

ACE IMPACT

**AFRICA CENTRE OF EXCELLENCE ON NEW PEDAGOGIES IN
ENGINEERING EDUCATION (ACENPEE)**

AHMADU BELLO UNIVERSITY, ZARIA

STUDENT HANDBOOK

2019/2020

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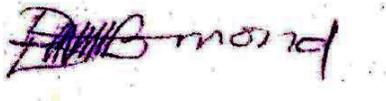
CENTRE LEADER'S MESSAGE

I welcome you all to the Africa Centre of Excellence on New Pedagogies in Engineering Education (ACENPEE). ACENPEE is a World Bank assisted African Center of Excellence on Development Impact with the mandate of scaling up postgraduate education and applied research in engineering education within the West African Sub-region.

We are thrilled that you are considering a career in this fascinating and rewarding specialty. The Development Challenge to be addressed by the Centre is the lack of skilled engineering human resources to staff the commanding sectors of the economy because of poor quality of engineering graduates from our universities and their inadequacies in meeting the challenges of a complex and constantly evolving workplace.

It is our long term goal that the Centre will meet our regional developmental challenge through the increased admission and graduation of students (especially female) at the Masters and Doctorate (MSc/PhD) degree levels that are likely to become a new crop of faculty in engineering departments with better hands-on skilled training.

I encourage you to explore our website <https://acenpee.abu.edu.ng/> and find out more about the Centre and how you could be involved in some of the programmes and services we have to offer.



Prof. Raymond B. Bako
Centre Leader, ACENPEE

FOREWORD

This Student Handbook will avail students of the Africa Centre of Excellence on New Pedagogies in Engineering Education (ACENPEE) to have access to the necessary and vital information about the Centre. This handbook contains information on the various M.Sc. and Ph.D programs run by Chemical Engineering, Civil Engineering, Mechanical Engineering and Water Resources and Environmental Engineering Departments on behalf of the Centre as well as the Certificate of Engineering Education.

It provides prospective students with the admission policy, selection criteria, duration of the programs, graduation requirement, course structure, scholarship policy, ethics policy, research policy, University resource Centres, Students welfare, teaching staff of the various programs run by the center as well as key contacts at the University and Centre..

The centre programs will be located in the various department and the departments will award the degree. Research emphasis will be on exploring innovative ideas and effectiveness of new pedagogies in enhancing teaching and learning of the various engineering programs aimed at producing better quality engineers that will help in meeting the current man-power gap in the industry.

I will encourage the centre students to make good use of this handbook and welcome them to the Africa Centre of Excellence on New Pedagogies in Engineering Education (ACENPEE), Ahmadu Bello University Zaria, Nigeria.

Centre Leader

CENTRE COORDINATING COMMITTEE

1. Centre Leader – Prof. Raymond B. Bako
2. Deputy Centre Leader – Prof. Abdulkarim S. Ahmed
3. Monitoring & Evaluation officer (M&E) – Prof. Fatai O. Anafi
4. Academic Coordinator – Dr. Baba Abdul
5. Curriculum Development Coordinator – Prof. Ayuba Guga
6. Outreach Coordinator – Dr. David O. Obada
7. Research Coordinator – Dr. Adrian Eberemu
8. Communications Officer – Dr. Suleiman A. Zubairu
9. Environmental Safeguard Officer – Dr. Fatima B. Ibrahim
10. Gender Coordinator – Prof. Binta Abdulkarim
11. Project Accountant – Mal. Rabiya Musa
12. Procurement Officer – Engr. Bashir I. Garba
13. Internal Auditor – Mal. Sani Sale Doguwa
14. Project Admin. Secretary – Aishat I. Baballe

CENTRE BRIEF

A BRIEF ON THE AFRICA CENTRE OF EXCELLENCE ON NEW PEDAGOGIES IN ENGINEERING EDUCATION (ACENPEE).

ACENPEE as an ACE Development Impact Centre has the mandate of scaling up postgraduate education and applied research in engineering education that are fundamental to economic growth in the West African sub-region. The Development Challenge to be addressed by the Centre is the lack of skilled engineering human resources to man the commanding sectors of the economy as a result of poor quality of engineering graduates from our universities and their inadequacies in meeting the challenges of a complex and constantly evolving workplace. The expected impact of the Centre on the development challenge over its lifetime will be the increased admission and graduation of students (especially female) at the Masters and Doctorate (MSc/PhD) degree levels that are likely to become a new crop of faculty in engineering departments. Also, short term professional courses for industry workers will be mounted to improve their skills, efficiency and service delivery.

ACENPEE will engage in applied research and the findings and knowledge will be shared through research articles that are published in internationally recognized high impact peer reviewed journals. Similarly, the Centre will strive for global quality of its programmes that will receive accreditation by internationally recognized accreditation bodies. Another important expected impact of the Centre is improvement in teaching and learning facilities and infrastructure in the university. We hope to provide opportunity to our staff and students for internship in relevant sector institutions for at least one month in a year while also developing entrepreneurship, innovation, start-up companies, and commercialization support programs.

The Education objective of the Centre is to mount M.Sc and Ph.D degree programmes in Chemical, Civil, Mechanical as well as Water Resources and Environmental Engineering with emphasis on the use of new pedagogies to improve teaching and learning. This will be complimented by the running of professional short term courses in various aspects of engineering practice to improve and fill the skills gap that exists in sectoral institutions. The expected outcome of the education objective will be improvement in student critical thinking, team skills, conceptual understanding, receptivity among students and lecturers and improved grades supported by positive testimonials on the Cooperative, Hands-on, Active, Problem-solving Learning (CHAPL) experience. This will

be measured using scores on critical thinking rubric and concept inventories, responses in student and faculty assessment surveys, improved grades and pass rates.

Academic and sectoral partners are expected to play a key role in the success of the ACENPEE. The academic partners are distinguished scholars who are expected to provide academic leadership and mentoring to the Centre. They will help the Centre to remain focused on its mandate, providing advice and ensuring the Centre maintains academic excellence according to global standards. They will be engaged in teaching and research as visiting Professors and also support Centre efforts at international accreditation.

The sectoral partners are expected to support the Centre by providing technical expertise in addition to supporting the Centre financially. In addition, it is expected that the sectoral partners will accept internship placement in their institutions as well as support the Centre's professional short term courses by sponsoring their staff to participate.

1.0 INTRODUCTION

This Centre handbook is a complement to the University School of Post Graduate Studies Handbook and the Post Graduate Handbooks of Chemical, Civil, Mechanical as well as Water Resources and Environmental Engineering Departments of the Faculty of Engineering.

Students of the Centre will be registered in the various Engineering department listed above taking relevant Engineering courses required for the award of their Masters or Ph.D degrees. In addition, they will be required to undertake Certificate in Engineering Education (CEE) Courses to be mounted by the Centre in collaboration with the Faculty of Education through staff of the Centre and relevant resource persons from the Faculty of Education and Faculty of Engineering. This will enable them to acquire in addition to Engineering degree a Certificate in Engineering Education.

The M.Sc. and Ph.D programmes are generally by course work and research.

The following areas of specialization are available for the postgraduate studies in Chemical Engineering:

1. Petroleum and Gas Processing
2. Process Engineering
3. Polymer/Ceramic Engineering

The objective of this program is to provide advanced and specialized courses in the various options above. The trained engineers should be capable of adapting Chemical Engineering principles to solving local as well as regional problems and should have teaching and research competence and the motivation to train others providing innovation to evolving problems.

The following areas of specialization are available for M.Sc and Ph.D studies in Civil Engineering.:

1. Structural Engineering
2. Geotechnical/Geo-Environmental Engineering
3. Civil Engineering Construction Materials
4. Highway and Transportation Engineering

The trained civil engineer should be capable of adapting Civil Engineering principles to solving local as well as regional problems. They should also be able to train others and make academic and professional contributions in their area of specialization. The departmental postgraduate programme is geared towards the realization of these broad objectives.

The following areas of specialization are available for M.Sc and Ph.D studies in Mechanical Engineering:

1. Production Engineering
2. Energy Studies
3. Mechatronics Engineering (M.Sc Only)

The trained engineers should be capable of adapting Mechanical Engineering principles to solving problems and should be able to train others and make academic and professional contributions in their area of specialization. The departmental postgraduate programme is geared towards the realization of these broad objectives

The following areas of specialization are available for M.Sc and Ph.D studies in Water Resources and Environmental Engineering:

1. Environmental Engineering
2. Hydraulics and Engineering Hydrology

This program is designed to train high level manpower to man the Water Boards, River Basin Development Authorities, major water and environmental related infrastructural challenges, higher institutions of Learning, Research Centres etc. They should be able to adapt water resources and environmental engineering principles to solve local and regional challenges

2.0 PHILOSOPHY, VISION AND MISSION OF THE CENTRE

Philosophy

The philosophy of the Centre is to deploy the tools of technology, cognitive sciences, and educational psychology to create novel, effective and significant world-class engineering learning experience designs.

Vision

The vision of this Centre is to raise the quality of engineering teaching, learning and practice in the West African subcontinent through world-class research and training.

Mission

The mission of the Centre is to produce highly skilled human resources at the postgraduate level with knowledge and research competence in core engineering disciplines and engineering education,

3.0 CERTIFICATE IN ENGINEERING EDUCATION (CEE) PROGRAMME

Name of Programme/Certificate

Certificate in Engineering Education (CEE)

3.1 Introduction

Engineers who desire to become effective educators must accept the fact that basic knowledge of educational principles and learning theories including working knowledge of instructional technology and media are desirable. New pedagogies in Engineering Education such as the Cooperative, Hands-on, Active, Problem-solving Learning (CHAPL) are required to breakdown complex engineering concepts and skills to the level that students can easily comprehend. The mandate of the Africa Centre of Excellence on New Pedagogies in Engineering Education (ACENPEE) is to provide the platform for the acquisition of these knowledge and skills. The Certificate in Engineering Education (CEE) programme is primarily intended for Postgraduate Engineering students who desire to become engineering educators in the future and also for Faculty who want to improve their knowledge and teaching skills in course design and instruction.

3.2 Philosophy of the Programme

The philosophy of the Certificate in Engineering Education (CEE) programme is to produce Engineering Educators with a sound knowledge of educational principles and practices for effective teaching and learning that meet international standards.

3.3 Objectives of the Programme

The programme objectives are to:

- i. Understand and appreciate the History and Philosophy of Engineering Education
- ii. Acquire the basic knowledge of curriculum and course design.
- iii. Acquire knowledge and skills in the use of new pedagogies in engineering education.
- iv. Be able to use technology (soft and hardware) in teaching and learning.
- v. Interpret and apply theories of learning in engineering education.
- vi. Design, manage and ensure safety of engineering laboratories.
- vii. Develop research proposals in Engineering Education.

3.4 Admission Requirements

In addition to the general university requirements for admission to postgraduate programmes in Engineering, a candidate must

- a. Indicate an interest in Engineering Education
- b. Be in good academic standing at point of admission
- c. Be willing to integrate Engineering Education in his/her research work
- d. Be committed to the vision of making the Centre a centre of excellence

3.5 Course Structure

First Semester	Status	CU
ACEE 123456 Hist. and Phil. of Engineering Education	Core	3
ACEE 123457 Curr. and Course Design in Engineering	Core	3
Second Semester		
ACEE 123458 Instruct. Tech. and Media in Engr. Educ.	Core	3
ACEE 123459 Learning Theories in Engineering Education	Core	3
ACEE 123460 Micro Teaching Practice	Core	9

3.6 Course Description

i. History and Philosophy of Engineering Education

This course provides students background information on the history and philosophy of Engineering Education. The course aims at providing a historical background of engineering and providing insight into what it means to be an engineer, the principles, ideas and methods that underlie engineering. The course provides forum for discussing the philosophy of Engineering Education.

ii. Curriculum and Course Design in Engineering

This course provides students with insight into what curriculum is, its constituent components and its importance. It aims at helping Engineering students understand what

Engineering curriculum is and the constituents of engineering curriculum are and how to manage them for effective learning. The course introduces students to the structure of engineering curriculum, the content resources and methodologies needed for effective teaching of engineering at the undergraduate and graduate strategies for obtaining objective harmony outcomes in engineering. Thus the course shall be organized as follows

- a. General Concept of Curriculum
- b. Curriculum Trends in Engineering Education
- c. Structure of Engineering Curriculum
- d. Pedagogies in Engineering
- e. Teaching strategies in Engineering
- f. Learning resources in Engineering
- g. Assessing learning outcomes in Engineering

iii. Instructional Technology and Media in Engineering Education.

This course introduces students to existing and projected media/Technology used in facilitating learning in general but with particular reference to engineering. The course aims at helping students understand what instructional media is, the various forms of instructional media and how to apply them in an engineering classroom. Components of the courses, both theoretical and practical, will create opportunities for students to learn the art of improvising, simple instructional media and practical application of the instructional media in engineering environment. The content would include:

- a. Concept of instructional media and their forms
- b. History of instructional media in an engineering classroom
- c. Forms of instructional media for Engineering
- d. Improvising and developing Engineering instructional media
- e. Application of Instructional media in Engineering classrooms

iv. Learning Theories in Engineering Education.

This course introduces students to the world of psychology, particularly educational psychology with a view of helping them understand the relevance of psychology to engineering. The course introduces students to the theories of human development and learning as they relate to thinking in engineering. It also provides an insight into the

different psychological makeup of individuals and how they interact with people and their environment differently. This provides a window for understanding both how individuals interpret their environment and how best to schedule learning for engineering students.

- a. Foundation of Engineering Education
- b. Engineering and Society
- c. Laboratory design, management and safety in Engineering

v. Micro Teaching Practice

Micro teaching is to allow students put in practice what they have learnt by designing a course in Engineering and teaching it to a class. The class will make observations for possible improvement. The Teaching activity will be recorded for subsequent review by the student.

3.7 Staff Strength

S/No	Name	Qualification	Specialization	Rank
1.	Raymond B. Bako	PhD	Educational Philosophy	Professor
2.	Abdulkarim S. Ahmed	PhD	Engineering Education	Professor
3.	Fatai O. Anafi	PhD	Engineering Education	Professor
4.	Ayuba Guga	PhD	Curriculum & Instruction	Professor
5.	Binta Abdulkarim	PhD	Research Methods	Professor
6.	Elizabeth F. Adeniyi	PhD	Psychology of Learning	Professor
7.	Bernard Van Wie (WSU - Visiting)	PhD	Engineering Education	Professor
8.	Hazel Sive (MIT - Visiting)	PhD	Curriculum & Course Design	Professor
9.	Adrian O. Eberemu	PhD	Engineering Education	Reader
10.	Baba Abdul	PhD	Engineering Education	Senior Lecturer
11.	Suleiman A. Zubairu	PhD	Instructional Technology	Senior Lecturer

4.0 ADMISSION POLICY

To be considered for admission into the Centre various Engineering programs, the students must have the relevant Engineering first degree and Masters of Science in Chemical, Civil, Mechanical and water resources engineering for M.Sc and Ph.D programs, respectively. They must also meet the stipulated requirement of the university and various department. Candidates are also expected to have O' Level Credits passes in English language, Mathematics, Physics, Chemistry and any other science subjects in not more than two sittings from a recognized examining body.

Note: O' Level Credits in English language would be waived for regional students from non-English speaking countries, as they would be expected to undertake English certification program from the University Language Department.

Detailed admission requirement for the various department are listed below.

4.1 M.Sc. Chemical Engineering

Candidates must possess a minimum of

- a. Second class Honours degree in Chemical Engineering from a recognized Institution.
- b. Upper Credit Postgraduate Diploma in Chemical Engineering obtained from Ahmadu Bello University, Zaria.

4.1.1 Ph.D. Chemical Engineering

Candidates shall

- a. Possess a minimum of 4.0 Cumulative Grade Point Average on 5.0 scale or equivalent letter grade (B) in M.Sc Chemical Engineering course work from a reputable University
- b. Possess a Master's research thesis

4.2 M.Sc. Civil Engineering

To be eligible for admission into M.Sc. programme a candidate must possess:

- a. A minimum of Second Class Honours degree in civil engineering from a recognized University or equivalent Institution;
- b. Any other qualification, which together with relevant experience is deemed to be equivalent to (a) above by the department and approved by the Faculty Board and University Senate.

Where necessary candidates may be required to clear or make up for deficiency in previous training. Each case will be considered individually by the departmental postgraduate

committee, which will recommend the Civil Engineering courses or otherwise that must be taken by the candidate to clear the deficiencies.

4.2.1 Ph.D Civil Engineering

To be eligible for admission into Ph.D. Programme a candidate must possess:

- a. In addition to having obtained a Second Class Honours degree in Civil Engineering, an M.Sc. in Civil Engineering from a recognized University or equivalent Institution is required;
- b. Any other qualification, which together with relevant experience is deemed to be equivalent to (a) above by the department and approved by the Faculty Board and Senate.

4.3 M.Sc. Mechanical Engineering)

a. M.Sc. Production Engineering

At least a Second Class (Honours) Degree in Mechanical Engineering, production Engineering or any related degree of Ahmadu Bello University or of any other recognized university.

b. M.Sc Energy Studies

At least a Second Class (Honours) Degree in Mechanical Engineering or any related degree of Ahmadu Bello University, or of any other recognized University.

c. M.Sc. Mechatronics

Applicants should have a minimum of a second class lower (2:2) honors degree (B.Sc, B.Eng, B.Tech) in Mechatronics, Mechanical, Electrical or Computer Engineering disciplines from a recognized university or its equivalent. Other qualifications that are equivalent to an honors degree may also be acceptable that is Postgraduate Diploma in Mechanical, Electrical or Computer Engineering.

4.3.1 Ph.D Mechanical Engineering

Candidates applying for the PhD programme must hold a good Master degree or M. Phil which includes coursework with a research thesis component (not project report) in a relevant Engineering discipline from the Ahmadu Bello University or any other recognized institution. In Addition, prospective candidates must have obtained a CGPA of not less than 3.50 on a 5-point scale or 3.00 in a 4-point scale or an overall B grade.

A candidate whose first degree or Master degree is not in Mechanical Engineering may be required to take some courses to meet up with any deficiency observed from his/her transcript of academic records.

4.4 M.Sc Water Resources and Environmental Engineering

Candidates with the following qualifications may seek admission

- i. Holders of first degree in Water Resources and Environmental Engineering, Civil Engineering and Agricultural Engineering of Ahmadu Bello University or any other recognized University, with a first or second class honors degree may seek admission into the two available option.
- ii. Holders of first degree in Chemical Engineering and Mechanical Engineering of Ahmadu Bello University or any other recognized University, with first or second class honors degree may seek admission into the Environmental Engineering option.
- iii. Holders of equivalent qualifications from other University may be considered as in (i) and (ii) above.
- iv. Holders of any other qualification which, together with relevant experience, are deemed by the Faculty Board, Postgraduate School Board and Senate to be equivalent to (i) and (ii) above.

4.4.1 Ph.D (Water Resources and Environmental Engineering) Department

Candidates for Ph.D Water Resources and Environmental Engineering Programme must be holders of good Masters Degree (minimum of 3.5/5 grade or its equivalent), from reputable higher institutions both in Nigeria and from other countries with good and actualizable research proposal.

5.0 SELECTION CRITERIA

- i. Selection would be competitive and merit based
- ii. Candidates must ready for full time study.
- iii. Two favourable letters of recommendation, one of which must be from the candidate previous academic tutor
- iv. Thirty percent (30 %) of the admission quota will be reserved for female applicants when available.
- v. Thirty percent (30 %) of the admission quota will be reserved for Non Nigerians i.e regional students.

6.0 DURATION

The M.Sc. programs would run for a minimum of two (2) academic sessions before the student is eligible for examination. The first two semesters consist of formal lectures supported by laboratory work, drawing office practices, seminars and case studies, designs etc as appropriate for each program of study. The last two semester would be for the research component of M.Sc work before the student is eligible for examination on completion of the dissertation. Ph.D program will run for a minimum of three (3) academic sessions before the student is eligible for examination.

7.0 GRADUATION REQUIREMENT

The programme will be run using a combination of approaches namely, taught courses (lectures), laboratory exercise, field trips, Industrial attachment, seminars, assignments and independent research. The research component may run concurrently with the course work during the second semester of the course work particularly for the M.Sc. program.

Generally, for successful completion of the course work part of the program, each student is expected to

- Register for and pass all the taught courses
- Attain at least 75% attendance of lectures and laboratory practical works
- Obtain a minimum of 'C' grade in all courses
- Present seminars

7.1 Examination

For the purpose of evaluating the knowledge and skills acquired by the student during the program, the following will be used:

- ✓ Descriptive examination (essay and multi-choice questions)
- ✓ Case studies
- ✓ Seminar
- ✓ Practical reports
- ✓ Assignments

- ✓ Project works

Specific graduation requirement are detailed below for the various department:

7.2 M.Sc. Chemical Engineering

The course work will normally last for a duration of two semesters. A minimum of “C” grade is required in each of the prescribed courses to graduate. The minimum requirement for M.Sc. course work is 30 credit units.

In addition, a student must successfully defend his/her thesis or dissertation before a panel of both Internal and External Examiners. This amounts to 16 Credit Units. Seminar carries 2 Credit Units in addition.

Course Structure

List of Core Courses

S/N	Course Code	Course Title	Credit Unit
1	CHEN 801	Advanced Transport Phenomena	3
2	CHEN 802	Advanced Unit Operations	3
3	CHEN 803	Advanced Thermodynamics	3
4	CHEN 804	Advanced Chemical Reaction Engineering	3
5	CHEN 805	Computational Techniques for Chemical Engineers	3
6	CHEN 806	Process Modelling and Optimization	3
7	CHEN 890-899	Research/Thesis (2Cu/Semester)	
8	CHEN 880-899	Seminar (1Cu/Semster)	

List of Elective Courses

S/N	Course Code	Course Title	Credit Unit
1	CHEN 807	Petroleum Refining	3
2	CHEN 808	Petrochemical Processing	3
3	CHEN 809	Gas and Gas Condensate Processing	3
4	CHEN 810	Heat Pump Technology	3
5	CHEN 811	Environment and Sustainable Engineering	3
6	CHEN 812	Less Common Separation Processes	3
7	CHEN 813	Advanced Biochemical Engineering	3
8	CHEN 814	Polymerization processes	3
9	CHEN 815	Unit Operation in Polymer	3
10	CHEN 816	Polymer Properties and Application	3
11	CHEN 817	Ceramic Materials	3
12	CHEN 818	Refractories	3
13	CHEN 819	Corrosion Technology	3
14	CHEN 820	Biofuels Technology	3
15	CHEN 870	Special Design Problems	3

Course Content

CHEN 801 Advanced Transport Phenomena (3 Credits)

Molecular transport and conservation equations; Analysis and approximation solutions of equations of change; Simultaneous heat and mass transfer and analysis of multicomponent molecular transport; Turbulence models and boundary layer approximations for turbulent flow. Other solution methods for turbulent flows and computational fluid dynamics (CFD).

CHEN 802 Advanced Unit Operations (3 Credits)

Distillation: plate columns, flooding prediction pressure drop, entrainment point efficiency, models for predicting Murphree plate efficiency, completely mixed flow, plug flow and plug flow with Eddy diffusion. Measurement of dispersion parameters. Liquid-liquid extraction: calculation of column diameter and dispersed phase hold-up for packed column; pulsed packed columns, pulsed plate columns, rotating discs column, Flow models.

CHEN 803 Advanced Thermodynamics (3 Credits)

Review of thermodynamics of simple systems: Definitions, concepts and terms, PVT behaviour and equations of state, laws of thermodynamics, thermodynamic relations for gases and liquids; Thermodynamics of multicomponent systems: criteria for equilibrium and stability, phase equilibria at low and high pressure, chemical reaction equilibria of simple and multiple reactions; Analysis of process: energy and exergy analysis, pinch technology; Statistical thermodynamics.

CHEN 804 Advanced Chemical Reaction Engineering (3 Credits)

Review of chemical reaction kinetics of simple systems (elementary and non-elementary reactions); Kinetic modeling of complex systems based on specific mechanistic postulates (Langmuir, Michelis-Menten, Briggs-Haldane, Free Radical, Carbenium ions, Carbonium ions etc.); Kinetics and reactor design for fluid-particle reaction systems (catalytic and non-catalytic reactions); Catalysts development (science and technology); Catalyst deactivation and regeneration.

CHEN 805 Computational Techniques for Chemical Engineers (3 Credits)

Normalization of equations. Solution of systems of linear algebraic equations: Gaussian elimination; tridiagonal and banded systems; LU factorization. Solution techniques for non-linear algebraic equations. Solution techniques for non-linear ordinary differential equations:

interpolation and quadrature; explicit integration methods; implicit integration methods; predictor-corrector methods and Runge-Kutta methods. Solution techniques for non-linear partial differential equations: finite difference; orthogonal collocation; orthogonal collocation on finite element. Computer packages (such as MATLAB, MATHEMATICA, MATHCAD, POLYMATH, etc) would be used to demonstrate application of the various numerical techniques.

CHEN 806 Process Modelling and Optimization (3 Credits)

Review of modeling of chemical engineering systems: uses of mathematical models, principles of formulation, continuity equations, energy equations, equations of motions, transport equations, equations of state, chemical kinetics, equilibrium. Models of chemical engineering systems: series of isothermal constant holdup CSTRs, two heated tanks, gas phase pressurized CSTR, Non Isothermal CSTRs, multicomponent flash drum, reactor with mass transfer, ideal binary distillation column, batch distillation column, multicomponent non ideal distillation, Objective function: economic objective function, influence of time. Optimization methods: analytical and numerical methods, Type II constraints, global, local and constrained elimination of type II constraints, multidimensional objective functions, dynamic programming, selection of optimization methods.

CHEN807 Petroleum Refining (3 Credits)

Structure of petroleum industry. Origin and Production. Petroleum transport and distribution. Crude oil sorting, gathering and stabilization. Petroleum Products – their properties and importance. Crude oil de-salting and de-watering processes. Primary and secondary refining processes: Primary and secondary crude oil distillation, Thermal and catalytic cracking; Thermal and catalytic reforming; alkylation, polymerization; hydrocracking, hydrodesulfurization, extraction: Blending of petroleum products – gasoline, lubes. Lubricating oil production processes. Classification, properties and uses of lubes. Lubes treatment processes – hydrofining, de-waxing, de-asphelted. Lubes additives. Asphalt production – Asphalt blowing, General refinery structure and directions Environmental consideration in the refinery. There should be at least one visit to a refinery.

CHEN808 Petrochemical Processing (3 Credits)

Overview of Petrochemical Industry. Overview of Hydrocarbon classes and their importance in petro-chemical synthesis. Petrochemical feedstocks from refinery processes: Synthesis gas, olefins and Benzene – Toluene-Xylene (BTX), Oxidation and Halogenation processes.

Petrochemical Products and their areas of application Structure and types of petrochemical. Alkylation. At least one visit to a Petrochemical plant.

CHEN 809 Gas and Gas Condensate Processing (3 Credits)

Overview of gas Industry. Introduction: Origin and production of gas and gas condensate. Transport storage and distribution of gas. Gas processing equipment. Classification and properties of natural gas, liquefaction and transportation of LNG. (At least one visit to a gas processing plant). Understanding various natural gas processing.

CHEN 810 Heat Pump Technology (3 Credits)

Thermodynamic basis of heat pumps, Heat pump cycles, Power cycles, Drives for heat pump systems, Heat pump working fluids, Applications of heat pump systems: energy recovery/recycling and economic and social implications, Thermodynamic analysis of heat pump systems.

CHEN 811 Environment And Sustainable Engineering (3 Credits)

Sustainable development (conventions/protocols and legal frame works), environmental management systems, EIA (environmental imaging, analysis, etc), Environmental pollution and control – safe and sustainable technologies, energy sources and energy utilization technologies, environmental pollution remediations. – air, water, land. Health and Safety Issues, industrial hazard analysis, industrial health and hygiene.

CHEN 812 Less Common Separation Processes (3 Credits)

Thermal separation, gel permeation chromatography (GPC), Electrophoresis, Adsorption methods, Ion Exchange; Membrane Separation, Ultrafiltration and Reverse Osmosis.

CHEN 813 Advanced Biochemical Engineering (3 Credits)

Enzyme kinetics and regulation of cellular activities, Modelling of biological systems; Heat and mass transfer in biochemical reactors; Unit operations in Food and biochemical industries. Preservation of biological materials, Fermenters: types, design and scale-up. Hazards in biochemical industries. Application of biochemical engineering in some local industries.

CHEN 814 Polymerization Processes (3 Credits)

Addition and condensation polymerization: mechanism, kinetics and molecular weight control Copolymers: copolymerization-mechanism and kinetics. Modification of polymers: alloying, blending, composites, post-polymerization reactions. Industrial polymerization methods. Reactor choice and design.

CHEN 815 Unit Operations In Polymer (3 Credits)

Polymer fluid dynamics: Compounding ingredients and additives: Extrusion, Blow molding, injection and reaction injection molding, compression and transfer holding; calendaring.

CHEN 816 Polymer Properties & Application (3 Credits)

Polymer Solution: Criteria for polymer solubility, conformations of dissolved polymers, thermodynamics of polymer solutions, fractionation of polymers. Polymer melt rheology: definitions, simple rheological models, viscous flow. Solid state properties of polymers: mechanical, electrical, optical. Applications of selected polymers.

CHEN817 Ceramic Materials (3 Credits)

Review (Distinction between ceramics and other materials): History and current size of the ceramic industry; the Nigerian ceramic industry; Atomic and crystal structure of ceramics; survey of ceramic products electronic and technical ceramics, synthetic crystals and gemstones, whitewares and nuclear ceramics) – Industrial processing, raw materials, properties and applications; Temperature measurement; Plant trips to local ceramic industries, flow sheet of processes; Production of simple ceramic porcelains.

CHEN 818 Refractories (3 Credits)

Applications and classification of refractories; Properties of refractory materials; Fireclay refractories: Clay raw materials (classification and geology, structure of clay minerals, plasticity, effect of heat on clays and methods used for their identification, Nigerian clays), Production of fireclay refractories; Raw materials and production of other refractories: High alumina, silica, magnesite, dolomite and carbon refractories, Pure oxide refractories Lightweight insulating refractories, Refractory mortars, plastics and castables (cements, preparation, refractory mortars plastic and castables (cements, preparation, properties and applications).

CHEN 819 Corrosion Technology (3 Credits)

Metallic corrosion (Corrosion caused by electric currents, atmospheric corrosion, differential metal corrosion, differential aeration corrosion), Effect of atmospheric pollution on corrosion. Influence of pH upon degree of corrosion. Aerobic corrosion. Corrosion of boiler plant (Caustic cracking, corrosion caused by dissolved oxygen and carbon dioxide, steam blanket corrosion, dezincification of condense tubes). Corrosion of non-ferrous metal (Aluminum, Copper, Lead and

Zinc); Corrosion prevention by protective coatings (passive films metallic coatings, coatings such as vitreous enameling and rubber linings, paints and varnishes).

CHEN 820 Biofuels Technology (3 Credits)

Introduction: Renewable energy sources and their importance. Overview of Nigerian energy sources. Biofuels and Global politics. Biofuels (Bioethanol, Biodiesel and Biogas) raw materials, Production technologies. Properties and their comparison with gasoline, petrodiesel and natural gas. Biofuels and Food issues. Global and local production of Biofuels raw materials.

CHEN 899 Special Design Problems

Design problems in different areas of chemical and process industries will be given to students to solve.

7.2.1 Ph.D Chemical Engineering

The programme is by course work and research. In addition, candidate admitted into the programme who are adjudged, by the department to be deficient in the area of his/her research interest will be required to take additional stipulated course at the master’s level to remedy the deficiencies.

The course work to be taken are three (3) core courses and one elective course depending on the area of research specialization.

Course Structure

List of Core Courses

S/N	Course Code	Course Title	Credit Unit
1	CHEN 901	Thermodynamics of Complex Processes	3
2	CHEN 902	Turbulence Modelling	3
3	CHEN 903	Advanced Reactor Analysis	3
4	CHEN 991-999	Ph.D. Dissertation	(3Cu/Semester)
5	CHEN 981-989	Seminar	(1Cu/Semester)

List of Elective Courses

S/N	Course Code	Course Title	Credit Unit
1	CHEN 904	Adsorption	3
2	CHEN 906	Advanced Petroleum and Gas Dispersion System	3
3	CHEN 908	Structure, Properties and Performance Relationship in Materials	3
4	CHEN 910	Design and Selection of Materials	3

Course Content

CHEN901 Thermodynamics of Complex Processes (3 Credits)

Molecular and statistical thermodynamics of multicomponent systems. Energy conversion processes; Non-equilibrium thermodynamics.

CHEN902 Turbulent Transport (3 Credits)

Introduction to turbulence. The equations of motion. Scaling laws for mixing layers, jets and wakes. Description of turbulent shear flows. Turbulence modeling: constant eddy viscosity, mixing length, k-epsilon models. Reynolds stresses models. Application using CFD packages.

CHEN903 Advanced Reactor Analysis (3 Credits)

Fixed Bed Reactor: continuity equations, reactor parameters, significance of dimensionless parameters, chemical dimensionless parameters, physical dimensionless parameters, radial Peclet Number for Heat and mass transfer, Biot number (local and overall), and adiabatic fixed bed; Fluidized Bed Reactor systems: Reactor Modelling (Davidson-Harrison model, Kunii-levenspiel model), anatomy of the overall rate coefficient, olson's fluid- bed reactor analysis, and yield in fluidized – bed reactor; Slurry Reactors: global reactions in a slurry, coefficient and area correlations, analysis of first order slurry reaction systems, and selectivity in slurry reactors; Trickle Bed Reactor: trickle bed kinetic model, verification of the model, trickle-bed scale up, mass transfer in trickle bed.

Ph.D Elective Courses

CHEN 904: Adsorption (3 Credits)

Adsorptive separation processes, structure and physical properties of adsorbents. Classical and statistical thermodynamic equilibrium models for pure and multicomponent sorption. Study of individual and combined kinetic resistances in sorption on single adsorbent particles. Classification of adsorption column dynamic systems. Models for isothermal, non-isothermal, single and multicomponent, linear and non-linear sorption in columns. Asymptotic behavior in columns. Discussion of adsorptive separation processes involving kinetic and equilibrium selectivity, cyclic two bed processes optimization, and continuous counter-current both moving and simulated moving bed type.

CHEN906 Advanced Petroleum and Gas Dispersion System (3 Credits)

Classification of Petroleum Dispersion Systems. Chemical composition of petroleum and its systems. Modern Perspective on the structure of Petroleum and gas systems. Chemico-Colloidal properties of petroleum and gas dispersion system. Phase transition during evaporation and condensation. Principle of extreme conditions of petroleum systems. Irreversible phase transition

of petroleum systems. Effect of petroleum and gas dispersion systems on crude oil production, transportation preparation, processing and utilization of products. Environmental consideration.

CHEN908 Structure, Properties and Performance Relationship in Materials (3 Credits)

Structure of material (electronic, atomic, molecular, crystal), micro-structural control methods, properties of materials (ceramics, metals, polymers, composites), Relationship between structure and mechanical, thermal, dielectric, magnetic properties. Specific applications in engineering.

CHEN910 Design and Selection of Materials (3 Credits)

Design and control of properties of materials, surface properties, Fracture in solids, Biocompatibility of materials, computer simulation of materials, emerging materials and new applications.

7.3 M.Sc. Civil Engineering

For graduation, a registered student must complete all PG and Departmental requirements. In addition, the student must satisfy the following:

- a. Satisfactory completion of coursework requirements with a minimum of C grade;
- b. Presentation of a seminars which covers the research proposal and two (2) progress seminar
- c. Completion of Dissertation and Project, meeting the requirements of internal and external examiners as well as to the PG Board and Senate;

The minimum credit units requirement for an M.Sc. (Civil) Engineering degree is 34 credit units for coursework and 16 credits units for dissertation and projects, depending on the area of specialization.

For any of the options selected:

- a. A student must score a minimum of 50% in all courses taken towards the degree;
- b. Each student will be expected to pass all the core courses and a specified minimum number of elective courses depending on the specialization.

In order to complete the programme requirements a student must accumulate a minimum of 34 to 41 credit units (depending on the specialization) from the courses and submit a satisfactory Dissertation. Electives should be selected after proper guidance from the departmental coordinator of postgraduate studies.

The core courses (for all areas of specialization) for First Semester are:

Course Structure

First Semester

Course Code	Title	Credit Unit
CVEN 801	Bituminous Materials	3
CVEN 803	Numerical Methods and Statistical Analysis	4
CVEN 805	Advanced Soil Mechanics	3
CVEN 807	Cement & Concrete Technology	3
CVEN 809	Timber Technology	3

The core specialization courses for Second Semester are:

Highway and Transportation Engineering Option

Course Code	Title	Credit Unit
CVEN 810	Advanced Transportation Planning	3
CVEN 812	Highway Materials & Pavement Design	3
CVEN 814	Advanced Traffic Engineering	3
CVEN 816	Airport Design	3
CVEN 818	Geometric and Earth Design	3
CVEN 852	Road Management	3
WREN 804	Dams Design and Reservoir Operations	3
CVEN 882	Proposal Seminar	1
CVEN 892	Research/Dissertation	3

Structural Engineering Option

Course Code	Title	Credit Unit
CVEN 820	Advanced Structural Analysis	3
CVEN 822	Advanced Reinforced Concrete Structures	3
CVEN 824	Prestressed Concrete Structures	3
CVEN 826	Theory of Plates and Shells	3
CVEN 828	Advanced Metal Structures	3
WREN 804	Dams Design and Reservoir Operations	3

CVEN 882	Proposal Seminar	1
CVEN 892	Research/Dissertation	3

Geotechnical/Geo-Environmental Engineering Option

Course Code	Title	Credit Unit
CVEN 830	Advanced Foundation Engineering	3
CVEN 832	Earth pressure on Retaining Structures/Earth Structures (Slope Stability)	3
CVEN 834	Rock Mechanics	3
CVEN 836	Environmental Geotechnics	2
CVEN 838	Lateritic Soils and Other Problem Soils of Africa (Expansible and Collapsible Soils)	3
CVEN 854	Waste Containment Facilities	3
WREN 804	Dams Design and Reservoir Operations	3
CVEN 882	Proposal Seminar	1
CVEN 892	Research/Dissertation	3

Civil Engineering Construction Materials Option

Cours Code	Title	Credit Unit
CVEN 840	Instrumentation and Testing Methods	3
CVEN 842	Advanced Construction Materials and their Applications	3
CVEN 844	Failure Theories	3
CVEN 846	Fibers and Composite Materials	3
CVEN 848	Masonry and Precast Structures	3
WREN 804	Dams Design and Reservoir Operations	3
CVEN 882	Proposal Seminar	1
CVEN 892	Research/Dissertation	3

Second Year (For all options);

First semester

Course Code	Title	Credit Unit
CVEN 883	Progress Seminar I	1
CVEN 895	Research/Dissertation	2

Second Semester

Course Code	Title	Credit Unit
CVEN 884	Progress Seminar II	1
CVEN 898	Research/ Dissertation	2

Course Content

CVEN 801: Bituminous Materials (3 Credit Units)

Types of business materials properties and sources consistency tests and their interpretation. Use of bitumen. Functions of waterproof road surfaces. Rolled asphalt-hot and cold processes. Asphaltic concrete. Mix design methods. Sampling and analysis of bituminous and road mixtures. Applications to surface dressing of roads. Other road making materials: Properties and services. Influence of consistency characteristics on formation and propagation of cracks in the pavements section. Standards and specifications.

CVEN 803: Numerical Methods and Statistical Analysis (4 Credit Units)

Matrix methods, finite difference methods, finite element methods and applications. Distributions and their processes, decision theory estimations and hypothesis testing. Empirical determination of distributions. Regression analysis and analysis of variance.

CVEN 805: Advance Soil Mechanics (3 Credit Units)

Engineering properties of soils and aggregates. Selection of engineering parameters for design purposes. Classification of soils and materials used in pavement construction. Mineralogical study of clay. Effective stress and geologic history in relation to: compressibility,

consolidation, permeability, pore-pressure changes, shear Influence of in-situ stresses and sampling on soil behavior: settlement estimates. Soil stabilization and machinery for stabilization. Slope stability.

CVEN 807: Cement and Concrete Technology (3 Credit Units)

Review of cement – types, properties and use. Properties of constituent materials, standards specifications, testing and evaluations. Concrete mix design. Concrete production, handling and compaction and special concretes hot weather concreting, testing of fresh concrete hardened concrete, tests on concrete structural members. Use of statistical methods in concrete mix design and evaluation of strengths. Newly developed technologies relating to concrete and use of polymeric materials.

CVEN 809: Timber Technology (3 Credit Units)

Preservation and seasoning, adhesives, fasteners, finishes and coatings. Properties of wood and structural usage. Design of joints and components in wood and wood products, e.g. beams columns, wall trusses, etc. Protection against fire and biological agents. Prototype testing and wood jointing. Utilization marketing and quality control. Timber in roofing systems. Testing of timber pieces and structures.

WREN 804: Dams Design and Reservoir Operations (3 Credit Units)

Types of dams: Gravity dams, Slab and buttress dams, Embankment dams, arched concrete dams, Investigation of dam sites. Gravity dams: Requirements for stability of gravity dams, general procedure for the design of gravity dams. Earth and rock fill dams: General principles of design, seepage position of the seepage line, the flow new seepage line in earth dams of composite cross-section, effect of drainage on line of seepage, foundations types and treatments, typical design of embankment dams and method of construction.

Spillways, gates and outlet works, over flow spillway (Ogee spillway), chute spillway, side channel spillways, siphon spillway, shat spillway, spillway crest gates radial gates, rolling gates, drum gates, high pressure outlets, gates and valves, needless valves protection against scour below dams, basins and energy dissipaters, hydraulic model studies, Fishways at dams. Hydropower plants: Types of plants, penstocks, tunnels and water turbines. Reservoir Operation: Reservoir, physical characteristic, capacity, sedimentation, reservoir capacity for a given yield, selection of site for a river reservoir, wind set up and waves in reservoirs, flood routing through reservoir, flood mitigation. Direct supply reservoirs, regulating reservoirs.

Pumped storage reservoirs, conjunctive use schemes, control rules, simulation. Evaluation criteria for comparing alternatives, seasonal effects and correlation.

CVEN 810: Transportation Systems Planning (3 Credit Units)

Transportation system characteristic. Transportation survey analysis and planning. Topics include trip generation and attraction. Growth factor methods and gravity models. Application of linear programming. The aims and scope of environmental planning. The influence of planning theories on urban form. Factors affecting the use of ions. New towns and current planning theories and trends.

CVEN 812: Highway Materials Pavement Design and Maintenance (3 Credit Units)

Soils and materials used in pavement construction. Theory of stresses and deformation in layered systems. Review of soil survey. Design methods of flexible and rigid pavements. Bituminous materials. Types of bituminous surfacing and their performance. Machinery for bituminous pavement. Types of rigid pavement and their performance. Machinery for rigid pavements. Soil stabilization. Machinery for Soil Stabilization. Low cost pavements. Highway Maintenance.

CVEN 814: Advance Traffic Engineering (3 Credit Units)

Highway Traffic Characteristic. Volume and speed surveys. Traffic Signals and Signs traffic operations and control. Traffic Channelization. Traffic accidents analysis. Characteristics of public transport systems.

CVEN 816: Airport Design (3 Credit Units)

Contemporary development of air transport. Air transport characteristics. Contemporary air plane stock characteristics. Fundamental notions and terms. International classification of airports by ICAO. Factors affecting airport location. Airfields and their elements. Geometric design of runways, taxiways and aprons. Typical schemes of runways layout. Principles of air terminals design. Air traffic operations and control. Earthworks design and calculation methods. Principles of rigid and flexible airfield pavements design. Soil stabilized runways. Maintenance of runways. Drainage of airfields. Heliports.

CVEN 818: Geometric and Earthwork Design (3 Credit Units)

Machinery for earthworks performance. Site investigation (and soil class applied to highway construction) Economic aspects of earthworks design. Suitability of soil for fill, earthworks specifications. Mass haul diagram. Control of compaction. Effect of weather and drainage

during construction. Design of cutting and embankment slopes. Reinforced earth construction. Erosion control, drainage, greasing problems of partial saturation. Collapsing soils, expansive clays, construction of embankment over soft ground. (Surcharging stage construction, use of facies and mats). Rock excavation, drilling and blasting techniques. Catchment area run off, Culvert design. Subsoil and sub-grades drainage.

CVEN 820: Advanced Structural Analysis (3 Credit Units)

Review and generalized extension methods for computing displacements of framed structures. Review and generalized extension of methods for analysis of indeterminate framed structures. The elastic stability of structures.

CVEN 822: Advanced Reinforced Concrete Structures (3 Credit Units)

Review of design silos, tanks, shells, tall buildings, large panel precast building etc. Design of members under torsion and biaxial bending of beams and columns.

CVEN 824: Pre-stressed Concrete Structures (3 Credit Units)

Limit state design of beams (simply supported and continuous). Analysis and design of pre-stressed statistically indeterminate frames. Constructional details of pre-stressing systems.

CVEN 826: Theory of Plates and Shells (3 Credit Units)

Analysis of stress and deformation state of plates bent by transverse loads. Energy and approximate methods of solution. Plates on elastic foundation. Anisotropic plates. Membrane theory of shells. Bending theory of shells. General theory of cylindrical shells. Symmetrical bending of shells of revolution. Plates and shells structures.

CVEN 828: Advanced Metal Structures (3 Credit Units)

Design of steel industrial buildings. Design of steel bridges. Limit analysis of steel structures. Aluminum structures.

CVEN 830: Advanced Foundation Engineering (3 Credit Units)

Analysis, design and construction of foundations for buildings, bridges and other structures including excavation, footings, piling, caissons, retaining walls, sheet pile bulk heads, tunnels, fills, embankments, earth-fill and rocks dams including seepage dewatering and grouting. Field measurements and control. Foundations subjected to dynamic forces.

CVEN 832: Earth Pressure/Retaining Structures /Earth Structures (Slope Stability) (3 Credit Units)

Earth pressures measurement and prediction. Choice, design and construction of retaining structures. Earth pressure considered as a problem of shear resistance, review of theories and measurements. Influence of geologic factors and ground water pressure, changes of pressure with time and deformation. Sheeted excavations, retaining walls, cellular coffer dams, silos, tunnels, the initial and long-term stability of strutted excavations. Review of choice and type of dam. Design construction and control of dams, embankments and slopes. Principles of dam design, explorations, construction and materials, foundation treatment, stability analysis, deformation, prediction, groundwater control, construction procedure. Field equipment and field instrumentation.

CVEN 834: Rock Mechanics (3 Credit Units)

Rock as a material; elasticity and strength of rock; linear elasticity and laboratory test of rocks. The effects of size and stress gradient on strength. Fluid pressure and flow in rocks. Crack phenomena and the mechanisms of fracture. The state of stress underground: underground measurements, geological applications, mining and other engineering.

CVEN 836: Environmental Geotechnics (2 Credit Units)

Introduction; Environmental Site Characterization, Geophysical techniques for subsurface site characterization, Soil exploration at contaminated sites, Remediation, Strategies for remediation, Remediation treatment technologies (landfilling [excavation and hauling] into landfill; stabilization/solidification, electro-kinetic treatment, soil washing/flushing, vitrification, phytoremediation, bioremediation). Treat the various methods. Role of geotechnical engineers in remediation processes. Waste containment facilities, Beneficial reuse of agro/industrial waste products.

CVEN 838: Lateritic Soils and Other Problem Soils of Africa (Expansive and Collapsible Soils) (3 Credit Units)

Laterites: Pedogenesis, morphology, physico-chemical and composition, strength, bearing capacity, durability, weathering, compressibility and stabilization of laterites. Expansive soils: Properties of tropical black clays (black cotton soils). Collapsible soils: location, formation and engineering characteristics.

CVEN 806: Waste Containment (3 Credit Units)

Waste generation and disposal, waste characterization, Liners, compacted soil liners, geomembrane/geosynthetics liners, Covers, Vertical walls, Slurry walls, Design criteria for liners and Covers, Hydraulic conductivity, shear strength, Desiccation, Chemical compatibility/ waste soil interaction that alter hydraulic flow, liner and leachate collection systems, capillary barrier covers, Soil Water content – Density Criteria for landfill hydraulic barrier, Stability and settlement of landfills. Operation, performance, monitoring, closure plans, long-term impacts and monitoring of landfills. Mine wastes disposal (tailings dams). Unsaturated flow properties of soil and its estimation, Soil - water characteristics curves.

CVEN 840: Instrumentation and Testing Methods (3 Credit Unit)

Strain and stress measurement types of gauges and criteria for selection of gauge type. Chemical tests for salinity in water and determination of salt contamination in aggregates. Various Non-Destructive Tests (NDT) and partially destructive tests for assessment of strength and quality of in-situ concrete; in-situ load testing; recent advances in NDT; condition assessment with case studies; durability characteristics and chemical tests on concrete structures. Types of concrete repair, repair strategy, compatibility and selection of repair materials, patch repair, corrosion repair and crack repair.

CVEN 842: Advanced Construction Materials and their Applications (3 Credit Units)

Introduction to the internal structure of construction materials. Fundamental construction materials. Fundamental groups of construction materials. Deterioration of building materials and causal factors. Acoustic in construction materials. Brick and tiles mortars, gypsum and plaster, glass, polymer materials in construction. Adhesives and surface finishes.

CVEN 844: Failure Theories (2 Credit Units)

Partial and complete failure. Failure criteria for one to five parameters models, classical theories of failure based on the maximum of normal stress, strain and shear stress. Constitutive equations and finite element analysis. Linear-elastic brittle-fracture and non-linear elastic fracture models. Limit analysis for perfectly plastic material. Flexural and shear failures.

CVEN 846: Fibers and Composite Materials (4 Credit Units)

Definition and function of fibers. Properties and mix design, fiber handling admixing applications, resin concrete and polymer concrete, physical and mechanical properties, applications in construction industry, concrete reinforced with fibers, building material.

Composite structural elements – precast and cast-in-situ concrete, variety of applications in building constructions and design of the elements. Reinforced fiber composite materials.

CVEN 848: Masonry and Precast Structures (3 Credit Units)

Masonry units and their applications, materials of masonry construction, columns, walls under gravity and transverse loads, shear walls, retaining walls, general design and construction considerations, anchorage to masonry, design aids and tables. Precast frame analysis, precast floor slabs, precast concrete beams, columns and shear walls, floor diaphragms, joints and connections, beam and column connections, ties in precast concrete structures.

7.3.1 Ph.D Civil Engineering

The programme is by course work and research. In addition, candidate admitted into the programme who are adjudged, by the department to be deficient in the area of his/her research interest will be required to take additional stipulated course at the master’s level to remedy the deficiencies.

The course work to be taken in the first semester is common to all the areas of specialization (Options) but vary from the second semester as detailed below:

Coursework and Research/Seminar/Thesis for Ph.D.

First Year:

First Semester

Course Code	Title	Credit Unit
CVEN 901	Research methodology	3
CVEN 903	Advanced statistical methods	3
CVEN 905	Optimization Techniques	3
CVEN 991	Research/Thesis	3

Second Semester

Course Code	Title	Credit Unit
CVEN 992	Research/ Thesis	3

Second Semester Coursework (For Structural Engineering Option)

Course Code	Title	Credit Unit
CVEN 920	Finite Element Method	3
CVEN 922	Structural Reliability	3

Second Semester Coursework (For Geotechnical/Geo-environmental Engineering Option)

Course Code	Title	Credit Unit
CVEN 930	Environmental Geotechnics	3
CVEN 932	Special Topics in Geotechnical/Geo-environmental Engineering	3
CVEN 934	Waste Containment Facilities	3
CVEN 936	Contaminant Transport	3

Second Semester Coursework (For Civil Engineering Construction Materials Option)

Course Code	Title	Credit Unit
CVEN 941	Advanced topics in concrete and composite materials	3

Second Year:

First Semester

Course Code	Title	Credit Unit
CVEN 981	Proposal Seminar	1
CVEN 993	Research/Thesis	3

Second Semester

Course Code	Title	Credit Unit
CVEN 982	Proposal Seminar I	1
CVEN 994	Research/ Thesis	3

Third Year:

First Semester:

Course Code	Title	Credit Unit
CVEN 983	Progress Seminar II	1
CVEN 995	Research/Thesis	3

Second Semester

Course Code	Title	Credit Unit
CVEN 984	Progress Seminar III	1
CVEN 996	Research/ Thesis	3

Course Content

CVEN 901: Research Methodology (3 Credit Units)

Introduction to research, the role of research and research process overview. Philosophy and the language of research theory building- signs and its functions, what is theory and what is the meaning of methodology. Thinking like a researcher- understanding concepts, constructs, variables and definitions. Problems and hypotheses- defining the research problem, formulation of the research hypothesis, the importance of problems and hypothesis. Research design; experimental and non-experimental research design, field research and survey research. Methods of data collection- secondary data collections, qualitative method of data collection and survey methods of data collection. Attitude measurement and scaling- types of measurement scales, questionnaire designing- reliability and validity. Sampling techniques- the nature of sampling, probability sampling design, non-probability sampling design, determination of sample size. Processing and analysis of data. Ethical issues in conducting research. Report generation, report writing and APA format- title page, abstract, introduction, methodology, results, discussion, references and appendices.

CVEN 903: Advanced Statistical Methods (3 Credit Units)

Data analysis using descriptive statistics. Advanced statistical concepts; p-value significance level, power analysis, hypothesis etc. Application of classical multiple linear regression. Further advanced statistical methods; ANOVA, cluster analysis, factor analysis etc.

CVEN 920: Finite Element Method (3 Credit Units)

Theory and applications of the finite element method; General procedure for solving a structural problem using FEM; Variational Methods; Weighted Residual (WR) Methods; Review of one-dimensional elements; Techniques for constructing element stiffness matrices; Various two- and three-dimensional solid elements; Isoparametric formulation; Plates and shells elements; Stress recovery and post processing; Error, convergence; Solving linear system of equations.

CVEN 922: Structural Reliability (3 Credit Units)

Fundamentals in probability theory; Reliability assessment and uncertainties; Solution methods for the generalised reliability problem; Reliability of structural systems; Time dependent reliability; Modelling of actions and action effects; Resistance modelling; Calibration of safety factors using reliability analysis methods; Evaluation of existing structures.

CVEN 930: Environmental Geotechnics (3 Credit Units)

Introduction; Environmental site characterization, Geophysical techniques for subsurface site characterization, Soil exploration at contaminated sites, Remediation, Strategies for remediation, Remediation treatment technologies (landfilling [excavation and hauling] into landfill; stabilization / solidification, electro-kinetic treatment, soil washing/flushing, vitrification, phytoremediation, bioremediation). Treat the various methods. Waste containment facilities, Beneficial reuse of agro - industrial waste products.

CVEN 932: Special Topics in Geotechnical / Geo-Environmental Engineering (3 Credit Units)

Geotechnical Uncertainty, risk and Reliability, Soil improvement, Biogeochemical processes for improvement of soil engineering properties, Microbial Induced Calcite Precipitation, Bio-mediated Soil improvement, Geosynthetics, Geo-Environmental Testing. Ground improvement state of the art review, Geopolymers, Energy Geo-Technology.

CVEN 934: Waste Containment Facilities (3 Credit Units)

Waste generation and disposal, waste characterization, Liners, compacted soil liners, geomembrane/geosynthetics liners, Covers, Vertical walls, Slurry walls, Design criteria for liners and Covers, Hydraulic conductivity, shear strength, Desiccation, Chemical

compatibility/ waste soil interaction that alter hydraulic flow, liner and leachate collection systems, capillary barrier covers, Soil - water content – density criteria for landfill hydraulic barrier, Stability and settlement of landfills. Operation, performance, monitoring, closure plans, long-term impacts and monitoring of landfills. Mine wastes disposal (tailings dams), Unsaturated flow properties of soil and its estimation, Soil -water characteristics curves.

CVEN 936: Contaminant Transport (3 Credit Units)

Introduction, Transport processes, Advection, Dispersion, Diffusion, etc. Coupled flow dispersion equation, Transport of reactive (adsorbing) organic compounds, Transport of radioactive chemical species. Diffusion, Diffusion in free solution, Diffusion in Soil, Effective Diffusion coefficient, Transient Diffusion (Reactive and Non-Reactive Solutes) Adsorption Isotherm, Batch Equilibrium studies, Colum tests for geo-environmental application, Measurement of Diffusion, Pilot and laboratory studies, Application for one dimensional problems, Waste disposal sceneries, steady state flux determination, Analytical solution, Transient time determination.

CVEN 942: Advanced Topics in Concrete and Composite Materials (3 Credit Units)

Advanced topics selected from the broad area of concrete and composite materials to provide the student with knowledge of recent applications and developments in the specialty. Special concretes and composites including nano-concrete, high strength, high performance, ultra-high performance, polymer matrix, self-compacting, geo-polymer, self-healing and light-weight concretes etc. will be discussed.

7.4 M.Sc. Mechanical Engineering Programme

A candidate must achieve, in the written (or continuously assessed) examinations, at least 50% in each of the subjects. In addition, candidates are expected to present a minimum of three (3) seminar, i.e. proposal, progress and final seminar on the researched thesis; and must pass an oral examination of the thesis conducted by a panel of both internal and external examiners.

Course Structure

Core Courses

First Semester

Course Code	Title	Credit Unit
MEEN 810	Production Management	3

MEEN 821	Research Methods	3
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Second Semester

Course Code	Title	Credit Unit
MEEN 818	Numerical Analysis, Simulation and Modelling	3
MEEN 820	Quality Control, Reliability and Ergonomics	3

Course Structure for M.Sc. Mechanical Engineering (Energy Option)

First Semester

Course Code	Title	Credit Unit
MEEN 801	Heat Transfer	3
MEEN 803	Thermodynamics	3
MEEN 805	Fluid Mechanics	3
MEEN 807	Solar Energy	3
MEEN 809	Internal Combustion Engines	3

Second Semester

Course Code	Title	Credit Unit
MEEN 802	Mass transfer	3
MEEN 804	Thermal Power Generation	3
MEEN 806	Fuels and Combustion	3
MEEN 808	Miscellaneous Power Plant and Power Plant Mgt.	3

Course Structure for M.Sc. Mechanical Engineering (Production Option)

First Semester

Course Code	Title	Credit Unit
MEEN 811	Advanced Metal Forming	3
MEEN 813	Design for Production	3
MEEN 815	Measurement	3
MEEN 817	Advanced Finishing	3
MEEN 819	Advanced Joining	3

MEEN 821	Advanced Research Methods	3
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Second Semester

Course Code	Title	Credit Unit
MEEN 810	Production Management	3
MEEN 812	Advanced Casting	3
MEEN 814	Advanced Machine Tool	3
MEEN 816	Advanced Control	3
MEEN 822	Materials Selection and Costing	3

Course Structure for M.Sc. Mechanical Engineering (Mechatronics Engineering Option)

Course Structure

First Semester

Course Code	Title	Credit Unit
MCEN 801	Robotics	3
MCEN 803	Microcontrollers and Embedded Systems	3
MEEN 807	Production Management	3
MEEN 813	Design for Production	3
MEEN 815	Advanced Measurements	3
MEEN 821	Research Methods	3
	Electives	3

Electives

First Semester

Course Code	Title	Credit Unit
COEN 838	Optimal Control Systems	3
MCEN 805	Advanced Vibration	3
MCEN 807	Advanced Programming	3

Second Semester

Course Code	Title	Credit Unit
MCEN 802	Artificial Intelligence	3
MEEN 814	Advanced Machine Tools	3
MEEN 816	Advanced Control	3
MEEN 818	Numerical Analysis and Simulation	3
MEEN 820	Quality Control Reliability and Ergonomics	3
MEEN 822	Materials Selection and Costiong	3
	Electives	3

Electives

Second Semester

Course Code	Title	Credit Unit
MCEN 808	Finite Element Analysis of Structure	3
MEEN 808	Power Plant Management	3

Second Year (For all options);

First semester

Course Code	Title	Credit Unit
MEEN 891	Research/Dissertation	

Second semester

Course Code	Title	Credit Unit
MEEN 892	Research/Dissertation	

Course Content

MEEN810 (MEEM807) Production Management (2 credits)

Types of manufacturing systems. Production planning. Planning, routing, scheduling, dispatching, sequencing and machine-loading. Product design, Product analysis. Standardization. Simplification. Process technologies. Automation and computer-aided/manufacturing. Computer-aided design. Flexible manufacturing system.

MEEN818 Numerical Analysis and Computation (3 credits)

Numerical methods for solving linear and non-linear algebraic equations; Iteration, optimization techniques; Numerical differentiation and integration; solution partial differential equation with engineering applications; finite difference formulation and application to engineering problems: Computer programming; Techniques and languages. Various energy

MEEN 820 Quality Control, Reliability and Ergonomics (3 Credits)

Quality Control Principles and Concepts; Economics of Quality Organization and Management of Control; Control Charts (for Variables) and Attributes), Sampling Systems and Defects Control. Material and Product Control. **Reliability:** Statistical methods for quality Structural and Mechanical reliability Labour variables in structural and Mechanical reliability. Reliability Testing Technology. Frequency Distributions of Life and Reliability, Estimation of Distribution Parameters, Reliability Design and Testing. Acceptance sampling, Life Exponential and International Standards. **Ergonomics:** Human Factors in Engineering. Application of Human Factors and Engineering Practice in Accidents Prevention and Reduction of Health hazards.

MEEN 821 Research Methods (3 credits)

Use of Libraries; Literature Searching and Information Patenting; Research Methodology: Meaning of Research, Objective of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Methods, Defining the Research Problems, Research Design, Verifying of papers and report organization of research, experimental planning. Statistical analysis of experimental results. Computer in Design and analysis of systems, Interpretation of results and report writing.

MEEN 801 - Heat Transfer (3 credits)

Review of fundamentals; Application to engineering services. Steady state Conduction. Convective Heat Transfer: Forced convection heat transfer in laminar and turbulent flow; Thermal

boundary layer flat plate heat transfer; External and Internal flow through annular sections; Pressure loss and heat transfer.

Free Convection: General equations of free convection, Empirical relationship Laminar and turbulent flow for horizontal and vertical planes and for circular and rectangular sections.

Boiling Heat Transfer: Free convection boiling or boiling without bubbling, Nucleate boiling or boiling with bubbles; forced convection with boiling.

Condensation: Film condensation, dropwise condensation. Vertical Surfaces: Laminar condense flow, Turbulent condense flow; Laminar condense flow for the inside and outside of horizontal tubes; Effect of impurities (oil) and non-condensable gases (air) on the process of heat transfer.

Extended Surfaces: Circular and rectangular cross-action; Heat loss; Effectiveness, Design and selection.

Insulations: Cryogenic - vacuum, evacuated, percuss insulation and solid foam, Building insulation - loose fill, blanket, reflective, plastic foam, etc. High temperature insulation. Design

Aspects of Heat Exchangers: Basic types, Design and selection; Equipment, Condensers, Evaporators, Cooling towers, Boilers, etc.

MEEN 802 - Mass Transfer (3 credits)

Introduction Fundamentals of mass transfer; molecular mass transfer Diffusion coefficient, Convective mass transfer. Steady State Molecular Diffusion: One-dimensional mass transfer, Diffusion through a stagnant layer.

Unsteady Molecular Diffusion: Analytical solutions, Charts for simple geometric shapes.

Convective Mass Transfer: Fundamentals; Significant parameters; Mass Transfer to plates, cylinders and spheres; Mass transfer involving turbulent flow through pipes. Analogies between Mass, Heat and Momentum Transfer: Case Study: Design of absorbers.

MEEN803 - Thermodynamics (3 credits)

Thermodynamics: Equations of state - Ideal gas law and its limitations', Behavior of real gases; some equations of state (Van Der Waals equations, Dieterici equations)); Law of corresponding states; the generalized compressibility charts.

Thermodynamics Relations: Joule Thompson coefficient, Inversion temperature. Use of thermodynamics relations to obtain other properties from P-V-T measurements.

Generalized charts: Enthalpy departure; Fugacity and entropy changes at constant temperature; Gas liquefaction.

MEEN 804 - THERMAL POWER PLANTS

Review of Power Systems: Internal Combustion engines; Steam and nuclear power plants; Gas turbine plant; Hydro power; Geothermal, Solar, Tidal, Wind.

Internal Combustion Engines: Ideal cycle analysis; Engine air flow under naturally aspirated and supercharged operations, turbo-charging and compound naturally aspirated and supercharged operations, turbo-charging and compound cycles; Combustion in S.I. and G.I. engines; Factors influencing selection of engines, Design considerations with respect to dimensions speed, rating and type of cycles; Pollution from engines.

Steam and Nuclear Power Plants: Modern steam cycles and components (boilers, condensers, cooling towers, turbine design); Thermodynamic and economic effects of reheating and feed water heating; Selection of cycles and components in relation to performance required; Elementary reactor physics, Special characteristics of reactor as a heat source cycles for BNR, PWR, AGR sodium cooled reactors, and HTR; Optimization of reactor cycles.

Gas Turbine: Types and features of modern day gas turbines for various duties (aeronautical, process, marine and power); Requirement and criteria of merit for above uses; Effect of performance of main cycle variables (pressure ratio and turbine inlet temperature); Effect of component efficiencies and pressure losses; Effects of inter cooling, reheat, heat exchanges and use of semi-perfect gas properties; Features of gas turbine combustion chamber and their performance; Methods/Criteria selection characteristics of intake compressors, combustion systems, turbines; Nozzles, duct burners and heat exchangers.

MEEN 805 - Fluid Mechanics (3 credits)

Introduction: Boundary layer; Laminar and turbulent boundary layer with and without heat addition; Analogy between mass, momentum and heat transfer. Flow of compressible and incompressible fluids inside and outside of pipes and rectangular ducts.

Fluid flow in Dusts/Pipes: Air handling apparatus, Dust design; Piping design, Flow in capillary tubes; air/Water piping; Refrigeration piping; Turbo machinery; Compressors and turbine.

MEEN 806 - Fuels and Combustion (3 credits)

Fuels: Different types of fuels: Conventional fuels (solids, liquid, gaseous);

Alternative fuels (alternate forms of conventional fuels); Alternative applications of conventional fuels, supplementary fuels (LNG, NG); Substitute fuels (H₂, alcohol, biofuels). Fuel properties and specifications: Antiknock rating and octane number, diesel fuels and octane numbers; Properties and specifications for gasoline, kerosene, diesel, fuel oil; choice of fuels for various applications, industrial heating, boilers, furnaces, lagging.

Combustion Fundamentals: - Laminar and turbulent flames; Kinetics Physically controlled flames. Combustion of fuels and applications - Combustion calculations (solid, liquid and gaseous fuels), Alternate fuel combustion processes/spray formation; Vapour formation, Ignition, Combustion and post combustion stages; Alternate fuel combustion quantities (stoichiometry, dissociation, calorific value, combustion temperature). Examples of technical combustion processes - Otto and Diesel engines, gas turbine, turbo-jet and ram-jet cycles, rocket engines, and combustion problems in these engines; Analysis of flue and fuel gases.

Combustion in reciprocating engines - Ignition, flame propagation, turbulent combustion control; Abnormalities in modes of combustion pre-ignition, knock, methods of investigating knock, Combustion in C.I. engines, atomization, evaporation of fuel sprays, models of combustion, Mathematical models of combustion of liquid droplets, Combustion of turbulent gas jets, Laminar flame stabilization by bluff bodies; Kinetics of bimolecular collision controlled reactions. Design of furnaces and combustion equipment.

MEEN 807 Solar Energy (3 credits)

Solar Radiation: Source and nature; Solar constant, Terrestrial and extra-terrestrial solar intensities, Direct, diffuse, and total solar intensities; Measurement and prediction of solar energy intensities, Solar angles and their relationships, Relationship between solar and local time.

Solar Energy Conversion: Conversion to heat, solar energy collectors, flat plate and focusing collectors; Thermal losses, optical losses, useful gains and efficiency. Performance analysis of collectors. Direct conversion to electricity; Photovoltaic (PV) cells and their characteristics;

Solar Energy Systems: Solar energy activated power cycles; solar water heating systems, solar cooling systems, Simulation and optimization of solar energy systems; PV system Components and System Design.

Economics of Solar Energy Systems: Simple payback period; discounted payback period; Replacement energy payback period; Incentives to Encourage use of Solar Energy.

MEEN 808 Miscellaneous Power Plants and Power Plant Management (3 credits)

Introduction: Importance of Energy, Introduction to Renewable and Unconventional Methods of power generation.

Hydropower generation: Types and sizes of Hydropower plants; Hydro-Electricity generation; Design considerations for hydro power stations; Hydroelectric Turbines.

Wind Power generation: Wind energy and its applications, wind powers; wind Turbine-Generator Units; Wind Energy conversion systems;

Biomass Energy and Conversion: Biomass Energy Resources: Biomass conversion processes.

Solar Power generation: Conversion of Solar Energy; Principle of solar Thermal power generation. Geothermal Power generation: Characteristic features of geothermal energy; origin of Geothermal Resources; Geothermal Electric Power Plants.

Other Energy Sources for Power Generation: Ocean Energy, Hydrogen/Fuel cells, Magneto Hydrodynamic (MHD) Power, etc.). Other Energy Sources for Power Generation:

Power Plant Management: Location of power plants; operation management, performance management, maintenance management, production management and Environmental Management of Power Plants: Power Plant Economics.

MEEN 809 Internal Combustion Engines (3 credits)

Ideal cycle analysis, Engine air flow under naturally aspirated and supercharged operations, turbo-charging and compound cycles; Combustion in S.I. and C.I. engines, Factors influencing selection of engines, Design considerations with respect to dimensions speed, rating and type of cycles, Pollution from engines.

MEEN801 - Production Management (3 credits)

Production Management: Introduction to production management, linear programming, Graphical and simplex methods; Transportation models; Assignment model; Network Analysis - PERT, CPM Techniques; Inventory control, Queueing theory. Economic Studies: Economic Background to management: The business firm and its objectives, Profit; Investment policy; Competition, Cost control; Demand Analysis and forecasting: Pricing policy, Product Policy, Sales promotion and market strategy.

MEEN 811 -Metal Forming Processes (3 credits)

Plasticity: Yield criteria. Plastic flow theory; slip line field theory. Load bounding theorems - upper and lower bound theorems, application to forming processes. Theoretical analysis of some forming processes - wire drawing, rolling, indentation, extrusion, flanking etc. Technical and metallurgical aspects of forming processes - forging, rolling, sheet and wire drawing, shearing processes, coining, bending etc. Technical and Metallurgical Aspects of Forming Processes: Forging, rolling, sheet and wire drawing, shearing processes, coining, bending, etc.

High Energy Forming Processes: Advantages. Pneumatic/Mechanical Forming. Electromagnetic forming. Electrohydraulic forming. Explosive forming. Advantages and disadvantages of cold and hot forming. Friction and lubrication in metal forming. Defects in metal forming.

MEEN 812: Advanced Casting (3 credits)

Casting Processes: Sand Casting: Sand characteristics. Bonding materials for moulds and cores-clays, organic resins and oil binders, inorganic Materials. Moulds-types. Other Casting Process: Precision casting, Investment casting. Types of centrifugal casting, ceramic and plaster casting. Vacuum casting. Continuous casting. Types of moulds and mould materials. Design for Castings: Patterns: Draft allowances. Shrinkage allowances. Allowances for machining. Wall thicknesses. Minimum section thicknesses. Tolerances. Moulds: Types. Cores and inserts. Wear effects on moulds and cores. Venting of moulds. Core making equipment. Melting: Types of furnaces and factors that affect selection. Types of metal, mode and rate of metal delivery size and shape of an available metal. Pouring: Gating Design Basic flow principles cross-sectional areas. Types - vertical, horizontal, bottom. Number and location. Riser design and placement. Cooling and Solidification: Mechanisms of solidification for pure metals and alloys and grain structure. Rate of solidification of large castings in insulating moulds, with predominant interface resistance, with constant casting surface temperature, with predominant resistance in mould and solidified metal. Continuous casting process. Residual stresses in castings. Defects and Inspection of Castings: Defects - Types and Causes. Inspection - types and applications.

MEEN 813 - Design for Production (3 credits)

Classification of jigs and fixtures; Main elements in jigs and fixtures; Clamping and locating, locating errors; Mandrels; Principles of clamping; Clamping elements; Power drives for clamping, Continuous action clamping devices; Tool guiding elements for jigs; Indexing and rotary elements; Bodies and frames; Standardization of jigs and fixtures.

MEEN 814 - Advanced Machine Tools (3 credits)

Metal Cutting: Theory of chip formation; Angle of tool surfaces; Types of the materials available and their applications. Cutting conditions for economic tool life; Machinability of workpiece materials; cutting action of milling, drills, broaches, etc.; Grinding processes, selection of grinding wheels and quality of surface produced; lapping and honing; New metal removal processes, Electro-chemical machining and spark erosion.

Machine Tools Construction: Principles of design of machine frames, gearboxes, spindles, bearings and slide ways; Factors limiting the performance of machine tools; Economic selection of machine tools; Machine load devices for automatic control; Electrical control with feedback and digital programming.

MEEN 815 - Measurement and Control in Industry (3 credits)

Measurement: A review of basic considerations of measurement, the wave-length as standard of length, slip gauge; care of slip gauges; Tolerance and limit system; Geometrical tolerances; Screw thread tolerance; Gauge tolerance; Measurement of straightness, flatness, roundness; Profile measurement; Measuring machines and comparators; Internal measurement.

Optics in Metrology: Screw threads: Errors in screw threads, screw thread gauges, measurement of external and internal threads; Gear measurement; Surface texture assessment and instruments; Inspection and gauging in manufacture; Automatic gauging and work sizing, Quality control; Control charts for variables; Defectives and defects; Acceptance sampling; Design of acceptance sampling plans.

MEEN 816 - Advanced Control (3 credits)

The generalized measurement system; First stage devices and elements; Intermediate modifying systems and devices; Terminating methods and devices, Generalized control system; Applications of Microcomputers in Control System; Design of control systems.

MEEN 817 - Advanced Industrial Finishing (3 credits)

Grinding: Grinding abrasives. Grinding materials and bonds. Grinding wheels and speeds. Types of grinding. Honing: Super-Finishing, Lapping. Polishing: Types of discs. Polishing speeds. Lubrication. Paste wheels. Burnishing. Buffing. Wire brushing. Barrel Finishing Electro-polishing: Advantages and costs. Types of metals electro-polished. Procedure and equipment. Metal cleaning for Electro-polishing and Electroplating: Nature of soil to be removed. Methods

of application of cleaning materials, hand, tank, machine, electro cleaning and barrel cleaning. Types of cleaning materials - self emulsifying solvents, alkaline. Rinsing. Pickling: Basic theory. Procedure. Materials used.

Coating of Surfaces: Spraying: Roughening - by sand blasting, metal shot blasting anodizing. Dipping. Plating: Basic theory with various types of electrodes. Rate of metal deposition and quality of deposits. Electroplating procedures - cleaning, electroplating and cleaning. Plating metals - copper, nickel chromium, zinc and others. Plating procedures and materials used in plating of low carbon steel, high carbon and low alloy steels, stainless steels. Gold plating. Chromium plating. Copper and copper base alloys plating. Applications of electroplating.

MEEN 819 - Advanced Joining (3 credits)

Principles of Solid Phase Welding; Principles of Fusion Welding: Sources of heat. Modes of metal heat transfer in arc welding. Heat flow characteristics. Gas metal reaction. Cooling of fused welds. Solid/Liquid Joining: Soldering and brazing. Adhesive bonding. Metallurgical aspects of welding: Welding of ferrous and non-ferrous metals. Fatigue and brittle fracture of welded joints. Weldability of metals. Weld defects and inspection.

Joining Processes: Solid phase welding at elevated temperatures - forge, butt, oxyacetylene pressure, flash butt and friction welding. Arc, welding types Resistance welding - electroslag, spot, projection and seam. Gas and shielded gas welding. Thermite welding. Electron beam welding. Laser beam welding. Explosive welding. Applications. Preparation of joints for welding.

COEN 838 – Optimal Control Systems (3 credits)

Linear regulator problem, Linear quadratic methods, State regulation, State estimation, Riccati equations. Optimal control systems design, objective functions and use of quadratic performance index. Performance and robustness of multivariate feedback system design; based on Nyquist like techniques, linear quadratic gain (LQG) method, etc.

MCEN 801 – Robotics (3 credits)

This course provides an overview of robot mechanisms, dynamics, and intelligent controls. Topics include planar and spatial kinematics, motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, 3D graphic, embedded software.

Project: Fabrication of a working robot to perform a simple task.

MCEN 802 – Artificial Intelligence (3 credits)

Fundamentals of Neural Networks; Back Propagation and Related Training Algorithms; Different Types of Neural Network: Practical applications of Neural Networks: Classification, Forecasting, Pattern Recognition; Use of the ANN Matlab toolbox, Fundamentals of Fuzzy Set Theory and Fuzzy Logic Control; Fuzzy System Models and Developments; Membership Functions and their roles in the Fuzzification process; Defuzzification Methods; Design of Fuzzy Controllers; Fuzzy Time Series Forecasting; Use of fuzzy logic Matlab toolbox. Fundamentals and applications of Neuro-Fuzzy systems; Use of ANFIS Matlab toolbox, Fundamentals and applications of Genetic Algorithm (GA), Introduction to any select learning algorithm(s).

MCEN 803 – Microcontrollers and Embedded Systems (3 credits)

Microcontroller architectures, Microprocessor architectures, Difference between microcontrollers and microprocessors, Embedded System architecture, design and programming.

MCEN 805 – Advanced Vibration (3 credits)

Several degree of freedom system, Continuous systems, Transient vibration, Non-linear vibration, Differences between linear and non-linear vibrations, Examples of non-linear vibration system, Estimation and delineation of non-linear vibrations, Forced vibration with non-linear spring, sub-harmonic & super harmonic resonance.

MCEN 807 – Advanced Programming (3 credits)

Flow-Charting and Algorithm formulation, Coding with (C++, Visual Basic). High Level Languages (e.g. C++, Linux, visual Basic). Applications to solution of engineering problems.

MCEN 808 – Finite Element Analysis of Structure (3 credits)

Finite element method formulation, Finite element for non-linear static analysis, Heat transfer, Fluid flow, Finite element formulation for fluid structure interactions, The procedures in setting up finite element model and interpreting the result. The methods are meant to be of practical use. The following software will also be employed – ANSYS Multiphysics and CFD.

7.4.1 Ph.D Mechanical Engineering

Course Structure

Course Structure for PhD Mechanical Engineering (Energy Studies)

First Semester

Course Code	Title	Credit Unit
MEEN 901	Advanced Research Methods	3
MEEN 903	Dimensional Analysis	3
MEEN 905	Energy Modelling and Forecasting	3

Second Semester

Course Code	Title	Credit Unit
MEEN 902	Computational Fluid Dynamics	3
MEEN 904	Renewable and Non-Conventional Energy Conservation Systems	3

Course Structure for PhD Mechanical Engineering (Production Engineering)

First Semester

Course Code	Title	Credit Unit
MEEN 901	Advanced Research Methods	3
MEEN 907	Advances in Production Engineering	3

Second Semester

Course Code	Title	Credit Unit
MEEN 900	Reverse Engineering	3
MEEN 906	Composites	3

MEEN 900 Reverse Engineering**(3 Credit Units)**

Historical background, Reverse engineering vs machine design, Reverse engineering hardware and software, Analysis and verification, Applications of reverse engineering, Surface and solid model reconstruction, Dimensional measurements, Part tolerance, Prototyping, Steps in geometric modeling, Material characterization, Part failure analysis, Fatigue, Creep and stress rupture, Environmentally induced failure, Material specification, Composition determination, Microstructural analysis, Manufacturing process verification, Statistical analysis, Data analysis, Reliability and theory of interference, Weibull analysis, Data conformity and acceptance, Performance criteria, Methodology of performance evaluation, System compatibility, Regulatory certification of part performance, Legality of reverse engineering, Patent, Copyrights, Trade secrets and Third-party materials.

MEEN 901 Advanced Research Methods**(3 Credit Units)**

Introduction to Research:

- Definitions and characteristics of research; Types of research - Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.
- Main components of any research work, Various Steps in Research process
- Topic Selection; Problem identification; Criteria for prioritizing problems for research.
- Analysis and Statement of the problem; Analyzing the problem; Formulating the problem statement. Developing a research question-Choice of a problem.
- Formulation of the research objectives.

Literature Review:

Uses of literature review; why write literature reviews? Importance of Literature review, Essential elements of literature reviews. Structure of the literature review, Literature search, Organization of information. Surveying, synthesizing, critical analysis, reviewing, rethinking, critical evaluation, interpretation of information. Web Search: Search engines and advanced search tools usage. Scientific editing, citation and referencing techniques and tools. Case Study: Write a Literature review.

Research Methodologies:

Quantitative Research Methodology for: Experimental research, descriptive research, correlational research, survey research and evaluation research.

- Work Plan: Major components and outline of the different phases in a research process.
- Study population; Variables, Sampling, Sample size determination, Plan for data collection, Methods of data collection, Plan for data processing and analysis.
- Statistics: use of statistics in Research, Probability & Sampling distribution; Correlation & regression analysis. Types of Experiment design – Factorial design (one factor experiment and two level factor design), Randomized Blocks, Latin Squares, and Related Designs, Taguchi orthogonal array, ANOVA, interaction, Signal-to-Noise ratio, Replication of experiments; Multivariate methods, Error Analysis.
- Critiquing a thesis methodology.

Modeling and Simulation Software and Tools

Types of models: (i) Physical models: (a) prototype (b) real, (ii) Mathematical models (static or dynamic): (a) Analytical (b) Numerical. Types of simulation: (a) physical (b) numerical (computer simulations).

Selection and use of Modeling and Simulation Tools: (i) 3D model development tools: auto desk inventor, solid works, auto CAD (ii) Numerical modeling and simulation tools: ANSYS, COMSOL Multiphysics, Simulink (iii) Symbolic modeling and simulation tools: maples, TRNSYS (iii) Programing, solver and simulation tools: MATLAB (iii) statistical modeling tools: SPSS.

Verification and validation of model: Length of simulation run, Replication and batches, Elimination of initial bias, Validation of input/ output data, variance reduction techniques.

Applications: System design and optimization for manufacturing, fluid flow analysis, energy systems. Case study

Data Collection, Preparation and Presentation:

- Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis.

- Data Collection: Experiments and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study.
- Data Preparation Process, Some Problems in Preparation and processing of data, Missing values and Outliers, Types of Analysis.
- Generating charts/graphs & other features using spread sheet.

Data Interpretation, Report Writing and Oral Presentations:

- Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation,
- Report writing, Different steps in writing report, Layout of the research report, Types of reports, Mechanics of writing a research report, Precautions for writing research reports.
- Oral Presentation: Review of presentation tools, their features & functions, creating presentations, customizing presentation, layout of slides, techniques in oral presentation, keeping your audience engaged, voice and diction, managing nervousness, gesturing, etc.

Others:

- Application of results and ethics: Environmental impacts, Ethical issues in research, Commercialization, Copy right, Royalty, Intellectual property rights and patent
- Referencing in academic writing, Citations and acknowledgement.
- Summary of major components of a research proposal.

MEEN 902 Computational Fluid Dynamics (3 Credit Units)

Momentum, mass and energy characteristics. Theories of turbulent flow. Turbulence scale, dynamics of turbulence. Wall and free shear flows. Conservation equations for turbulent flow and their closure. Transport equations for Reynolds stresses. Laminar and turbulent boundary layer flows of the following kind: wall flow, jets, wakes, confined flows. Recirculating flows. Flows with body forces. Technique for measuring of convective flows. Finite elements in fluid dynamics.

MEEN 903 Dimensional Analysis**(3 Credit Units)**

Units and dimensions, Units-conversion factors, Dimensional system, Synthesis of experimental data, Comparison of the results, Re-ordered Functions, Benefits of dimensional analysis. Summary of basic logic, Definition of concepts, time, force and quantity, Constant relative magnitude, Dimensional equality, Product of concepts, Functional relations, the Pi-theorem, the development of dimensional analysis, Choice of dimensions, Supplementation of derivations, Systemic experiment, Analytical results, Model testing, Assessing experimental correlation, Derivation of dimensions of quantities.

MEEN 904 Renewable and Non-Conventional Energy Conservation Systems (3 Credit Units)

Solar energy resources assessment and fundamentals; solar thermal heating systems, - passive and active; solar photovoltaic electricity, solar thermal power generating systems, -solar central tower Rankine systems, solar dish sterling cycle systems, solar PV mini-grid systems; solar energy storage technology and applications: technologies and applications appropriate for developing countries.

Biomass energy resource assessment and fundamentals; bio-conversion processes and technologies, - biogas digesters, liquid fuels (e.g ethanol) from energy crops and energy farms; socio-economic issues; applications and applications appropriate for rural and urban areas; case studies from both developed and developing countries.

Wind energy resource assessments and fundamentals; multi-blade types and turbine types and applications; wind farming technology and applications; environmental aspects of wind farms; hybrid wind and solar systems.

Ocean Thermal, Wave and Tidal Energy resource assessments and fundamental physics; conversion technologies; performance data and economic evaluation; existing and potential applications. Case studies,

Fuels Cells- chemistry and technology applications, potential in developed and developing countries. Hydrogen and fuel production technology and applications; the hydrogen economy; resource potential assessment.

MEEN 905 Energy Modelling and Forecasting (3 Credit Units)

Energy data-national, regional, global; sources, acquisition mode, techniques, energy supply and demand forecasts into the next half century; units and conversion factors; data interpolation and extrapolation; analysis of energy supply and demand- sectoral and deregulated, energy demand models, prices and elasticities, economic and energy growth interrelationships, and concepts, operational research techniques in energy modelling.

MEEN 906 Composites (3 Credit Units)

Definition of composite materials, Composite material structure, Processing of composite materials, Composite design concept, Application of composite materials, Carbon fibers and nanofillers, Basic mechanical properties, Effects of damage on the mechanical properties, Strengthening, Vibration damping ability, Brittle vs ductile materials, Corrosion resistance, High temperature resistance, Fatigue resistance, Durability, Materials for light weight structures, Materials for civil infrastructure, Materials for joining, Materials for repairs, Tailoring of composite materials, Electrical properties, Thermal properties.

MEEN 907 Advances in Production Engineering (3 Credit Units)

Vibrations; Fracture mechanics; Advanced theory of elasticity (3-dimensional problems), Robotics and automation, Micro electro mechanical systems (MEMS), Reliability engineering, Metal forming and machining, Manufacturing systems and modeling, Reverse engineering, Composite materials, Characterization and materials testing, Nanomaterials and nanotechnology, High temperature corrosion, Quantitative techniques, Facility planning, production systems, Advanced machine tools design, work study and ergonomics, Advanced/non-conventional machining and Tribology.

7.5 M.Sc. Water Resources and Environmental Engineering

To graduate, a student must complete all Faculty and Departmental requirements. In addition, a student must successfully defend a thesis before a panel of both internal and External Examiners. A minimum of 50% grade is required for all courses to graduate. A minimum of 37 credit unit is required before graduation.

Course Structure

First Semester

Core Courses offered by all M.Sc. Students

Course Code	Title	Credit Unit
WREN 801	Hydraulics 1	2
WREN 803	Engineering Hydrology	2
CVEN 803	Numerical Methods and Statistical Analysis	3
WREN 805	Principles of Water Quality	2
WREN 807	Water Law, Management and Economics	2
WREN 818	Thesis	9
WREN 812	Seminar	1

Second Semester

Course Work (Specialization Options)

Option A: Hydraulic and Engineering Hydrology

Course Code	Title	Credit Unit
WREN 802	Ground Water Modelling	3
WREN 804	Dams Design and Reservoir Operation	2
WREN 806	Catchment Modelling	2
WREN 808	Hydraulics II	3
WREN 810	Environmental Impact Assessment	2
WREN 814	Hydroinformatics	2
WREN 812	Seminar	1

Course Work (Specialization Options)

Option B: Environmental Engineering

Course Code	Title	Credit Unit
WREN 810	Environmental Impact Assessment	2

WREN 818	Environmental Pollution Control	3
WREN 820	Water Treatment and Supply	2
WREN 822	Waste Treatment and Disposal	2
WREN 824	Elements of Public Health	2
WREN 826	Industrial Water Engineering	2
WREN 812	Seminar	1

Second Year

First Semester

- Research Data Collection
- Seminar
- Notification of Thesis Title and Appointment of External Examiner

Second Semester

- Compilation of write-up of Thesis
- Internal Defense of Thesis
- External Defense of Thesis

7.5.1 Ph.D. (Water Resources and Environmental Engineering) Programme

A Ph.D candidate is expected to present a proposal for his Dissertation at the commencement of the programme, after which he would be expected to provide progress reports and at least two seminars before being presented for external examination.

Course Structure

First Year

First Semester

- Confirmation of Registration

- Appointment of Supervisory Committee
- Approval of Research Topic
- Research Literature Review
- Identification of Problems to be addressed
- Course Work.

Course Work for Hydraulics and Engineering Hydrology Option

Course Code	Title	Credit Unit
WREN 901	Advanced Mathematical Analysis 1	3
WREN 909	Advanced Hydro Informatics	3
WREN 911	Advanced Hydraulics	3

Course Work for Environmental Engineering Option

Course Code	Title	Credit Unit
WREN 901	Advanced Waste & Wastewater Treatment	3
WREN 903	Bioremediation	3
WREN 907	Environmental Management	3

Second Semester

- Proposal defense
- Research Commences

Second Year

First Semester

- Research Data Collection
- Progress Report
- Laboratory Sample Analysis

Second Semester

- Research Data Collection

- Laboratory Sample Analysis
- Literature Review
- Seminar

Third Year

First Semester

- Research Data Collection
- Data Analysis
- Seminar Presentation/First Internal defense
- Writing of Dissertation
- Notification of Dissertation Title and Appointment of External Examiner

Second Semester

- Completion of Writing of Dissertation
- Second Internal Defense
- External Defense of Dissertation

8.0 SCHOLARSHIP POLICY

8.1 Background

The Africa Center of Excellence on New Pedagogies in Engineering Education (ACENPEE) is proud to honour academically talented and exceptionally skilled students with a variety of scholarships. The Center will annually award more than \$50,000 in scholarships to regional graduate students as funded by the World Bank and as accrued to the Center based on the disbursement linked indicators (DLIs). The objective of this scholarship policy document is to provide details of how the Africa Center of Excellence on New Pedagogies in Engineering Education (ACENPEE) manages the selection and award process for Scholarships. This document ensures that the management of the Scholars is consistent with the World Bank guidelines. The Scholarships are part of a broader framework within the Center. Therefore, the Scholarship program aims to have a clear and transparent framework, policy and process that is responsive and targeted toward student success.

ACENPEE has a number of Scholarships available to students based on academic merit and leadership potential. Scholarships may be provided for partial or full tuition fees and the award of such Scholarships is at the discretion of the Selection Panel.

- (a) The purpose of the academic merit aspect of the Scholarship is to provide students with a reward for academic excellence. A weighted average of 60% or above in subjects is the minimum academic requirement for granting of a Scholarship. Specific requirements and weighted averages are outlined in the conditions of each Scholarship.
- (b) The purpose of the leadership aspect of the Scholarships is to invest in exemplary individuals who are likely to drive strong socio-economic outcomes in society throughout their careers.

There are two categories of Award:

1. The Centre awards scholarships to postgraduate candidates to enable them undertake higher degree studies in ACENPEE at Masters and Doctorate levels and for short professional training in engineering education and ICT.
2. ACENPEE awards scholarships on the basis of the need to acquire technological skill sets (Digital literacy, Entrepreneurship, Leadership and project management and teaching

pedagogies) to enhance the quality of the teaching of engineering courses and as a spin-off, serve as a boost to Science, Technology, Engineering and Mathematics (STEM) education. The scholarship beneficiaries are expected to contribute actively to development in their countries.

Scholarship to be taken at:

Africa Centre of Excellence on New Pedagogies in Engineering Education (ACENPEE), Ahmadu Bello University, Zaria, Nigeria.

Priority Fields

- Tuition (\$500)
- Living expenses (\$900)
- Books and School supplies (200/PhD, 150/MSc)
- Travel (\$500)
- Consular services (100)
- Research and publication (\$200/PhD, \$150/MSc)
- English language training for non-English speakers (\$100)

Commencement
2020

Scholarship Type

Masters and Doctorate Degrees

Eligibility

To be considered for a postgraduate scholarship, applicants must meet the following requirements:

- Citizen of African country
- **Minimum academic requirement:** Bachelor’s or Master’s degree or equivalent for Masters and Doctorate Degrees, or a minimum of 5 credits at O’Levels for short courses. For PhD applicants, a weighted average of 60% or above in subjects taken is the minimum academic requirement for granting of a scholarship
- Demonstrate a clear vision of how the training will be used to fill gaps and make reform in their home countries
- Satisfactory English or French proficiency to enable full participation in a training course delivered in English or French

- Satisfy all requirements of the Nigerian Government for the appropriate student visa.

Target Group

- Nationals of African Countries.
- Qualified candidate who wish to undertake a Masters or Doctorate degree in one of the Centre's fields of study.
- Candidates who have a clear agenda on how the knowledge and training gained through the programme will fill gaps in their proposed field of study.
- **Gender Equality:** ACENPEE targets equal participation of females and males. Applications from female candidates are strongly encouraged, and mechanisms are in place to support female applicants and awardees. Full scholarships will be awarded to regional female candidates where eligibility is proven.
- **Disability Inclusion:** ACENPEE aims to ensure that people with disabilities are given fair and equal opportunity to apply and obtain a scholarship.
- Special consideration will be given to Regional candidates (West African Sub- Region)

Number of Scholarships per Year

Fifteen (15) for Masters Students, Five (5) for Doctorate Degree students

Value of Scholarships

The scholarship budget is valued at \$2,400 for Masters' student, \$2,500 for Doctorate degree

Duration of Scholarship

For the duration of candidate's programme, and renewed annually for academic programs. No scholarship would be allowed beyond the duration of the course.

The Process

- ACENPEE will place an advert in two National dailies and on their website as well as send fliers to other regional ACE Centres, use ACENPEE social media handles and contact relevant embassies for student recruitment.

- ACENPEE opens the portal (scholarship.nitda.gov.ng) for application, which will be open for 12 weeks from the date of advert.
- Applications will be reviewed and screened
- Successful applicants are notified through email and SMS.
- Verification of original certificates and oral interview of successful applicants.
- Release of award letters to successful candidates.

Application Process

Application Forms can be obtained on <https://www.acenpee.edu.ng> : and closes 12 weeks from the date of publication

Requirements

MSc

1. A minimum of Second Class Upper (2.1) qualification in the first degree or its equivalent
2. Possession of five (5) O/level credits or its equivalent, including English or French language.

PhD

1. A minimum of Second Class Upper (2.1) or its equivalent in their first degree and a good second-degree certificate;
2. Must submit a research proposal (of not more than five (5) pages) to include: Topic, introduction, objective, methodology and expected results

English Language Requirements: Applicants whose first language is not English are usually required to provide evidence of proficiency in English at the higher level required by ACENPEE

Required Documents

Applicants are advised to scan copies of all relevant academic documents and attach to their online application form.

NOTE:

Special consideration will be given to regional students.

How to apply for ACENPEE scholarship award

- Application Form must be requested online: Go to <https://www.acenpee.edu.ng>
- Choose a course (Masters, Doctorate Degree)

- Carefully read the eligibility criteria to check that you are eligible to apply
- Fill in the details, upload relevant documents and submit request
- Acknowledgement will be sent via Email address

Check list:

1. Completed application form
2. Recent passport-size photograph
3. Certified copies of academic certificates and transcripts
4. Certified copies of passport or national identity card indicating citizenship
5. Two (2) reference letters with contact

No additional documents can be submitted other than those listed above in the required format, unless specifically requested by the ACENPEE Secretariat. No applications will be considered if received after the submission deadline or if they do not strictly meet the guidelines, notably as concerns the specified format.

Selection Process

Scholarships in ACENPEE are highly competitive and only applicants who are outstanding across board are selected. A selection committee will be constituted to assess applications using the following criteria;

- Academic merit as evidenced by quality of degrees, full academic transcripts, and relevant publications to be referenced by applicants
- The viability of the study/research plan (PhD Applicants only).
- Applicants are required to make a case for their scholarship by submitting a statement of purpose (maximum 500 words) stating the reason(s) they want to undertake the study, and a proposed research concept note (maximum 1500 words) . These documents should show the potential to impact on national development (MSc and PhD Applicants only).

After the application deadline, all applications will be evaluated by the selection Committee of ACENPEE. At Stage 1, the Selection Committee will screen applications as per the set eligibility criteria and seek evaluations from a scientific committee comprising all the Academic Members of ACENPEE. At Stage 2, the Selection Committee will seek evaluations from the Project Management Committee Members of ACENPEE for the final decision. In submitting their application to ACENPEE for scholarships, the applicant acknowledges and accepts the fact that

the identity of reviewers will not be disclosed. Decision regarding all submitted applications for scholarship will be published on ACENPEE website approximately 8 weeks after the application deadline.

Scholarship Acceptance and Terms

Acceptance of an individual scholarship award is an agreement to the terms and conditions of that award as well as all policies governing the scholarships. Every student's financial award package is subject to audit with the final determination to be made by the Project Management Committee Members in compliance with the World Bank regulations. A student's scholarship funds may not exceed in-state direct costs (tuition, fees, room and board). If the student also receives external scholarships, the total of all funds cannot exceed the total direct and indirect costs of education. Indirect costs include allowances for personal expenses and transportation.

- ACENPEE reserves the right to adjust individual scholarship awards after letters have been accepted to ensure it is in line with approved policy.
- Renewable awards are contingent upon maintaining a minimum grade point average, and meeting all other conditions of the renewal criteria as specified.
- All ACENPEE scholarships will be visible on the students' portal and will be automatically disbursed to their accounts before lecture begins.

Academic Integrity

Academic integrity is a fundamental concept underlying the educational enterprise of ACENPEE. We are committed to honesty, fairness, trust, respect, and taking responsibility for our actions. All students are expected to abide by the principles of academic integrity and the ACENPEE Student Code of Conduct. All policies and procedures described are subject to change. All statements in this publication concerning requirements, dollar amounts, conditions or other matters are for informational purposes only and are subject to change without notice.

Questions

For any questions on scholarships, please contact Dr Adrian O. Eberemu (Academic and Research Coordinator, ACENPEE)

Phone: +234 803 544 7149

Email: aeberemu@yahoo.com, aoeberemu@abu.edu.ng

The answer to questions may be published on the ACENPEE website.

9.0 GUIDELINES FOR SELECTING NON-STAFF STUDENT MEMBER

As part of operational principles, ACENPEE is required to select a non-staff student member to fulfil certain roles towards the actualization of the Centres' mandate. The guidelines for selecting the non-staff student member include:

The student member must be a PhD student preferably in the first year of his/her study and must be enrolled on a full-time basis. In addition, the candidate must show satisfactory academic standing which will be based on both the percentage of attempted credit hours completed (satisfactory academic progress) and the cumulative grade point average (GPA). The candidate should demonstrate strong communication skills which involves the ability to convey information clearly and concisely. Candidates should demonstrate good leadership skills essential to supervising a group and showcase his/her ability to lead by example. In this way, personal attributes that would enable the candidate to interact effectively and harmoniously with other people (soft skills) will suffice.

In summary, the eligibility criteria for applicants include:

1. First year PhD student
2. Full-time PhD student
3. Good academic standing
4. Good communication skills
5. Evidence of leadership skills
6. Evidence of soft skills

The selection decision will be based on the candidates' performance at the selection interview which will rank the applicants based on criteria 1-6 above, using an average weighting of scores from each panel members.

10.0 SEXUAL HARASSMENT POLICY

10.1 Preamble

The Africa Centre of Excellence on New Pedagogies in Engineering Education (ACENPEE), Ahmadu Bello University, Zaria, Nigeria has a zero tolerance for sexual harassment. The Centre's Sexual Harassment Coordinator is **Professor Binta Abdulkarim** who is also the university's former Director, Gender Policy Unit.

10.2 Policy Statement

ACENPEE is committed to providing a safe and conducive learning environment for all its staff and students free from discrimination on any ground including sexual harassment. ACENPEE will operate a zero tolerance policy for any form of sexual harassment in the Centre, treat all incidents seriously and promptly investigate all allegations of sexual harassment. Any person found to have sexually harassed another will face disciplinary action. All complaints of sexual harassment will be taken seriously and treated with respect and in confidence. No one will be victimized for making such a complaint.

10.3 Definition

Sexual harassment is unwanted sexual attention that makes a person uncomfortable or causes problems in school, work, or in social settings. Some examples are verbal slurs or abuse; suggestive, offensive, or derogatory comments; sexist remarks about someone's body, clothing, or sexual activity; insults of a sexual nature; requests or demands for sexual favors; catcalls or other suggestive or insulting sounds or gestures; unnecessary and unwanted physical contact; and physical assault.

Sexual harassment can include, but is not limited to, the following:

- a. An unwanted physical advance or verbal approach of a sexual nature;
- b. Subtle or overt pressure for sexual involvement;
- c. Unwanted reference to one's physical appearance, sexuality or to sexual activities;
- d. Unwanted physical contact;
- e. The demand for sexual favors accompanied by implicit or explicit threats against one's job security or success;
- f. Any comments or actions which denigrate a person based upon gender; or
- g. Unsolicited sexual gestures or comments or the display of offensive, sexually graphic materials.

10.4 Complaints Mechanism

Any person who believes he or she has been the victim of sexual harassment by a board member, a parent, a volunteer, an administrator, faculty member, student or employee of the Centre is encouraged to report and discuss the alleged acts immediately and confidentially with the Sexual Harassment Coordinator. Any complaints of alleged sexual harassment made to the Sexual Harassment Coordinator will be discussed fully and confidentially with the person raising the complaint or concern and will require approval of the reporter prior to disclosure or direct investigation of the matter.

If, after discussion by the reporting person with the Sexual Harassment Coordinator, it is agreed between the reporting party and the Sexual Harassment Coordinator that a more detailed investigation is appropriate, the following investigative procedure will be utilized.

10.5 Investigation

Following discussion with the Sexual Harassment Coordinator, and the agreement of the reporting party that an investigation should be undertaken, the complaint will be made fully known to the Centre Leader. Once so advised, immediate follow-up in the form of a full investigation by the Centre Leader will be performed.

In determining whether alleged conduct constitutes sexual harassment, the totality of circumstances, such as the nature of the sexual advances and the context in which the alleged incidents occurred, will be considered. To assist in the investigation, incidents will be documented, including specifics such as dates, times, witnesses, if any, and a full and clear statement of what transpired. A determination of the appropriateness (or lack thereof) of the particular action will then be made from the facts by the Centre Leader (with the assistance and advice of the University lawyers), and appropriate action will be pursued expeditiously in each case.

10.6 Disciplinary Measures

Any administrator, faculty member, employee, or student of the school who engages in sexual harassment is subject to immediate and appropriate discipline, up to and including discharge or expulsion. The results of the investigation of each complaint filed under this Policy will be reported to the complaining party by the Centre Leader. The report will document any disciplinary action taken by the Centre as a result of the complaint, and will become part of the personnel file or record of the disciplined individual.

10.7 Reprisal

Retaliation against any individual who complains of sexual harassment is strictly forbidden by the Centre, and anyone who practices such retaliation will be subject to immediate discipline, up to and including discharge or expulsion.

10.8 Non-Harassment

The Centre recognizes that not every advance or comment of a sexual nature constitutes harassment. Whether a particular action or incident constitutes sexual harassment or not requires an objective determination based upon all of the facts and surrounding circumstances. False accusations of sexual harassment can have a serious detrimental effect on innocent parties, are prohibited by the Centre, and can be cause for disciplinary action up to and including discharge or expulsion.

10.9 Code of Conduct for Staff and Students

Staff and Students are expected to treat one another with dignity and respect. We encourage staff and students to make responsible decisions regarding sexuality and to consider the consequences of their decisions in terms of their health, their relationships with others, moral considerations, and the law. The Centre forbids pre-marital sexual intercourse and other forms of sexual intimacy among staff and students. Staff and Students should understand that pre-marital sexual behavior may result in corrective action. From our concern for their emotional, physical, and spiritual well-being, we also will respond to sexually active staff and students by initiating and fostering open communication that may be helpful to them.

Staff and Student couples are encouraged to make responsible choices regarding sexuality. When they are together in public, however, they have a responsibility to others as well as to themselves to conduct themselves appropriately. Public displays of affection are unacceptable when they embarrass or make others uncomfortable. Examples of such behaviors include, but are not limited to, extended kissing or hugging, lying or sitting together inappropriately, and placing hands on each other in inappropriate ways.

10.10 Helping Victims

Aside investigating and punishing perpetrators, the Centre shall refer victims of harassment to the Guidance and Counseling Directorate of the University for the Cure of trauma and related stress experiences. The Directorate has senior resource managers that facilitate and investigate formal

and informal complaints. While victims have these options, they can also extend complaints outside of the University where necessary.

10.11 Implementation

The Centre shall implement its Sexual Harassment Policy in line with existing university rules and regulations and in conformity with the laws of the Federal Republic of Nigeria. The Centre shall develop a Sex Offence Service Provider (data base) and Sex Offenders' Register (SOR) to be shared with institutions and relevant Ministries, Departments and Agencies (MDAs) within and outside Nigeria. This policy shall be included in the Centre's Staff and students' handbooks.

10.12 Education on Sexual Harassment

The Centre shall educate the University community on the consequences of sexual harassment on the perpetrators, the victims and the society. It shall organize in conjunction with the university Gender Policy Unit various activities to sensitize, enlighten and educate staff and students on Sexual harassment issues. These will include advocacy, handbills and posters, seminars, lectures and workshops. These activities will be carried out on a continuous basis to ensure that staff and students are always well informed and guided on their sexual rights and responsibilities.

Monitoring and evaluation strategies will be drawn from data in the Sex Offender Registers and review consultations from Faculties, Departments and Centre's.

10.13 Terms of Reference (TOR) for Coordinator

The Sexual Harassment Coordinator shall;

- a. Develop a Sexual Harassment Policy for the Centre.
- b. Formulate Staff and Student's sexual code of conduct.
- c. Investigate reports of sexual harassment and make appropriate recommendations to Centre leadership for action.
- d. Organize activities to educate staff and students on sexual harassment issues (such as advocacy visits, handbills, posters, seminars and workshops).
- e. Advise on gender balance and inclusiveness.
- f. Assist students with gender related issues.
- g. Scouting for female students for admission into Centre programmes.

10.14 Contact of Coordinator

Prof. Binta Abdulkarim

ACENPEE Building, Beside ABU Business School,

Ahmadu Bello University, Zaria

+234 803 605 3037

+234 909 250 6466

Email: bintaabdul76@yahoo.com

11. ETHICS POLICY

The code of ethics for students of the center is detailed below:

11.1 Code of Ethics

1. The Student shall comply with the Ethics Policy of ACENPEE and all the statutes, policies and rules established by Ahmadu Bello University.
2. The Student shall also comply with all rules and regulations peculiar to his/her Faculty/Department /Unit.
3. The Student shall recognize and respect diversities that exist in the Centre, University and its Community.
4. The Student shall be honest and trustworthy in all his/her dealings with fellow students, staff and the public.
5. The Student shall collaborate with others in a positive, cooperative and courteous manner.
6. The Student shall create and maintain a conducive, safe, physical and emotional learning environment.
7. The Student shall not interfere with another student's academic progress and social welfare.
8. The Student shall not falsify or misrepresent facts, documents, reports or information given to the Centre and the University. Deceitful or dishonest behavior is not in the character of the Centre student.
9. The Student shall submit only original work as a project, thesis, dissertation etc.
10. The Student shall dress decently in accordance with the dress code of the University
11. The Student shall exhibit respect at all times in the class, field assignments and the University at large, by recognizing the constituted authority
12. The Student shall consistently attend classes, field works, practical etc. Absenteeism or tardiness in class or field assignments is unacceptable.
13. The Student shall accept constructive criticisms from other students, lecturers, supervisors or others. A hostile attitude towards learning or tutorial sessions is unacceptable.

14. The Student shall not engage in sexual harassment or accuse others inappropriately of the same.
15. The Student shall not issue explicit or implied threats to members of the Centre and the University.
16. The Student shall not attend classes or field assignments under the influence of alcohol or drugs.
17. The Student shall not use any form of harassment such as phone or GSM calls, email, or written communication toward the Centre and the University.
18. Students should not engage in any form of cult activity.
19. Students must not engage in any form of examination malpractices.
20. Students must not engage in any form of stealing or any other misconduct.

Undertaking: *I have read the Centre Code of Ethics. I understand it and agree to abide by the policies stated therein.*

Student's Name:

Registration No:

Faculty/Dept./Unit:

Signature: - Date:

12.0 RESEARCH POLICY

12.1 Preamble

ACENPEE being a Centre of excellence within Ahamdu Bello University will adopt fully and comply with the research policy of the University of which a detailed copy can be sourced from the link : <https://lifesciences.abu.edu.ng/downloads/docs/abu-zaria-research-policy.pdf>

The Centre recognizes research and research–led teaching as the primary responsibilities of its academic staff. It places value on fostering, publishing, and disseminating research of the highest international quality and University research should serve to develop intellectual independence and promote community learning.

The Centre will ensure that it maintains the highest ethical standards. Dishonesty of any kind in research is unacceptable. Such dishonesty damages the search for truth, the individual(s) themselves, their colleagues and the general community. The Centre cannot permit the integrity of its research programmes to be placed in doubt.

The Centre Research Policy is a university wide policy and these guidelines should be seen as a framework for sound research practice and for the protection of individual research workers, including both staff and postgraduate research students, from possible misunderstandings. This policy sets the framework for the development and implementation of research within the Centre, within which academic staff carry out their required research obligations, and in which graduate students can engage and be supported in their research.

12.2 Research Ethics Policy

12.2.1 Overview

Research Ethics refers to an appropriate conduct of researchers and scholars in the performance or relationship with each other in the course of scholarship and research.

Ethical misconduct in research is any "fabrication, falsification and plagiarism in proposing, conducting or reporting research or other scholarly activities." Fabricating research findings refers to making up fictional results, while falsifying research results refers to altering, misrepresenting, or selectively reporting findings. Each of these acts violates the integrity of the research process and constitutes a serious breach of accepted ethical standards. Ethical research practice therefore

requires that researchers at all stages of the research process conduct their research in an open and honest manner and make every effort to ensure the accuracy of their findings.

Plagiarism is a form of ethical misconduct in research and consists of the intentional or unintentional "use of the words, ideas, diagrams of publicly available work without appropriately acknowledging the sources of these materials." Thus, any use of the words, phrases, ideas, or work of others in any form without acknowledging the original sources constitutes plagiarism.

The Centre, which adopts the ABU Policy on Research Ethics is aimed at protecting the integrity of the University and staff/students in the areas of research and scholarship.

12.2.2 Ethical Guidelines

1. The Centre hold researchers and scholars undertaking various researches within, affiliated to or under the supervision of the University responsible for upholding the following principles:
 - a. Recognizing the substantive contributions of collaborators and students; using unpublished work of other researchers and scholars only with permission and with due acknowledgement; and using archival material in accordance with the rules of the archival source;
 - b. Obtaining the permission of the author before using new information, concepts or data originally obtained through access to confidential manuscripts or applications for funds for research or training that may have been seen as a result of processes such as peer review;
 - c. Using scholarly and scientific rigor and integrity in obtaining, recording and analyzing data, and in reporting and publishing results
 - d. Ensuring that authorship of published work includes all those who have materially contributed to, and share responsibility for, the contents of the publication, and only those people;
 - e. Revealing to sponsors, universities, journals or funding agencies, any material conflict of interest, financial or other, that might influence their decisions on whether the individual should be asked to review manuscripts
2. The Centre through the University will hold Sections and individuals that administer University or Department guaranteed funds responsible for:

- a. Promoting integrity in research and scholarship; and
 - b. Investigating possible instances of misconduct in research or scholarship, including:
imposing appropriate sanctions in accordance with their own policies and informing the appropriate authorities of conclusions reached and actions taken.
3. Researchers should reveal to sponsors, collaborating universities, journals or funding agencies, any material conflict of interest, financial or other, that might influence their decisions on whether the individual should be asked to review or applications, test products or be permitted to undertake work sponsored from outside sources.

12.2.3 Research Compliance

"Research Compliance" refers to the process by which the supervising authority, in accordance with laid down laws and regulations, certifies that research activity is conducted in a legal and ethical way while "Clearance" is the process by which the supervising authority proves this compliance.

A thesis/dissertation represents the culmination of years of academic preparation and uniquely expresses a student's training, skills and ideas. It therefore deserves the student's greatest effort and, as with all scholarly work, demands compliance with the highest ethical standards.

12.2.4 Publication and Authorship

1. Authorship of publications should include and be limited to the individuals who have made a significant intellectual contribution to the research, including students.
2. Reviewers for articles submitted to learned journals should carry out their duties in a timely manner, declaring any conflicts of interest and agreeing to abstain from such situations.
3. Recognize the substantive contributions of collaborators and students as appropriate; Use unpublished work of other researchers and scholars according to the usual conventions (including due acknowledgement).
4. Use scholarly and scientific rigour and integrity in obtaining, recording and analysing data, and in reporting and publishing results.

5. Ensure that authorship of published work includes all those who have materially contributed to, and share responsibility for, the contents of the publication, and only those people.

6. Where young graduates, assistants or postgraduate students are engaged as part of a major research work it should be made clear matters such as the ownership of data, authorship, expected time commitments, access to research funds, remuneration of assistants, space arrangements, and project phases and deadlines etc.

12.2.5 Research Concept and Data Collection

1. All data will be collected and used in a manner consistent with the ethical standards of this policy to be amended to reflect any changes in policy from time to time, and researchers will be notified of the changes.
2. All research reports and articles must contain sufficient data to allow for experiments and analyses to be reproduced

12.2.6 Financial Accountability

1. Any member of staff or postgraduate student funded in parts or whole by the Centre or guaranteed by the department shall disclose any such monies available for the research and present a detailed report on expenditure of the said funds to the Centre.
2. It is the responsibility of the lead researcher to ensure judicious use of funds made available for the research project.

12.2.7 Mandate

Ensuring a high standard of ethical practice in research is primarily the responsibility of researchers, whether departmental staff, or students. The Centre through the University has a collective responsibility to ensure and enable ethical research and to hold each researcher accountable for meeting these standards.

NOTE: More information on the research policy can be sourced from <https://lifesciences.abu.edu.ng/downloads/docs/abu-zaria-research-policy.pdf>

13.0 UNIVERSITY RESOURCE CENTRES

The university has several resource Centres, which facilitates students learning, and overall well being during the duration of their program. They include the University libraries, the University Medical Centre, University Bookshop, ABU Press limited, Guidance and Counselling Unit, the Iya Abubakar Institute of Information and Computer Technology (IAIICT), University Security Services, Sports Office, etc.

13.1. University Libraries

The Library's services and collections are entirely dedicated to support the A.B.U community of Centres, faculty, researchers, students, and staff. It also provides the opportunity for external researchers and postgraduates to request the use of its extensive catalog of books and journals. It provides excellent internet connectivity and efficient online access to our rich e-resources and digital content through our advanced information and communication technology-based facilities.

Detailed information about the library can be sourced on line through <https://library.abu.edu.ng/>

The Ahmadu Bello University Library Complex is made up of about ten major academic and research libraries. These include:

- (a) KASHIM IBRAHIM LIBRARY, also the main library on the main campus Samaru.
- (b) AGRICULTURAL LIBRARY at Samaru, providing information materials in agricultural science and allied disciplines.
- (c) MEDICAL LIBRARY for the Faculty of Medicine and attached to the Institute of Health.
- (d) LEE T. RAILSBACK LIBRARY, established to serve the Faculties of veterinary Medicine and Pharmaceutical Sciences.
- (e) PRESIDENT KENNEDY LIBRARY, the main library nd on the Kongo Campus.
- (f) LAW LIBRARY for the Faculty of Law at Kongo Campus.

Whereas these library function to serve the University Community, their organizational set-up and the classification schemes in use vary according to the literature covered and services requirements. The KASHIM IBRAHIM LIBRARY uses the Library of Congress for classifying its materials, Agricultural Library adopts University Decimal classification Scheme while the Medical Library uses Bernard Classification scheme for Medical literature.

The Kashim Ibrahim Library currently has about 446,690 volumes of books/bound periodicals and 2,873 current journal titles and can seat 2,000 readers.

List of K.I.L Resources Floor – By – Floor The Library occupies a two-storey building. Care has been taken not to duplicate the location of resources and facilities except where it is absolutely necessary

Ground Floor: On the ground floor of the library, you find a large exhibition Hall. Directly opposite the Main Control Desk is the Circulation Desk at the other end of the Exhibition Hall. Standing in front of the Main Control Desk, there are from the right to the left hand sides of the Exhibition Hall; Male and Female toilet; entrance to the Serial Reading Room; Circulation Librarian's Office; the New books Display Racks; Circulation Desk; Library Catalogue; the door to the Reference Reading Room; Photocopying Room; Information Services Unit and another Photocopying Room. On the same ground floor, there is an MTN/Foundation visual Library. The Library also has 50 work stations equipped with state of the art Internet Facilities.

First Floor On the first floor, there are medical Division, the S-H and J-P (Class marks) collections of Art and Social Science, Study Carrels, the office of the University Librarian

Second Floor The second floor contains the Q-Z collection of science, Technology, Librarianship, African materials, rare books, Thesis, Dissertations as well as other Documents.

Joining and Using the Library

1. Membership

Membership of the Library is open to the students of the University, who, on completion of all registration formalities, are issued with borrowing tickets. One registration lasts for the entire course duration and entitles students to borrow the following number of books:- Post-Graduates 10 at any given time Undergraduates 7 at any given time

2. How to Borrow Books, Journals etc.

All the borrowing exercise is conducted at the Circulation Desk. The books to be borrowed and the borrower's identity cards should all be presented to the staff at the lending desk, who would key the information into the computer.

3. *Reservation of Books*

Books on loan, but which other readers require may be reserved by filling Reservation Card obtainable at the Circulation Desk.

The Collection of the Library

1. *General Lending Collection*

The general lending stock is housed in K.I.L's three main reading rooms, A-H and J-P on the first floor, and Q-Z on the second floor. The books are arranged on the shelves in classified order by subject.

2. *Reference Collection*

The staff member in the reference reading room assists readers in finding information in the collection of encyclopaedias, handbooks, yearbooks, dictionaries, atlases, bibliographies, abstracts, indexes and other sources of information

3. *Reserve Books*

Textbooks and other materials in heavy demand are kept in the reserve book room. To obtain the use of a book, a reader fills a request slip and hands it in together with identity card to the staff, who supplies the publication. A book so borrowed must be used in the reserved Book Room only for two hours subject to renewal if nobody request for it.

4. *Serials Collections*

The serials (i.e. newspapers, Journals, magazines etc) are normally published at regular intervals, and issues are collected and usually bound together. The Serial Collection in K.I.L is housed in two separate sections on the ground floor:

- (a) The unbound issues of the current volumes are displayed in one half of the large room to the right of the exhibition hall.
 - (b) The bound volumes or back sets of journals are housed in the second half of the same room.
- All series taken by the Library are entered alphabetically by title on Stripdex catalogue labelled "Serials Catalogue" located by the serials control counter.

5. *Non-Book Material*

The Library holds microfilms, video cassettes, photographs, records and cassettes in the media Division on the first floor. Readers should contact the staff in the Division if they wish to use any of these materials.

6. *Africana, Rare Books and Theses/Dissertations*

Africana collections comprise book, and theses/dissertations, mostly of research level pertaining to areas of African studies. There are book collections, also in the same room with Africana/theses/dissertations. This floor contains books, which because of their date of publication, physical format and other qualities are considered extremely valuable.

7. *Documents*

The Document Unit has the following collections:

- (a) The United Nations Publications since April 1970
- (b) Government Publications.
- (c) Official Publication of other institutions, e.g. annual reports.
- (d) British and Nigerian standards and codes of Practice.
- (e) Printed materials deposited by publishers.

The collections of Africana, rare books, theses/dissertations and documents are solely for reference and items in them may not be borrowed.

8. *General Reading Collection*

A small collection of light reading material is kept on the ground floor to the right of the Circulation Desk. This collection is periodically changed and kept current for readers interested in light and casual reading.

Facilities Provided by the Library

1 Photocopying Photocopying facilities are available at a small charge (on the ground floor) compared to the high cost of books; copyright regulations must, however, be observed.

2 Inter-Library Borrowing Inter-Library borrowing of books (not available in Kashim Ibrahim Library) can be arranged on application by the reader to the Circulation Librarian. Where production is involved, the reader shall be required to bear the cost.

3 New Book Display New additions to the Library stock are displayed to the right of the Circulation Desk for a week before they can be borrowed.

13.2 University Medical Centre (UMC)

The University Medical Centre (UMC) is deeply committed to promoting the physical and mental wellbeing of Ahmadu Bello University students. UMC is a primary care facility. The Clinic offers free medical care to registered students University, medical examination, antenatal care, child welfare services. Family planning services, eye care; dental care, immunization, laboratory services and free dispensation of drugs from Pharmacy. Cases requiring specialist attention are referred to A.B.U. Teaching Hospital, Zaria with due consent of your Health Management Organization (HMO) who will bear the cost later. To enjoy the full compliments of the medical services offered by this clinic you must ensure the designated Health Management Organization (HMO) duly registers you. Please enquire from Student Affairs Division or the (UMC) for more information.

Location of Clinics

There is a UMC on the Main Campus adjacent to Suleiman Hall. It houses an administrative block, several consultation rooms, an Emergency room, an in-patient admission room, eye clinic, dental clinic, laboratory, Antenatal clinic, child welfare and Family planning clinic. There is also a preventive and sanitation unit. Satellites Clinics have been established in NAPRI, IAR, Kongo, Shika, etc.

Registration

New students are required to register immediately the semester begins. They should not wait until they fall sick. No charges are levied yet. The Vice Chancellor has now approved the extension of the National Health Insurance Scheme (NHIS) to postgraduate students.

Working Hours

University Health Service opens from 7:30am to 8:30pm for routine case Mondays through Saturdays (except on public holidays), Emergency case are however, treated on 24-hour basis.

Medical Laboratory Investigation:

In order to avoid fake medical test results that could distort early diagnosis and misguide the doctor, the doctors of the UMC do not accept investigation from laboratories other than their own at the Sick Bay. Fortunately, our medical laboratory is fully equipped and well-staffed. Furthermore, there is an arrangement with the Ahmadu Bello University Teaching Hospital to help us with investigation not done in our laboratory.

Medical Report:

Medical report is issued on request to the students treated in our clinic. The doctor that treated the ailment usually writes the report. A student who received treatment while at home should endeavour to collect medical report from the hospital or clinic before returning to the University. This is to avoid the inconvenience of having to go back for the report. The Sick Bay, on request of the Head of Department, also does authentication of medical reports brought from elsewhere. Such reports are confidential and should not involve the student confronting the Director for authentication. Note that we do not accept report from traditional healers. The University Health Service is fully aware of the attitudes of some students that malingering around the Sick Bay for medical cover for deliberate absenteeism. You are advised not to fall into that category.

Advice on Health Matters to New Students:

All students having left their parents may be faced with many challenges. You are advised to tread cautiously as you explore new grounds. Realize that HIV/AIDS is a reality, even on this campus. Your health is in your hands. You need to remain healthy in order to graduate. Being healthy means, you maintain a sound physical, mental and psychological well-being. You are expected to maintain a good personal hygiene and a clean environment. Avoid eating and drinking indiscriminately, especially when travelling. Learn to plan your time well in order to avoid stress associated with last minute preparations for your examination. Make sure you observe at least 8 hours sleep daily. Find time for regular outdoor exercises, at least 30 minutes, 3 days a week. Remember a sound mind is in a sound body.

Drug Abuse and Misuse:

Do not allow academic stress or the influence of bad friends drag you into drug abuse. Avoid all forms of stimulants, Panadol, cola nuts, Indian hemp, cigarette smoking, Pengo, Alabukun, etc. Take only prescribed drugs. It could be very dangerous. Avoid it. Try to see a doctor at the slightest sign of ill health.

Infectious Diseases

Malaria remains the number one cause of morbidity and hence poor academic performance in the environment. Help yourself by trying as best as you can to avoid mosquito bites. The use of mosquito nets, insecticide sprays and proper dressing can be very helpful. In any case see a doctor at the earliest symptoms. The commonest killer disease is typhoid fever. Make sure what you eat or drink is hygienic. A vaccine is available for those who can afford it. Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Most people

infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness.

Take preventive measures against:

COVID- 19

The best way to prevent and slow down transmission is to be well informed about the COVID-19 virus, the disease it causes and how it spreads. Protect yourself and others from infection by washing your hands or using an alcohol based rub frequently and not touching your face.

The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so it is important that you also practice respiratory etiquette (for example, by coughing into a flexed elbow).

At this time, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments. WHO will continue to provide updated information as soon as clinical findings become available.

Malaria (e.g., use mosquito net, long sleeve shirts in the evenings, avoid indiscriminate throwing of waste water etc)

Typhoid: (Wash hands with soap and water after toilet; boil drinking water, warm leftover food before eating; avoid eating open food and water accessible to flies, avoid indiscriminate disposal of waste)

Tuberculosis: (avoid indiscriminate spitting; boil cow milk before use; encourage any of your colleagues with chronic cough, coughing out blood, or loss of weight of up to 5kg to seek medical attention at the University Health Centres.

Meningitis: Epidemics of this disease are not uncommon in this region. Fortunately an effective vaccine is available against it. Faculty-to-Faculty immunizations are usually conducted between February and March each year. Those of you who missed that opportunity can meet us at the preventive health section of the University Health Services. Routine immunization is carried out every Wednesday throughout the year.

Sexually Transmitted Diseases (STDS):

These include Gonorrhoea, Syphilis, Genital Herpes and AIDS, among others. There is a high prevalence of these conditions among staff and students of this University. The complications of

STDS vary from loss of man-hour, poor academic performance, infertility to inevitable death in some cases. You should know that HIV AIDS is real and is here with us. Do not underestimate it. An HIV infected person may look quite normal like you. So be cautious and responsible while you discover your new world. Make sure you take certificates home and not AIDS. AIDS and the STDS are preventable through abstinence, avoiding casual sex and sticking to one partner. If you must have sexual intercourse, always use the CONDOM. Condom protects from STDS and unwanted pregnancies. However, it does not give 100% safety. If you would like to know your HIV status, screening is free at the Sick Bay. Contrary to what a lot of local traditional healers and some medical professionals proclaim, there is yet no vaccine or cure for AIDS. Don't be deceived.

Rape

There have been a few reported cases of rape in recent times. Avoid provocative dressing and don't walk around alone especially at night. Potential rapists must realise that it is a criminal act, which is punishable by immediate expulsion with subsequent Police action.

Dental Health

Take care of your teeth. Brush your teeth at least twice daily, in the morning and in the evening, preferably after your meals. Visit our Dental Clinic or your Dentist every 6 months for routine checks. Do not wait until it hurts.

Physical Fitness Examination/Certification

We carry out fitness examination in our clinic on demand or where it is binding on students. Diseases that could interfere with your academic performance would be identified and treated. You are required to present a certificate of good health before registration.

Staff Quality

The University Health Services has able and experienced medical doctors, pharmacists, medical laboratory scientists, nurses, public health officers and other paramedical staff. Do not hesitate to face them with your health problems.

13.3. University Bookshop (A.B.U. Bookshop Limited, Zaria)

The University bookshop was opened in July, 1967, to cater for students and academic staff needs of books and stationeries. Since its establishment, the range of books and subject is rapidly expanding and the number of books presently stocked is in the region of 200,000. On the main campus it is located near the security office.

There is a branch of the University Bookshop at the Kongo Campus.

Hours of Opening 1st & 2nd Semester

Monday – Friday 8.30a.m – 4.00p.m

Saturday: 8.30a.m – 1.00p.m

13.4 ABU Press Limited

The Ahmadu Bello University Press was established in 1974. The organization was incorporated in 1978 with publishing scholarly texts of nature as its focal point. Over the years it has blossomed into a formidable publishing outfit undertaking printing works of all kinds for the University and the general public. With its sophisticated modern printing machinery it can produce texts not only in English, Arabic and French, but also in Hausa, Yoruba, Igbo and other Nigerian Languages. In addition, the Press handles all sorts of printing for the University Community. It also prints posters, handbills, wedding cards and calendars, almanacs, stickers and complimentary cards. Student and staff can approach the Press for a desperately needed textbook, printing of posters or union almanacs or the binding of a final year project. The Press operating hours are 8a.m – 1p.m., 2p.m – 5 p.m. daily, except Saturdays and Sundays.

13.5 Iya Abubakar Institute of Information and Computer Technology (IAICT)

Formally known as Iya Abubakar Computer Center, Established in 1967 as a detachment from the Department of Mathematics of the Ahmadu Bello University, Zaria. In 1976, Moved to its permanent location and installed the CYBER 72 mainframe serving 60 user Departments of the University and in 1989 Replaced the CYBER 72 mainframe with the CYBER 932 mainframe. Also in 1998 Installed micro computer systems and all operations became end-user oriented. The Centre provides a full central computing service to all staff, research workers and students. The institute is saddled with the responsibility of providing timely and qualitative computing and information technology services of the University. Other microcomputers are now available for a variety of purposes including teaching, software research, management information and interactive simulation studies.

The University succeeded in deploying a robust optic-fibre network linking the major University campuses. The robust IT infrastructure facilitates delivery of high-speed internet and intranet access suitable for e-learning services, on-line applications and multimedia communication services. In furtherance to achieving this vision and to maximally harness the benefits from the

abundant potentials, IT services should be deployed effectively and efficiently to improve service delivery.

More details about the center can be sourced on line from <https://iaiiict.abu.edu.ng/>

13.6 University Security Services

The University Security Services falls within the Office of the Vice Chancellor. It is located beside the former Headquarters of the defunct Institute of Health adjacent the University Bookshop. A Security Coordinator who is assisted by the Chief Security Officer (CSO) heads the Division. Its functions are coordinated in conjunction with the Security Committee and there are security units on all the Campuses.

The Division has the following traditional responsibility:

- a. Maintenance of Law and Order as well as the sustenance of peaceful atmosphere that is conducive for the pursuit of academic activities.
- b. Protection of lives and property and ensuring that crime rate is brought to a manageable proportion.
- c. Receiving reports and vital information on criminal activities and carrying out investigations.
- d. Issuance of identity cards to both staff and students, cover notes as records for lost items and documents as well as Gate Pass for lawful removal of private genuine property through the University Gates.
- e. Taking lawful and temporary custody of private property and releasing same when desired by the owners. Seizing stolen items or ones suspected to be stolen and restore to the rightful owners on proper identification.
- f. Arresting and detaining suspects and criminals for interrogations.
- g. Fighting fire and its spread within the campus and staff quarters.
- h. Effective patrol of the campus to detect crimes.

The services of the Division are available 24 hours a day. All Information or other security related problems should be promptly reported to either the Headquarters or any security office (Officer) nearby. The Division avails itself to all for the continued maintenance of a peaceful environment for academic and other activities.

Tips on Security:

Security is defined as “generalised state of all well-being of the University arising from the safety of its personal, official secrets and corporate reputation”. This definition goes beyond the narrow concept of security in terms of preventing theft and burglaries to embrace all threats to the **PRINCIPAL OBJECTIVES OF THE UNIVERSITY**. This broad concept of security in the University underscores the point that the business of ensuring safety and general conducive atmosphere for learning and research involves so many aspects, which cannot be left to security personnel alone. In other words, security must be seen as a collective responsibility. All the stakeholders have their roles to play, particularly the students.

The Role of Security Personnel:

1. Protection of lives, property, and members of the University community including you as students.
2. Maintenance of law and order as well as the sustenance of peaceful atmosphere that is conducive for the pursuit of academic activities.
3. Prevention of crime and apprehension of offenders.
4. Detection of crime and enforcement of rules and regulations of the University. (Some of these rules and regulations are clearly outlined in this book (Centre Students Handbook as well as the ABU PG school handbook), your tenancy agreement forms which you signed at the Hostels, and you are very much expected to abide by them.
5. The Security Unit is also charged with the responsibility of issuance of I.D. Card to all members of the University Community. The importance of I.D. Card to you can never be over-emphasised.
6. Security Unit also deals with complaints from the staff and students. We intervene in disputes arising between parties concerned within the University community only. We also investigate criminal cases, findings of which are reported to the University authority or Police for further action depending on the nature of the case.
7. The Security Office issues cover notes to students at point of entry into the Campus with their personal effect in case their receipts were either lost or misplaced, after careful investigation. This becomes necessary because when taking any item out of the Campus,

the receipts or such notes must be produced at the gate otherwise you will not be allowed to carry such items out.

8. This is just to mention but a few of the roles Security play in the University. Since all tasks ahead of the Security Personnel are aimed at safeguarding the members of the University community particularly the students, you are expected to cooperate fully with us to achieve the desired goals, which encompass peace, stability and harmony, without which the very basis of the University will be defeated.

The Role of the Students in enhancing Security:

1. Assist Security Office with true and justified information without prejudices concerning any criminal act(s) or any secret plan to disrupt peace in the University, which you have knowledge of.
2. Report promptly to Security Office any suspicious move or movement of individual(s) in any part of the Campuses.
3. Always avail yourself to be checked at the gates or anywhere when security staffs demand to do so, as refusal can create many problems.
4. Do not support your fellow student(s) in criminal acts as this will certainly promote injustice and confusion within the University.
5. You should generally inculcate the habit of security consciousness.
6. Do not bring expensive and costly items to school, as they always attract thieves.
7. Keep your money in the Bank and retain only pocket money with you.
8. Students should always keep their doors locked while leaving the room, even to the bathroom or while in bed.
9. Do not align yourself to any group that holds its meeting secretly. That will certainly ruin you and affect your studies. Secret cult is deadly; you must have to avoid it.
10. Do not organise or participate in any riot/demonstration that would lead to total breach of peace, but adopt method of dialogue in addressing your grievances with the management.

It is important to note that the services of the Security Division are on a 24 hours basis. Therefore, all information, complaints and other security-related problems should be promptly reported to the Security Sub-Unit offices or the Security Headquarters.

Finally, you should always remember what you have come to the University for and ensure that you work diligently towards that goal. The achievement of this goal will give you an honourable status, honour to your family and the entire nation. Do not emulate the bad example of those who waste ten solid years pursuing one degree and end up being expelled.

13.7. Sports Office

Ahmadu Bello University maintains a virile programme of sports, athletics and recreational activities under the supervision of experienced full-time sport coaches and a number of honorary coaches from among the academic and administrative staff. The Sports Offices is located at the New Gymnasium of the Samaru Campus a sub-office at the Kongo Campus. A Director with coaches for each sporting activity heads the Office.

The duty of the sport office includes the following:

- (a) To arrange for students participation in all sporting events on the campus, at national and international level.
- (b) To advice the University on all aspects of sporting activities including the provision of sports equipments and facilities. Available sports facilities are distributed throughout the campus as follows:
 - (i) The new Gymnasium located north of Danfodio Hall has squash racket and badminton courts.
 - (ii) Basketball and volleyball courts are opposite Amina Hall.
 - (iii) Swimming pool, Handball, and Lawn Tennis Courts are located between Sulaiman Hall, Demonstration Secondary School and Amina Hall.
 - (iv) Athletics, Soccer, Hockey, and Crickets field are at the North Gate.
 - (v) Judo, and Taekwondo are at the old Gymnasium by the Convocation Square.
 - (vi) Chess at Alexander Hall Common Room.
 - (vii) There are also sports facilities at Kongo Campus and Barau Dikko Hall. Halls of residence have facilities for various recreational games including table tennis, badminton, etc.

Sports Administration

The sport Committee appointed by the Vice-Chancellor is the body governing sporting activities on the campus. There is also a Sports Committee of the Students Union, which plays an active part in organizing students for participating in inter-hall competitions. The University is a member of the Nigerian Universities Games Association, (NUGA), the West African University Games (WAGU), the Federation of African University Sports (Federation of Africane du Sports Universities, FASU) and the Federal Internationals Universities Sports (Federal Internationale du Sports University FISU). The University participates in both national and international sports contest organized by these associations. There is spirited competition among the halls of residence for the possession of the Championship cups, especially in soccer and Athletes.

What you can gain from the University Sports

Apart from maintaining a sound body, which is an asset for advanced thinking and rigorous academic pursuit, students, have the added advantage of travelling with teams outside this country. The Sports Office maintain bilateral annual friendly competitions in some selected sports with some U.S Universities which is open to all student, through these competitions students can make friends with other nationals. There is also a good opportunity of being awarded sports scholarship, which is part of inducement for good performance in sports and academic pursuit.

13.8 Guidance and Counselling Unit

The guidance and counselling Centre is one of the specialized services provided by the University to cater for students' wellbeing and to advise students on a wide range of their difficulties. It is also to perform all the functions of the office. The centre maintains a team of dedicated counsellor who offer helpful and understanding environment to students for the discussion of any matter, which is causing them concern.

Broadly, the centre serves as/for:

- (a) Rehabilitative function, which is to help students having trouble.
- (b) Preventive function, which is to anticipate, circumvent and forestall difficulties, which may arise in the future.
- (c) The overall function is to help the student derive maximum benefit from his educational, social and vocational experiences to enable him discover and develop his potentials to the fullest. Students are advised to seek the services of the centre in case of difficulties.

The Guidance and Counselling Unit also performs the following functions:

- (a) To organize career talks for prospective graduates.
- (b) To advise students and alumni on the choice of career, and to assist them on graduation, in securing suitable employments.
- (c) To organize and coordinate recruitment interviews by Government Ministries and parastatals; commercial enterprises, companies and other organizations wishing to recruit our undergraduates for permanent or part-time employments
- (d) The Office provides information about opportunities for part-time or full-time employment, for further training and study for higher degrees and for introduction to an interview with prospective employers.

Location: The Guidance and Counselling Unit is located beside Queen Amina female hostel opposite the basketball courts on main campus.

14.0 STUDENT'S WELFARE

14.1 Student Affairs Division

ACENPEE will liaise with the Student Affairs Division of the University that is managed by a Dean whose primary responsibility is the welfare of students during studies and stay in ABU.

The Students' Affairs Division (SAD) was established in 1986 following a re-organization emanating from the provision of the white paper on the Abisoye Panel's report. Consequent upon this re-organization, SAD was relocated to the office of the Vice – Chancellor, exercising the power bestowed on the Vice-Chancellor by Statute 9 of the ABU Law to handle Students' matters. The Students Affairs Division is located on the first floor of the Senate Building and is under the direction of Dean of students. As recommended by the Ford foundation Study Group in 1974, the Dean of Students Affairs should be “an inspiring and imaginative leader conscious of the hopes, aspirations and problems of modern day students, and a person of empathy and scholastic achievement”. The Dean must be skilled in human relations and an advocate of student needs.

Functions of the Students Affairs Division

The functions of the Students Affairs Division Includes the following:

1. Advise the Vice-Chancellor on policies, regulations and matters affecting students.
2. Develops Student cultural and social activities.
3. Develops Students recreation and sports programmes.
4. Supervises award of financials aids, scholarship and bursaries to students.
5. Provides careers information, and guidance and counselling.
6. Administration of halls of residence and dining halls.
7. Develops procedures for administration of students discipline and provisions for appeals to the Vice-Chancellor.
8. Assists with development and administration of Students Union.
9. Administers informational programmes to keep students advised on university and community affairs, available scholarships, etc.
10. Assist student organizations to publish student journals, magazines and information sheets for internal consumption.
11. Caters for the welfare including medical assistance to the sick and death relief to the deceased.

14.2 Accommodation

ACENPEE will liaise with the Dean Student affairs and the University management to have a dedicated block of hostel accommodation well-furnished and equipped for students of the Centre to stay in during the course of their program.

The University has sixteen halls for residence accommodating about 40% of the students. Eight of the halls (Akenzua, Amina, Alexander, Danfodio, ICSA, Ramat. Ribadu, Sulaiman) are on the Main Campus. Amina, Alex and Ribadu Halls Accommodate female students. The remaining six are at the Kongo Campus comprising Ali Akilu, Tafawa Balewa, Hostels 1, 2 and 3, Bedde and Sardauna. Hostels 1 and 2 Bedde and Sardauna Halls Accommodate only female students.

Of these hostels, Postgraduate students are accommodated in Amina, Suleiman and Akenzua halls as well as the Alh. Umaru Musa Yar'adua and Sassakawa hostels on the Main Campus and the Postgraduate Hostel on Kongo campus.

There is an Accommodation Officer, who is responsible for student accommodation. In each hall, there is a Hall Administrator and he/she has Porters and Cleaners who are responsible for issuing of keys to the rooms and keeping the Halls clean. There is a kitchen attached to each hall and are being run by reputable private caterers. Students can use any of these dining facilities (NOTE: males are not allowed into female dining halls).

All new Postgraduate students on reporting at the Main Campus are expected to collect their letters of admission from the Secretary, SPGS as well as the Centre before calling on the Hall Administrators to officially hand-over to them rooms earlier booked online. The Centre will facilitate this process for the regional students. Students are therefore, expected to know which hall they have been allocated.

Any room assigned or allocated is for two semesters (First and Second Semesters only) and the long Vacation Semester attracts additional rent. Students cannot also lay claim to rooms at the beginning of each session until an allocation is made and paid for. Post graduate students who wish to stay in their rooms during the Long Vacation semester need to make this known to the Accommodation Officer and pay the prescribed rent for the period.

Students are required to be in residence during the semester but not necessarily on Campus. At the beginning and end of each semester, students are required to report to their Hall Administrators in

order to sign the book provided for the purpose. On no account should a student go away with a key to a room during the long vacation. An offender may forfeit any allocation of a room the following session and will be required to pay the rent due for the period.

Each student must occupy the room allocated to him/ her unless the Dean of Students Affairs legally approves a change. Each student will be responsible for the care of furniture in the room and replacing of broken or lost keys. It is a serious offence for any student in the hostel to sell or sublet his room, bed space, harbour squatters or acquire accommodation on behalf of another student. Students who fail to return their keys before leaving the University campus for any period in excess of 24 hours will automatically lose the entitlement to accommodation for the rest of their course.

14.3 Living Arrangement

Accommodation in Hall of Residence

It is the policy of the University to provide an environment that will assist each student to develop his or her academic and social potentials to the fullest. For this reason, the hall of residence are considered an integral part of the total education enterprises at Ahmadu Bello University. The halls are not merely places to sleep in, but are “homes” for students for a good part of the year. Each hall has modest conveniences including showers, furniture and beddings. Each set of toilets and showers serve about ten students. Students who occupy a hall are responsible for all the conveniences located in the hall. Reception lounges, well-furnished Common-rooms and recreation areas are available in each Hall. The Housekeeper and the Porters are always available to attend to the needs of occupants.

14.4 Mail Services

Mail is delivered to each Hall daily, except Saturdays, Sundays and public holidays. Students living in halls are advised to always use the name of their hall, before Ahmadu Bello University, Zaria in order to facilitate the handling of their mail in the office of the Hall Administrator.

14.5 Shopping Facilities

Apart from the many shopping facilities in Samaru and Zaria, the University Campuses house several shopping complex, kiosks, buffets, and minimarkets. Some of these facilities are located inside the hall of residence. Although all shopping and other goods and services facilities are run through private operator, the University authority approves and supervises their activities through

a central coordinating committee. No other body of staff is authorised to initiate, approve or supervise commercial activities on campus.

14.6 Places of Worship

Facilities are provided for religious worship on the campuses. There is a Central Mosque with a resident Imam for the Muslims and two Chapels with resident Catholic and Protestant Ministers for the Christians on campus. It is envisaged that the relationship between the various religious groupings will remain cordial, as it has been over the years. The Imam, Priests, and other learned or ordained staff members offer religious counselling. Students may seek and receive advice on any form of personal or social matter including marriage plans.

15.0 INTERNATIONAL STUDENTS' DESK

Requirements for ECOWAS Member States/Residence Card

1. Valid International passport or ECOWAS Travel Certificate
2. Letter of Admission
3. Letter of Acceptance of Offer
4. Declaration of age
5. 3 passport sized photographs
6. Application/Acceptance of Immigration responsibility by ABU (on letter headed paper).

Requirements for Non-ECOWAS Member States/CERPAC

1. Valid International passport
2. Letter of Admission
3. Valid Visa – STR (subject to regularisation)
4. Letter of Acceptance of Offer
5. Declaration of age
6. 3 passport sized photographs
7. Application/Acceptance of Immigration responsibility by ABU (on letter headed paper).

Refugees

1. UN refugee passport
2. Evidence of full accreditation in Nigeria
3. Fee – N500.

Procedures for Filing Applications

Applications for residence card (ECOWAS States) or combined expatriate residence permit and aliens card (CERPAC) for non-ECOWAS Member States should be addressed to the State Comptroller of Immigration, Kaduna through the in-charge Zaria office for processing.

Requirements to Accompany the Application

All applicants are expected to pay the following fee;

1. ECOWAS member countries: N500:00 – N2, 500:00 depending on the nationality of the applicant.
2. Other nationals: \$25 or the naira equivalent for (CERPAC) Residence permit irrespective of the applicant's nationality.

Immigration Responsibilities of the Students on the University

It is the duty of the Ahmadu Bello University to accept full immigration responsibilities on behalf of the students before applications for regularisation could be processed.

Other Information

1. An endorsement at the point of entry to show that the applicant entered the country legally.
2. All applicants are expected to submit photocopies of their documents in triplicate except the letter of acceptance of immigration responsibility which **MUST BE ORIGINAL**.
3. Residence card is renewable after 2 years while CERPAC is only for one year.
4. Holders of any immigration facility who engage in any crime or related offences stand the chance of losing such right even before its expiration.

16. ACADEMIC STAFF LIST

DEPARTMENT OF CHEMICAL ENGINEERING ACADEMIC STAFF LIST

Name of Staff	Rank	Qualifications	Specialty
AHMED, A. S.	Professor	B.Eng, M.Sc. (ABU), Ph.D (UK)	Engineering Materials & Heat Transport
ADEREMI, B. O.	Professor	B.Eng, M.Eng (Benin), Ph.D (ABU)	Reaction Engineering and Catalysis, Materials and Biochemical Engineering
EL-YAKUBU, B. J.	Professor	B.Eng (ABU), M.Sc. (Saudia), Ph.D (UK)	Applied Catalysis, Enhanced Oil Recovery, Engineering Education/Accreditation, Computational Design of Materials
MOHAMMED- DABO, I. A.	Professor	M.Sc. Ph.D (Russia)	Petroleum Refining, Biofuels Technology, Pilot Plant Development, Environmental Pollution Control and Water treatment
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OLOWOSULU, A. T.	Professor	B.Eng., M.Sc., Ph.D (ABU)	Highway Engineering
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EBEREMU, A. O.	Reader	B.Eng. (FUTO) M.Sc. Ph.D (ABU)	Geotechnical & Geoenvironmental Engineering
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