE**

| **Common Courses** | | **CU** |
|---|---|---|
| MCE 740 | Seminar | 2 |
| MCE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**First Semester**

*Core Courses*

| **Course Code** | **Course Title** | **CU** |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| MME 701 | Chemical Processing | 3 |
| MME 703 | Structures & properties of metal & alloys | 2 |
| MME 705 | Extractive Metallurgy | 2 |
| MAN 701: | Management | 2 |
| | **Total** | **13** |

**ELECTIVE COURSES**

| | | |
|---|---|---|
| MME 711E: | Foundry, Casting, & Welding | 2 |
| MME 713E: | Mechanical Working & Powder Metallurgy | 2 |
| MME 715E: | Mechanical Properties of Materials | 2 |

**Second Semester**

*Core Courses*

| Course Code | Course Title | CU |
|---|---|---|
| MME 702 | Physical Processing | 3 |
| MME 704 | Economic Analysis, Casting & Material Selection | 2 |
| MEL 702 | ME Laboratory Course | 2 |
| | **Total** | **7** |

**ELECTIVE COURSES**

| | | |
|---|---|---|
| MME 714E: | Process & Furnace Design | 2 |
| MME 712E | Corrosion | 2 |
| MME 716E: | Ceramics, Classes and Polymer Materials | 2 |

Candidates taking the M. Eng. (Mechanical Engineering) have to offer the eight (8) core course listed above plus three (3) Electives from the option (with a minimum of 6 units) giving a total minimum of 30 units

**THIRD AND FOURTH SEMESTERS**

*Thesis Research and Seminar* *8 units*

ANY OTHER COURSE TO BE REMEDIED

**MME 701 CHEMICAL PROCESSING (3 UNITS)**

Analysis of pyrometallurgical processes in chemical and engineering terms.
Sintering or Iron Ores and of sulphide concentrates. Pelletising. Iron Blast furnace. Theoretical approach to packed bed processes. Steel making. Mass transfer relevant to steel-making. Mass transfer in continuous and batch processes. Copper production. Aluminium production.

**MME 702 PHYSICAL PROCESSING (3 UNITS)**

Casting and solidification: lectures providing a basis for understanding the phenomena involved in the origin of as-cast macrostructures, in the prediction of solidification rates and in the production of pound castings.

Mechanical Working: Lectures aimed at understanding of the manipulation and control of plastic deformation processes to produce satisfactory wrought products. Theories of major working processes.

Heat treatment processing: Lectures covering some of the main principles of sheat treatment processing.

**MME 703 STRUCTURES AND PROPERTIES OF METALS AND ALLOYS**

Solid state transformations: Principal solid state transformations relevant to the control of structure and properties in metals and alloys with special reference to mechanism and kinetics of the structural changes.
Electron metallography: basis for interpreting the main types of electron microscope images obtainable from crystalline materials.

Mechanical properties: Mechanical properties of engineering metallic alloys in terms of the defect solid state, and how such an understanding may be useful in the design development and structural control of these materials.

Structures and properties relationship in industrial carbon and alloy steels.

**MME 704 ECONOMIC ANALYSIS, COSTING AND MATERIAL SELECTION (2 UNITS)**

Raising of Capital, sot elements of a simple process, discounted cash flow calculations, and the effect of economics on development of metallurgical products and processes.

Review of a wide-range of industrial metals and alloys regarding the factors that govern selection for particular service conditions. Cost, availability, ease of fabrication, comparison of major alloy groups, specifications and their rise, mechanical testing and predictions of service behaviours.

**MME 705 EXTRACTIVE METALLURGY (2 UNITS)**

Princxiuples of extraction metallurgy including the application of chemical thermodynamics to reactions at high temperatures, free energy diagrams, factors controlling rates and affecting the choice of extraction methods, concise account of the extraction of iron and steel, copper, lead, zinc, nickel, magnessium and aluminium.

Pyrometallurgy, chemical transport processes. Electro-metallurgy: principles, electrowinning, electrocladding and electrorefining current research and developments.

**MEL 702 MECHANICAL ENGINEERING LABORATAORY COURSE (2 UNITS)**

A total of ten laboratories to be performed over 10 weeks, with 2 laboratories coming from each of the Mechanical Engineering Specialization options (for details, see page 7).

**ELECTIVE COURSES IN METALLURGY AND MATERIAL SCIENCE**

**MME 711E FOUNDRY, CASTING AND WELDING (2 UNITS)**

Gray Iron, Malleable iron, non-ferrous foundry. Design, layout and construction of foundries. Solidification, shrinkage and hot tearing. Introduction to continuous castings. Eutelic solidification. Directional solidification techniques. Power sources for metal arc welding. Metal transfer. Cracking phenomenum in fusion welds; effect of microstructure, determination of safe welding procedures. Dissimilar welds, dilution, choice of welding consumables. Fluxes.

**MME 713E MECHANICAL WORKING AND POWDER METALLURGY (2 UNITS)**

Mechanical Working:

Levy-Von Mises flow rule. Equivalent stress and strain. Hencky's equation. Slip – line field theory and its application to major mechanical wor45king processes.

Powder Metallurgy: production and properties of powders. Shaping of powders continuous powder production combined with continuous deformation. Sintering phenomena mathematical analysis. Applications of powder metallurgy.

MME 714E PROCESS AND FURNACE DESIGN (2 UNITS)

Particles in fluids:

Particle dynamics, applications, e.g. gas cleaning fluidized beds of inert solids. Solid particles undergoing chemical reaction in fluids, applications e.g. plus melting and roasting of sulphides. Fluidized beds as reactors in metallurgical processes, application of mass transfer models. Liquid drops reacting n fluids, mass transfer processes applications e.g. slag/metal emulsion electro-slag refining.

Furnace Design

Furnace used in process metallurgy. Heat transfer from flame to charge, radiation heat transfer thermodynamics approach to furnace efficiency. Aerodynamics in furnace chamber flow patterns, recirculation and erosion. Regenerators and recuperators, heat transfer. Electric furnaces – resistance.

**MME 715E MECHANICAL PROPERTIES OF MATERIALS (2 UNITS)**

Fracture of engineering materials

Introduction to failure mechanics residual stresses, ductile fracture in work hardening materials, brittle fracture, inter relation of Kc and Gc, crack opening displacement, fatigue, creep, plastic bending of beams.

Defects and Mechanical Properties

The flow stress as determined by the lattice, the microstructure, influence of temp, strain rate point defect solutes, precipitates, other dislocations, stored energy of deformation recrystallisation. Superplasticity.

Micro- structural aspects of fracture and fracture bughness

Orowan – Irwin theory of fracture, Kc and Gc, plastic work of fracture. Micro-structural processes occurring at notch leading to crack nucleation and crack propagation in metals, ceramics and polymers.

**MME 716 E CERAMICS, GLASSES AND POLYMER MATERIUALS (2 UNITS)**

Crystalline Materials

Control of stoichiometry of ceramic compounds. Effects of non-stoichiometry upon transport properties and sintering characteristics. Control of grain size. Effect of micro-structural variables upon mechanical electrical properties of ceramics.

Glasses and glass ceramics: Structure of inorganic glass-forming systems. Spectroscopy of glasses and application relevant to optional transmission and thermal conductivity. Coloured glasses, oxidation/reduction equilibria. Phase separation and devitrification processes. Physical, chemical and mechanical properties of glass ceramics.

Development and properties of the complex multiphase microstructure of a "mass produced" ceramic article e.g. triaxial white ware, aluminosilicate and chrome –magnesite refractories. Polymeric Materials: Polymerisation. Polycondensation propagation. Bulk, suspension and emulsion polymerization solutions, phase separation, fractionation, compatibility, solubility parameters. Stresses and strains. Plastic deformation and fracture of polymers. Tensile deformation theory of formation of lider bands, textural aspects drawing, rolling and thin film formation. Effect of annealing, effect of plastic deformation processes on dynamic properties.

**MAN 701 MANAGEMENT (2 UNITS)**

**MEL 702 MECHANICAL ENGINEERING LABORATORY COURSE (2 UNITS)**

**PST 701 PROJECT, SEMINAR AND THESIS (8 UNITS)**

**M. ENG. COURSES IN POWER AND PROCESS ENGINEERING**

**PROGRAMME STRUCTURE**

| **Common Courses** | | **CU** |
|---|---|---|
| MCE 740 | Seminar | 2 |
| MCE 799 | Thesis Research | 6 |
| | **Total** | **8** |

**First Semester**
*Core Courses*

| Course Code | Course Title | CU |
|---|---|---|
| CSC 701 | Use of Computer in Research | 4 |
| MPP 701 | Combustion Processes | 2 |
| MPP 703 | Nuclear Power | 2 |
| MPP 705 | Fluid flow and Heat Transfer (CAD/Computation) | 3 |
| MAN 701 | Management | 2 |
| | **Total** | **13** |

**ELECTIVE COURSES**

| | | |
|---|---|---|
| MPP 711E | Materials Technology | 2 |
| MPP 713E | Control Engineering | 2 |
| MCE 703 | Computers, Optimization and Design | 3 |

**Second Semester**
*Core Courses*

| Course Code | Course Title | CU |
|---|---|---|
| MPP 702 | Thermal Power Engineering | 3 |
| MPP 704 | Turbo machinery | 2 |
| MEL 702 | ME Laboratory Course | 2 |
| | **Total** | **7** |

**ELECTIVE COURSES**

| | | |
|---|---|---|
| MPP 712E | Environmental Engineering | 2 |
| MPP 714E | Other Energy Sources and Waste Materials Management | 2 |

Candidates taking the M. Eng. (Mechanical Engineering) have to offer the eight (8) core course listed above plus three (3) Electives from the option (with a minimum of 6 units) giving a total minimum of 30 units

**THIRD AND FOURTH SEMESTERS**

**Thesis Research and Seminar** **8**

ANY OTHER COURSES TO BE REMEDIED

**MPP 701 COMBUSTION PROCESSES (2 UNITS)**
Introduction to Combustion. Mass transfer. Droplet vaporization. Droplet combustion. Liquid propellant rocket Laminar jet laminar diffusion flame. Turbulent jetr5, turbulent diffusion flame. Chemical kinetics. Spontaneous ignition. Flame stabilization by bluff bodies. Laminar flame propagation. Spark ignition. Coal-particle combustion.

**MPP 702 THERMAL POWER ENGINEERING (3 UNITS)**
Thermodynamics
Open and closed cycles. Availability. Effects of irreversibility. Thermo measures of irreversibility e.g. isentropic efficiency of turbo machines, effectiveness of heat exchangers. Gas turbine cycles. Reheating and regeneration. Components of a typical G.T. cycle. Steam cycles, stages of heating, reheating, factors affecting choice of temperature and pressure. Combined cycles and other advanced cycles boilers and heat exchangers:

Introduction to external parameters e.g. effectiveness, flow rates, pressure drop etc. cost parameters. Exchangers with phase change. Cross flow and counter flow. Effects on size and geometry of external parameter, cost etc. Boilers and condensers. Application of boiling and condensation to steam generators and condensers.

Reciprocating Engines:
Cycles and thermodynamics aspects. Technological limitations: fuel, thermal problems Mechanical problems. Uses exhaust emissions.

**MPP 703 NUCLEAR POWER (2 UNITS)**

Reactor Core Analysis:
Nuclear stability; Radioactivity: neutron reactions and nuclear fussion, the chain reaction neutron diffusion, criticality and critical size. Reactor Engineering Descriptions of Nuclear Reactors. Selection of materials for fuel elements and other core components: core heat transfer and temperature distribution, core pressure drop and circulator work economics of nuclear power plants reactor optimization. Reactor start-up and control; flux distributions and reaction rates, gamma ray spectroscopy and shielding.

**MPP 704 TURBOMACHINERY (2 UNITS)**

Thermodynamics, efficiency criteria, velocity triangles, degree of reaction.
Axial flow compressors, blade and cascade geometry and nomenclature cascade theory, lift and drag coefficients, cascade or diffuser efficiency irreversible flow through blade row and stage. Stage efficiency, high speed flow, critical and maximum Mach numbers, supersonic compressors.

Axial flow turbines, blade and cascade geometry gas outlet angle, irreversible flow through blade row and stage, blade row losses (velocity coefficient, nozzle efficiency, enthalpy loss coefficient, increase in entropy, stagnation pressure-loss coefficient, drag coefficient). Stage efficiency. Evaluation of blade losses, soderberg correlation optimum pitch/chord ratio.

**MPP 705 FLUID FLOW AND HEAT TRANSFER (COMPUTATION AND COMPUTER AIDED DESIGN) (3 UNITS)**

Heat conduction: Review of fundamentals and equations, Analytical solutions, general numerical methods of solutions, computer programme: application to practical problems. Fluid Mechanics: Equations of general flows. Simplified models for fluids of very small and very large viscosity and for fully developed duct flows: solution by analytical and numerical means: solutions of general equations, computer programme. Application to impinging jets, boundary layers, turbulence.

Heat and Mass Convection: Fundamentals and equations: Analysis of heat and mass transfer in engineering equipments e.g. diffusers, environment. Correlation to transfer coefficients.

**MEL 702 ME LABORATORY COURSE (2 UNITS)**

**MAN 701 MANAGEMENT (2 UNITS)**

**PST 701 PROJECT, SEMINARS AND THESIS (8 UNITS)**

**ELECTIVE COURSES IN POWER AND PROCESS ENGINEERING**

**MPP 711E MATERIALS TECHNOLOGY (2 UNITS)**

Polymer Engineering: Molecular structure and basic types of polymers. Main classes of plastic and their uses. Processing of polymers, extrusion injection moulding, blow moulding, Mechanical properties of plastics including creep and impact. Viscoelasticity, spring dashpot models. Principles of fibre-plastics composites. Properties and selection of alloys for engineering applications: Brittle fracture. Toughness in different types of materials: Effect of composition and processing variables. Control of yield stress and toughness in steels. Pressure vessels, pipeline steels. Creep. Design of alloys for creep resistance. Fatigue, stage I and stage II crack growth. Prediction of fatigue life. Principles of corrosion and oxidation. Corrosion resisting materials. Automotive steels and high alloy steels. Harden ability and control of properties by heat treatment. UHSS. aluminium alloys. Materials for use at low temperature. Nickel ferritic steels, austenitic steels.

**MPP 713E CONTROL ENGINEERING (2 UNITS)**

Dynamic Analysis Control: General introduction. Demonstration of error actuation, power amplification effect of feedback, use of transfer functions and block diagrams.

Linear Control Systems: Analysis and synthesis of systems using Hurwtitz-Rauth, Nyquist, Bode and Root Locus techniques. Methods of improving system response. Use of phase plane.

Non-linear Control Systems: Use of phase plane and plane describing function techniques. More Advance Systems: sample data systems, use of analogue, digital and hybrid computer. More sophisticated control techniques.

**MCE 703 COMPUTERS, OPTIMIZATION AND DESIGN (3 UNITS)**

**MPP 714E OTHER ENERGY SOURCES AND WASTE MATERIALS MANAGEMENT (2 UNITS)**

Solar Energy: Liquid flat plate collectors; Solar air heaters; concentration collectors; Thermal energy storage, Solar ponds: Other Energy Sources. Wind Energy, Energy from Biomass, Ocean Thermal Energy Conversion, Nuclear Fusion and FBT, Tar sand and Oil Shales, Geothermal energy, Agricultural Waste Materials Management.

**MPP 712E ENVIRONMENTAL ENGINEERING (2 UNITS)**

Review of industrial and other emissions in relation to the natural cycles of materials in the biosphere. Particles: Dusts; removal by gaseous means; removal by liquid means. Pollutants viz air, radioactive, water. Solid waste disposal. Measurement and monitoring: Industrial safety norms. Reliability and risk analysis. Treatment of effluents and solid waste.

**LISTS OF STAFF IN THE COLLEGE OF ENGINEERING**

| NAME | Rank | QUALIFICATION | AREA OF SPECIALIZATION |
|---|---|---|---|
| Aiyedun, P. O | Professor | B. Eng (Zaria) M.Sc, DIC(London), Ph.D (Sheffield), FNIEM, MNSE, MINucE, MIMechE, MMSN, MNIMechE, C.Eng, R.Eng (COREN) | Metallurgical and Materials/Production Engr/Nuclear Engr. |
| *Mojola, O | Professor | B.Sc,Ph.D(London), C.Eng,R.Eng(COREN) | Fluid Mechanics/Aeronautics |
| *Sangodoyin, A. Y | Professor | B. Sc (Ibadan), M.Sc, Ph.D (Birmingham) MNSE, MNSAE, MASAE, MBIWES, R. Engr. (COREN) | Professor & Associate Lecturer, in Soil and Water Engineering |
| *Sadiq, M. O | Professor | B.Sc,M.Sc.Ph.D | Structural Analysis |
| *Agbede, O. A | Professor | B.Sc, M.Sc,(Ife), Ph.D(London)MNSE, MNMGS, MIWEM, MAGID | Geothenics/Water Resources Engr. |
| *Olateju, O. T | Professor | B.Sc,M.Sc,Ph.D (Purdue) | Building/High Way Engr. |
| * Adekola, S. A | Professor | B.Sc, M.Sc, Ph.D, FAS, C.Eng., FIET, SMIEEE, FAEng., FNSE, FASA | Communication and Electronics Electronics |
| *Adegboyega, G. A | Professor | B.Sc,M.Sc, Ph.D, R.E. COREN, C.Eng (UK) | |
| *Mojola, S. O | | B.Sc. M.Sc., Ph.D | Fluids Mechanics |
| Ukatu, A. C | Reader | B.Sc., M.Sc (Technion); FNSE, FNIAE, FIAE, MASAE, MIFT, MNIFST, MSAN, R. Eng (COREN) | Reader, Post Harvest Processing and Storage |
| Adewumi, J. K | | B. Eng, M.Sc, Ph.D (ABU) MNSE, MNIAE, C. Engr(UK) R. Engr. (COREN) | Senior Lecturer in Soil and Water Engineering |
| Alamu, O. J | Ag.Head/Senior Lecturer | B.Tech (Ogbomoso), M.Sc(Ibadan), Ph.D (Ogbomoso) MNSE, MNIMechE, MCREN, MAFRIWEA, AMNIM R.Eng (COREN) | Renewable Energy/Materials Science |
| Ismaila, S. O | | ND(Ilaro), B.Sc(Ife),M.Sc, Ph.D(Ibadan), MNSE,R.Eng (COREN) | Industrial and Production |
| Olayanju, T.M.A | Senior Lecturer | B.Sc, M.Sc, Ph.D(Ibadan) MNSE, MNIAE, MNIFST, R. Engr (COREN) | Agric. Processing and Storage |
| * Raji, A | | B.Sc, M.Sc, Ph.D | Crop Processing and Storage |
| Adejumobi, I. A | | B.Sc,M.Sc, Ph.D | Power and Machine |
| * Fakolujo, O | | B.Sc,M.Sc, Ph.D | Computer and Electronics |

**Associate Lecturers*