

UNIVERSITY OF NIGERIA, NSUKKA

FACULTY OF PHYSICAL SCIENCES

DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY

REVISED Ph.D. DEGREE PROGRAMMES

2015/2016 SESSION

UNIVERSITY OF NIGERIA, NSUKKA
DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY
PhD PROGRAMMES IN CHEMISTRY

PHILOSOPHY

The programmes provide training in in-depth experimental research designed to make contribution to chemical knowledge.

OBJECTIVE

To produce high level manpower for academia, research institutes, industries and for government policy formulations.

SCOPE

Studies will be offered in the broad areas of Inorganic, Organic, Physical Analytical, Fossil Fuel, Polymer, Environmental and Industrial Chemistry.

ENTRY REQUIREMENTS

Graduates of the University of Nigeria, Nsukka or other recognized Universities with masters' degree with CGPA of at least 4.0 on a 5 point scale, 3.0 on a 4 point scale or their equivalent will be eligible for admission to a Ph.D. programme.

MODE OF STUDY

Students will be expected to carry out 12 units comprehensive research work that will lead to a thesis. In addition students are required to offer 6 units course work, and 12 units' seminar.

DURATION OF STUDY

Full Time: 6 Semesters minimum and 10 semesters maximum

Part Time: 8 Semesters minimum and 12 semesters maximum

EMPLOYMENT OPPORTUNITIES

Successful postgraduate students are equipped for careers in teaching, research institutes, chemical laboratories, Ministries of Science and Technology, Industry

Environment, and in such diverse industries as vegetable oils, soap and detergents, paints and varnishes, plastics, brewing, pharmaceutical, sugar, paper and pulp, textiles, fertilizer, cement, ceramic, iron and steel, petroleum, coal, dyestuff and other chemical industries.

AREAS OF SPECIALIZATION

1. Inorganic Chemistry
2. Physical and Theoretical Chemistry
3. Organic Chemistry
4. Analytical Chemistry
5. Fossil Fuel Chemistry
6. Polymer Chemistry
7. Industrial Chemistry
8. Environmental Chemistry

STRESS AREAS

Inorganic Chemistry	0
Physical and Theoretical Chemistry	1
Organic Chemistry	2
Analytical Chemistry	3
Fossil Fuel Chemistry	4
Polymer Chemistry	5
Industrial Chemistry	6
Environmental Chemistry	7
Project/Seminar/General	9

Course No.	Course Title	Units
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INORGANIC CHEMISTRY

Doctor of Philosophy degree in Inorganic Chemistry will expose the students to advanced knowledge and research in Inorganic Chemistry.

CHM 701	Current Trends in Inorganic Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

PHYSICAL CHEMISTRY

Doctor of Philosophy degree in Physical Chemistry will expose the students to advanced knowledge and research in Physical Chemistry.

CHM 711	Current Trends in Physical Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

ORGANIC CHEMISTRY

Doctor of Philosophy degree in Organic Chemistry will expose the students to advanced knowledge and research in Organic Chemistry.

CHM 721	Current Trends in Organic Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

ANALYTICAL CHEMISTRY

Doctor of Philosophy degree in Analytical Chemistry will expose the students to advanced knowledge and research in Analytical Chemistry.

CHM 731	Current Trends in Analytical Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

FOSSIL FUEL CHEMISTRY

Doctor of Philosophy degree in Fossil Fuel Chemistry will expose the students to advanced knowledge and research in Fossil Fuel Chemistry.

CHM 741	Current Trends in Fossil Fuel Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

POLYMER CHEMISTRY

Doctor of Philosophy degree in Polymer Chemistry will expose the students to advanced knowledge and research in Polymer Chemistry.

CHM 751	Current Trends in Polymer Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

INDUSTRIAL CHEMISTRY

Doctor of Philosophy degree in Industrial Chemistry will expose the students to advanced knowledge and research in Industrial Chemistry.

CHM 761	Current Trends in Industrial Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

ENVIRONMENTAL CHEMISTRY

Doctor of Philosophy degree in Environmental Chemistry will expose the students to advanced knowledge and research in Environmental Chemistry.

CHM 771	Current Trends in Environmental Chemistry	6
CHM 793	Nanochemistry	4
CHM 790	PhD Seminars	6
CHM 791	Thesis	12
PGC 701	Synopsis and Grant Writing	3
	Minimum	31

COURSE DESCRIPTIONS

- CHM 701 Current Trends in Inorganic Chemistry (6 units)**
Lectures, seminars and paper presentations on cutting edge research in topics such as:
- (i) Supramolecular chemistry: Metal organic frameworks, multipodal ligands etc.
 - (ii) Bioinorganic chemistry: Interaction of metals with biological molecules, role of bioinorganic compounds in biological systems.
 - (iii) Catalysis: Synthesis and characterization of new catalytic materials and their applications in industries.
 - (iv) Properties of coordinations and organometallic compounds with respect to synthesis of new compounds, redox reactions etc.
- CHM 711 Current Trends in Physical Chemistry (6 Units)**
Lectures, seminars and paper presentations on cutting edge research in topics such as:
- (i) Catalysis and photochemistry in heterogeneous media.
 - (ii) Physical chemistry of colloids and interfaces
 - (iii) Surface and interfaces of nanostructured systems.
 - (iv) Heterogeneous kinetics, isotopic effects, fast reaction techniques.
 - (v) Physical chemistry of macromolecules.
 - (vi) Advances in quantum mechanics, computational chemistry and applications.
- CHM 721 Current Trends in Organic Chemistry (6 Units)**
Lectures, seminars and paper presentation on cutting-edge research topics in organic chemistry, such as:
- (i) Transition metal complexes as catalysts in organic synthesis.
 - (ii) Combinatorial chemistry including throughput screening in drug development.
 - (iii) Application of biological catalysts and proline in organic transformations
 - (iv) Application of microwave and ultrasound in organic transformations.
 - (v) Green chemistry (solvent free organic transformations).
 - (vi) Application of dyes in the development of artificial photonic antennas and solar cells.
- CHM 731 Current Trends in Analytical Chemistry (6 Units)**
Lectures, seminars and paper presentation on cutting edge research in topics such as:
- (i) Use of different statistical softwares (Matlab, SPPSS,

Excel etc) in chemometrics e.g. Multivariate analysis, ANOVA, (one tailed and two tailed significant test), correction analysis etc.

(ii) Solid phase extraction (SPE) and super critical fluid extraction (SFE): principles and application.

(iii) Chromatographic techniques: ion chromatography (IC), ion Exclusion chromatography (IEC), hydrophobic interaction chromatography (HIC), HPLC, etc.

CHM 741 Current Trends in Fossil Fuel Chemistry (6 Units)

Lectures, seminars and paper presentations on cutting edge research on topics such as:

- (i) Shale oil exploitation
- (ii) Mechanism of biogenic crude oil formation
- (iii) Coal mining and utilization
- (iv) Environmental, health and safety implications of fossil fuel exploitation .
- (v) Production of gasoline from refinery gases.

CHM 751 Current Trends in Polymer Chemistry (6 Units)

Lectures, seminars and paper presentations on cutting edge research on topics such as:

- (i) Green polymers/applications and strategies for polymer recycling
- (ii) Nanofabrication in polymer matrices.
- (iii) The concept of biorefinery and its implications
- (iv) Coatings and coating technology, Polymers in thin film applications.
- (v) Current instrumental methods for polymer characterization.
- (vi) Polymers for biomedical engineering and drug delivery.
- (vii) Membrane science and technology

CHM 761 Current Trends in Industrial Chemistry (6 Units)

Lectures, seminars and paper presentations on cutting edge research on topics such as:

- (i) Materials for energy development, conversion and storage such as: polymers, catalysts, batteries, fuel cells, thermoelectric, photovoltaics etc.
- (ii) Porous solids (activated carbons, zeolites etc) preparation, characterization and applications.
- (iii) Chemical process optimization using response surface methodology such as design of experiments, full factorial, fractional factorial, central composite design etc.
- (iv) Application of organic and inorganic compounds in corrosion inhibition.
- (v) Various techniques in the treatment of industrial wastes.

- CHM 771** **Current Trends in Environmental Chemistry** **(6 Units)**
Lectures, seminars and paper presentation on cutting edge research in topics such as:
- (i) Risk assessment modeling techniques as applied as soil, water, air and biological systems.
 - (ii) Green to approaches environmental pollution and control
 - (iii) Advances in environmental methods of chemical analysis.
 - (iv) Environmental Impact Assessment (EIA)
- CHM 790** **Ph.D. Seminars** **(6 Units)**
Presentation of 3 seminars comprising of (i) Research proposal and (ii) Mid-doctoral research seminar (iii) final seminar based on the students doctoral research results.
- CHM 791** **Ph.D. Thesis** **(12 Units)**
The work shall consist of an in-dept and comprehensive research to be embodied in a thesis. It should be an original contribution to knowledge in the student's area of specialization.
- CHM 793** **Nanochemistry** **(4 Units)**
Synthesis of nanomaterials. Characterization techniques. Applications of nanomaterials in areas such as industries, medicine, electronics, chemical synthesis and Environmental studies.
- CHM 701** **Synopsis and Grant Writing** **(3 Units)**
Identification of types and nature of grant and grant writing; mining of grants application calls on the internet. Determining appropriate strategy for each application. Study of various grant application structures and contents and writing of concept notes, detailed project description, budgeting and bedget defense. Study of sample grant writings in various forms and writing of mock research and other grants, Identification of University of Nigeria synopsis structure and requirements, (Introduction, Methodology and Results). Determining the contents of each sub-unit of the synopsis. Steps in writing of synopsis from the Dissertation/Thesis document. Structural and language issues. Common errors in synopsis writing and strategies for avoiding them. the roles of the student and the supervisor in the production of a synopsis. Writing of mock synopsis. All registered Ph.D students must attend a solution-based interactive workshop to be organised by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course conducted by selected experts.

List of Postgraduate Supervisors

P. O. Ukoha	B.Sc., M.Sc., (Nig.), Ph.D (ABU)	Professor
U. C. Okoro	B.Sc.(Lagos), Ph.D, (Nig.)	Professor
C. O. B. Okoye	B.Sc., M.Sc.(Ibadan), Ph.D (Ife)	Professor
J. N. Asegbeloyin	B.Sc.(Cal.), M.Sc., Ph.D (Nig.)	Senior Lecturer
P. M. Ejikeme	B.Sc.(Port Harcourt), M.Sc., Ph.D (Nig.)	Senior Lecturer
B. E. Ezema	B.Sc., M.Sc., Ph.D (Nig.)	Senior Lecturer
L. N. Obasi	B.Sc., M.Sc., Ph.D (Nig.)	Senior Lecturer
M. A. Ezeokonkwo	B.Sc.(Cal.), M.Sc., Ph.D (Nig.)	Senior Lecturer
N. R. Ekere	B.Sc., M.Sc.(Nig.), Ph.D (FUTO)	Senior Lecturer
J. N. Ihedioha	B.Sc.(NAU), M.Sc. Ph.D (Nig.)	Senior Lecturer
O. T. Ujam	B.Sc.,M.Sc.(Nig.) Ph.D (Waikato)	Senior Lecturer
V. E. Agbazue	B.Sc., M.Sc. Ph.D (Nig.)	Senior Lecturer

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REVISED M.Sc. DEGREE PROGRAMMES

2015/2016 SESSION

UNIVERSITY OF NIGERIA, NSUKKA
DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY
POSTGRADUATE PROGRAMMES IN CHEMISTRY

PHILOSOPHY

The programmes are designed to provide training in the theory and practice of all branches of chemistry and to stimulate creative thinking and research. The importance of a thorough grounding in experimental chemistry and the need to expose the students to the operational aspects of the chemical industry and to modern analytical tools are emphasized.

OBJECTIVES

The postgraduate programmes have the following objectives:

- (i) Production of high caliber chemists equipped to man responsible academic, industrial and research positions that require the utilization of chemical knowledge and skill in the service of a developing national economy;
- (ii) Probing of Nigeria's natural resources in order to accumulate relevant chemical data;
- (iii) Investigations of fundamental chemical nature;
- (iv) Chemical research directed at solving specific Nigerian problems.

SCOPE

Postgraduate studies will be offered in the broad areas of Inorganic, Organic, Physical Analytical, Fossil Fuel, Polymer, Environmental and Industrial Chemistry.

EMPLOYMENT OPPORTUNITIES

Successful postgraduate students are equipped for careers in teaching, research institutes, chemical laboratories, Ministries of Science and Technology, Industry Environment, and in such diverse industries as vegetable oils, soap and detergents, paints and varnishes, plastics, brewing, pharmaceutical, sugar, paper and pulp, textiles, fertilizer, cement, ceramic, iron and steel, petroleum, coal, dyestuff and other chemical industries.

ENTRY REQUIREMENTS

Masters Degree Programme

Graduates of the University of Nigeria, Nsukka or other recognized Universities who have obtained at least a second-class honours degree with at least a CGPA of 2.5 on a 5 point scale or its equivalent in Chemistry or a related discipline may apply for admission.

MODE OF STUDY

Masters Degree Programme

Course Work: Students will be required to do course work in relevant areas of chemistry. Such course work should normally be successfully completed at the end of the first year of study. Where necessary, students will be required to take specified undergraduate courses in chemistry and or other related disciplines.

Seminar: In addition to course work, students will be expected to attend the departmental seminars and to deliver at least one seminar in the course of their study.

DURATION OF STUDY

The duration of study will be as follows:

Masters Degree Programme

Full Time: 4 Semesters minimum and 8 semesters maximum

Part Time: 6 Semesters minimum and 10 semesters maximum

AREAS OF SPECIALIZATION

1. Inorganic Chemistry
2. Physical and Theoretical Chemistry
3. Organic Chemistry
4. Analytical Chemistry
5. Fossil Fuel (Petroleum, Coal and Natural gas) Chemistry
6. Polymer Chemistry
7. Industrial Chemistry
8. Environmental Chemistry

STRESS AREAS

Inorganic Chemistry	0
Physical and Theoretical Chemistry	1
Organic Chemistry	2
Analytical Chemistry	3
Fossil Fuel Chemistry (Petroleum, Coal and Natural gas)	4
Polymer Chemistry	5
Industrial Chemistry	6
Environmental Chemistry	7
Project/Seminar	9

Programme

Course No.	Course Title	Units
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(i) INORGANIC CHEMISTRY

Masters degree in Inorganic Chemistry will expose the candidates to advanced knowledge of coordination, synthetic, Inorganic Chemistry and cutting edge techniques in experimental Chemistry at the top level.

First Semester**Core Courses**

CHM 601	Inorganic Reaction Mechanism	2
CHM 603	Advanced Coordination Chemistry	2
CHM 605	Spectroscopic Techniques in Inorganic Chemistry	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 607	Selected Topics in Inorganic Chemistry	2
CHM 609	Molecular Symmetry and Group Theory	2
CHM 611	Advanced Chemical Thermodynamics	2
CHM 631	Experimental Design and Data Analysis	2
CHM 635	Radiochemical and Miscellaneous analytical Techniques	2
CHM 653	Polymerization Kinetics	2

Second Semester**Core Courses**

CHM 602	Advanced Inorganic Chemistry	2
CHM 604	Advanced Organometallic Chemistry	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 690	Seminar	2
CHM 694	Research Project	6

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 612	Advanced Chemical Kinetics	2
CHM 632	Quantitative Spectroscopic Methods	2
CHM 634	Separation Methods in Analytical Chemistry	2
CHM 636	Analysis of Materials	2

Minimum 31

PHYSICAL CHEMISTRY

Masters degree in Physical Chemistry will expose the candidates to advanced knowledge of thermodynamics, kinetics, quantum mechanics and high level experimental techniques in physical chemistry.

First Semester**Core Courses**

CHM 611	Advanced Chemical Thermodynamics	2
CHM 613	Advanced Quantum Chemistry	2
CHM 615	Advanced Chemical Kinetics	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 617	Selected Topics in Physical Chemistry	2
CHM 605	Spectroscopic Techniques in Inorganic Chemistry	2
CHM 609	Molecular Symmetry and Group Theory	2
CHM 633	Electroanalytical Techniques	2
CHM 635	Radiochemical and Miscellaneous analytical Techniques	2
CHM 653	Polymerization Kinetics	2

Second Semester**Core Courses**

CHM 612	Statistical Thermodynamics	2
CHM 614	Atomic and Molecular Spectroscopy	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 690	Seminar	2

CHM 694	Research Project	6	15
PGC 601	Research Methodology and Application of ICT in Research	3	

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 616	Selected Topics in Theoretical Chemistry	2	
CHM 618	Computational Chemistry	2	
CHM 632	Quantitative Spectroscopic Methods	2	
CHM 638	Analysis of Materials	2	
CHM 652	Solution Properties of Polymers	2	
CHM 654	Structure and Properties of Bulk Polymers	2	
CHM 664	Transport Phenomena	2	

Minimum 31

(iii) ORGANIC CHEMISTRY

At the end of the programme in Organic Chemistry, the student should be competent in the structure, determination, synthesis, applications, and uses of organic compounds.

First Semester

Core Courses

CHM 621	Advanced Organic Reaction Mechanisms	2
CHM 623	Advanced Organic Synthesis	2
CHM 625	Advanced Stereochemistry	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 641	Origin, Petrography and Classification of Coal	2
CHM 643	Crude Oil: Formation, Distribution and Refining	2
CHM 651	Organic Chemistry of Polymers	2
CHM 603	Advanced Coordination Chemistry	2
CHM 671	Hazardous Waste Chemistry and Management	2

Second Semester

Core Courses

CHM 622	Advanced Heterocyclic Chemistry	2
CHM 624	Natural Products Chemistry	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 690	Seminar	2
CHM 694	Research Project	6
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 626	Selected Topics in Organic Chemistry	2
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		16
CHM 634	Separation Methods in Analytical Chemistry	2
CHM 638	Analysis of Materials	2
CHM 642	Chemistry of Coal Utilization	2
CHM 642	Petrochemicals	2

Minimum 31

(iv) ANALYTICAL CHEMISTRY

In addition to their training in other areas of chemistry, graduates of analytical chemistry are equipped with excellent measurement skills and exposed to a wide range of modern analytical techniques.

First Semester

Core Courses

CHM 631	Experimental Design and Data Analysis	2
CHM 633	Electroanalytical Techniques	2
CHM 635	Classical Methods of Analysis	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 637	Radiochemical and Miscellaneous analytical Techniques	2
CHM 639	Instrumental Design and Electronics	2
CHM 605	Spectroscopic Techniques in Inorganic Chemistry	2
CHM 663	Separation Processes	2
CHM 675	General Concept in Environmental Chemistry	2
CHM 671	Hazardous Waste Chemistry and Management	2

Second Semester

Core Courses

CHM 632	Quantitative Spectroscopic Methods	2
CHM 634	Separation Methods in Analytical Chemistry	2
CHM 636	Analytical Chemistry Practicals	2
CHM 690	Seminar	2
CHM 694	Research Project	6
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 638	Analysis of Materials	2
CHM 642	Petrochemicals	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 672	Environmental Assessment Techniques	2
CHM 674	Chemical Environmental Pollution Studies	2

Minimum 31

(v) FOSSIL FUEL CHEMISTRY

The programme equips the candidate with competence in the following areas:

Petrochemicals from Petroleum and Natural Gas, Chemicals from Coal, Coal liquefaction, Coal gasification, and Environmental Management.

First Semester**Core Courses**

CHM 641	Origin, Petrography and Classification of Coal	2
CHM 643	Crude Oil: Formation, Distribution and Refining	2
CHM 645	Chemistry of Coal Utilization	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 647	Selected Topics in Fossil Fuel (Petroleum, Coal and Natural gas) Chemistry	2
CHM 605	Spectroscopic Techniques in Inorganic Chemistry	2
CHM 651	Organic Chemistry of Polymers	2
CHM 655	Selected Topics in Polymer Chemistry	2
CHM 663	Separation Processes	2
CHM 665	Selected topics in Industrial Chemistry	2
CHM 633	Electroanalytical Techniques	2

Second Semester**Core Courses**

CHM 642	Petrochemicals	2
CHM 644	Application of geochemical Techniques in Petroleum Exploration and Exploitation	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 690	Seminar	2
CHM 692	Research Project	6
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 632	Quantitative Spectroscopic Methods	2
CHM 634	Separation Methods in Analytical Chemistry	2
CHM 638	Analysis of Materials	2
CHM 654	Structure and Properties of Bulk Polymers	2
CHM 662	Chemical Reactor Theory	2

Minimum 31

(vi) POLYMER CHEMISTRY

MSc degree in Polymer Chemistry will expose students to advanced knowledge of polymerization processes, kinetics and thermodynamics; polymer structure-property relations and application; and polymer processing and techniques.

First Semester

Core Courses

CHM 651	Organic Chemistry of Polymers	2
CHM 653	Polymerization Kinetics	2
CHM 655	Solution Properties of Polymers	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 657	Selected Topics in Polymer Chemistry	2
CHM 605	Spectroscopic Techniques in Inorganic Chemistry	2
CHM 624	Natural Products Chemistry	2
CHM 631	Experimental Design and Data Analysis	2
CHM 633	Electroanalytical Techniques	2
CHM 663	Separation Processes	2

Second Semester

Core Courses

CHM 652	Structure and Properties of Bulk Polymers	2
CHM 654	Advanced Polymer Technology	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 690	Seminar	2
CHM 694	Research Project	6
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 612	Advanced Chemical Kinetics	2
CHM 632	Quantitative Spectroscopic Methods	2
CHM 638	Analysis of Materials	2
CHM 642	Chemistry of Coal Utilization	2
CHM 644	Petrochemicals	2
CHM 662	Chemical Reactor Theory	2

Minimum 31

(vii) INDUSTRIAL CHEMISTRY

Masters degree in Industrial Chemistry will expose the candidates to various aspects of Process Design and Modeling, Process Control and Quality Management.

First Semester

Core Courses

CHM 661	Industrial Thermodynamics	2
CHM 663	Separation Processes	2
CHM 665	Transport Phenomena	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 667	Selected topics in Industrial Chemistry	2
CHM 643	Crude Oil: Formation, Distribution and Refining	2
CHM 653	Polymerization Kinetics	2
CHM 655	Selected Topics in Polymer Chemistry	2
CHM 631	Experimental Design and Data Analysis	2
CHM 617	Selected Topics in Physical Chemistry	2
CHM 645	Selected Topics in Fossil Fuel (Petroleum & Coal) Chemistry	2

Second Semester

Core Courses

CHM 662	Chemical Reactor Theory	2
CHM 664	Advanced Chemical Process Optimization	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 690	Seminar	2
CHM 694	Research Project	6
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 4 units from the elective courses listed below:

CHM 604	Selected Topics in Inorganic Chemistry	2
CHM 632	Quantitative Spectroscopic Methods	2
CHM 638	Analysis of Materials	2
CHM 642	Chemistry of Coal Utilization	2
CHM 644	Petrochemicals	2
CHM 655	Solution Properties of Polymers	2

Minimum 31

(viii) ENVIRONMENTAL CHEMISTRY

Masters degree in Environmental Chemistry will expose the students to advanced knowledge of hazardous waste chemistry and management, environmental assessment techniques and chemical environmental pollution studies.

First Semester

Core Courses

CHM 671	Hazardous Waste Chemistry and Management	2
CHM 673	General Concepts of Environmental Chemistry	2

Required Ancillary Course

CHM 631	Experimental Design and Data Analysis	2
CHM 633	Electroanalytical Techniques	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 2 units from the elective courses listed below:

CHM 675	National and Global Environmental Issues	2
CHM 637	Radiochemical and Miscellaneous Analytical Techniques	2
CHM 639	Instrumental Design and Electronics	2

		20
CHM 605	Spectroscopic Techniques in Inorganic Chemistry	2
CHM 663	Separation Processes	2
CHM 635	Classical Methods of Analysis	2

Second Semester

Core Courses

CHM 672	Environmental Assessment Techniques	2
CHM 674	Chemical Environmental Pollution Studies	2
CHM 690	Seminar	2
CHM 694	Research Project	6
Required Ancillary Course		
CHM 632	Quantitative Spectroscopic Methods	2
PGC 601	Research Methodology and Application of ICT in Research	3

Students should choose a minimum of 6 units from the elective courses listed below:

CHM 676	Seminars/Case Studies in Environmental Chemistry and Pollution Control	2
CHM 638	Analysis of Materials	2
CHM 642	Petrochemicals	2
CHM 692	Advanced Applied Spectroscopy	2
CHM 632	Quantitative Spectroscopic Methods	2
CHM 634	Separation Methods in Analytical Chemistry	2

31 minimum

COURSE DESCRIPTIONS

CHM 601: Inorganic Reaction Mechanism (2 Units)

Theories and experimental techniques, role of solvent and catalyst, reactions involving solids, gas-phase reactions, acid-base reactions, isotopic exchange reactions, reactions of ions and molecules of non-metallic elements, substitution reactions, oxidation reduction reactions, reactions of transition metals, organometallics.

CHM 602: Advanced Inorganic Chemistry (2 Units)

Homopolyatomic Cations, Peroxy Compounds of Transition Metal, Organometallic Compounds of non-Transition Metals, Inorganic Polymers, Catenated Compounds of Si, P, As, Se and Te, Structure and Thermodynamics of Halides and Oxides

CHM 603: Advanced Coordination Chemistry (2 Units)

Synthesis pathways, bonding structural stereo-chemical aspects,

complex structures and site preference for regular symmetry.
Electronic state, spectra, magneto-chemistry.

CHM 604: Advanced Organometallic Chemistry (2 Units)

Synthesis, bonding, characterization, properties and applications of organometallic compounds of transition metals. Metal organic frame works; synthesis, characterization and uses.

CHM 605: Spectroscopic Techniques in Inorganic Chemistry (2 Units)

Advanced study of the following topics: Photoelectron Spectroscopy, Electronic Absorption Spectroscopy, Vibrational and Rotational Spectroscopy, Electron Paramagnetic Resonance Spectroscopy, Nuclear Quadruple Resonance Spectroscopy, Mossbauer Spectroscopy, Raman Spectroscopy.

CHM 607: Selected Topics in Inorganic Chemistry (2 Units)

Advanced treatment of selected topics such as co-ordination chemistry, radiation chemistry and non-stoichiometric compounds

CHM 609: Molecular Symmetry and Group Theory (2 Units)

Molecular Symmetry and point groups. Atomic and electronic properties of d-block transition elements. Orbital symmetries and their representation. Symmetry applied to molecular vibrations. Chemical bonding in transition metal compounds. The d-block elements and their chemistry.

CHM 611: Advanced Chemical Thermodynamics (2 Units)

Advanced discussions on the development of thermodynamic functions (based on the three main laws) which describe chemical systems in equilibrium, irreversible process near equilibrium, nonisothermal systems and steady states. Example will be taken from recent literature.

CHM 612: Statistical Thermodynamics (2 Units)

Definition of partition functions; translational, rotational, Vibrational and electronic partition functions and their calculation and application to thermodynamic problems; application of spectroscopic measurements to thermodynamic properties of matter.

CHM 613: Advanced Quantum Chemistry (2 Units)

Mathematical techniques, Fundamental of quantum mechanics, Approximate methods of solution of Schrodinger's equation. Valency theory, molecular orbital methods; valence bond methods. Group theory (symmetry) and its applications to chemical problems. Quantum theory of angular momentum. Advanced molecular quantum mechanics. The Lorentz

transformation. The Klein- Gordon equation, The Dirac equation

CHM 614: Atomic and Molecular Spectroscopy (2 Units)

Time-dependent state: time dependent perturbation theory, absorption and emission of radiation, selection rules, line shapes and widths, band contours, laser. Vibration and rotation, interaction and centrifugal distortion. Potential energy functions nuclear spins and the Pauli principle; the Raman effect; degenerate and near-degenerate levels; cryoscopy

CHM 615: Advanced Chemical Kinetics (2 Units)

The mechanism and rates of elementary processes in the gas-phase and in solution: experimental techniques in the investigation of free-radical reactions, reactions at interface and fast reaction, theories of chemical reaction rates based on equilibrium hypothesis, molecular dynamics and other theories of reaction rates neglecting the equilibrium hypothesis, energy transfer processes including detailed treatment of theoretical models; survey of experimental results and other topics of current interest.

CHM 616: Selected Topics in Theoretical Chemistry (2 Units)

Advanced treatment of selected topics such as semi-empirical molecular orbital calculations, Quantum electrodynamics, Theory of molecular crystals, Interaction of radiation with matter.

CHM 617: Selected Topics in Physical Chemistry (2 Units)

Advanced treatment of selected topics such as X-rays and crystal structure; heterogeneous catalysis and surface reaction, electrochemical kinetics, photochemistry; radiation chemistry, the chemistry of excited species; physical chemistry of macromolecules; mass spectrometry.

CHM 618: Computational Chemistry (2 Units)

Density Functional Theory. Quantum chemical calculations. Computation of molecular electronic structures by *ab initio* and semi-empirical techniques. Use of non-computational quantum chemistry to formulate analytical expressions for the properties of molecules and their reactions. Molecular mechanics; use of classical physics to explain and interpret the behavior of atoms and molecules. Application of softwares; Gaussian xx, Gaussian 94 currently, GAMESS, MOPAC, Spartan, Sybyl.

CHM 621: Advanced Organic Reaction Mechanisms (2 Units)

This course embraces the mechanisms of more complex organic reactions reported in modern chemical literature. Topics to be studied will be selected by the instructor.

CHM 622: Advanced Heterocyclic Chemistry (2 Units)

Selected heterocyclic compounds with two or more heteroatoms not already covered at undergraduate level, (Emphasis will be laid on recent literature of the subject and to point out how complex heterocyclic compounds have been studied). Heterocyclic compounds of biological interest e.g. β -lactam antibiotics, porphyrins, vitamins purines and pyrimidine, Further principles of heterocyclic ring synthesis e.g. the application of cycloaddition reactions, valence-bond isomerization and enamine condensation in heterocyclic synthesis.

CHM 623: Advanced Organic Synthesis (2 Units)

In the course, emphasis will be laid on modern techniques in organic synthesis and will involve constant reference to recent literature. Broadly, the synthesis of complex compounds of both synthetic and natural organic will be studied. Disconnection approach in organic synthesis. Use of synthons and synthetic equivalents.

CHM 624: Natural Products Chemistry (2 Units)

More complex examples of natural products than were studied at the undergraduate level e.g. higher carbon sugars; alkaloids; steroids; antibiotics; natural products and biosynthesis. Some detailed examples from recent literature on the structural elucidation, synthesis and stereochemical effects on the reactions of a few natural products.

CHM 625: Advanced Stereochemistry (2 Units)

Circular dichroism and optical rotatory dispersion. Examples from recent literature of stereochemical effects on the reactions and reactivity of organic compounds. Asymmetric synthesis. Enantiomeric excess, Enantiomeric ratio, Racemization, Homochiral molecules, Chirality without stereogenic carbon: allenes and related molecules, biphenyls. Prochirality, Enantiotopic and diastereotopic groups and faces. Use of NMR spectroscopy in stereochemistry.

CHM 626: Selected Topics in Organic Chemistry (2 Units)

Advanced treatment of selected topics such as organic photochemistry isotope effects in organic chemistry, reactive intermediates in organic chemistry, organic chemistry of P, S, Si, B, etc; structure of proteins chemistry and heredity; Analytical tools in organic chemistry; colour chemistry, organic reactions and orbital symmetry; medicinal chemistry and the chemistry of pesticidal agents

CHM 631: Experimental Design and Data Analysis (2 Units)

Limitations on the accuracy of experimental data. Statistical treatment of data. Theory of sampling. Theory of errors, Normal Distribution(Gaussian) curve. Types and characteristics of errors and their treatment. Planning of experiments.

- CHM 632: Quantitative Spectroscopic Methods (2 Units)**
Atomic absorption spectroscopy (flame and non-flame). Atomic emission spectroscopy (flame and plasma techniques). Types of flames, characteristics and optimization. Reactions in a flame. Molecular Emission Cavity Analysis (MECA) spectroscopy. Principles of X-ray crystallography. Calibration graphs and scatter around the mean value (on both sides of the straight line).
- CHM 633: Electroanalytical Techniques (2 Units)**
Theories of electrochemistry. Potentiometry, voltammetry, amperometry, coulometry, cathodic and anodic stripping, voltammetry, turbidimetry, nephelometry.
- CHM 634: Separation Methods in Analytical Chemistry (2 Units)**
Solvent extraction, liquid-liquid distribution equilibria, Complex equilibrium, Kinetics of solvent extraction; Applications in solution and analytical chemistry. Theory of chromatography; Gas, paper, thin-layer, column, ion exchange and gel permeation chromatography, electrophoresis, dialysis.
- CHM 635: Classical Methods of Analysis (2 Units)**
Reaction chemistry of selected elements. Theories of titrimetric analysis. Aqueous and non-aqueous acid-base titrimetry, redox titrimetry, complexometric titrations, precipitation titration. Theory of gravimetry and precipitation. Quality and types of precipitates. Gravimetry type process, PFHS and contamination. Microanalysis for halogens, carbon, sulphur nitrogen and oxygen.
- CHM 636: Analytical Chemistry Practicals**
Investigation of errors inherent in glasswares and equipments (instrumental errors). Determination of accuracy and precision of methods. Recovery experiment (methodic errors). Experimental basis for choosing methods and equipment.
- CHM 637: Radiochemical and Miscellaneous Analytical Techniques (2 Units)**
Radiochemical methods: Properties and safe handling of radioactive decay curves and applications to quantitative analysis, tracer techniques, Enzymatic methods, kinetic methods, thermal methods, X-ray methods, functional group analysis.
- CHM 638: Analysis of Materials (2 Units)**
Control techniques in the analysis of materials. Analysis of agricultural chemicals, soil, minerals and metallurgical materials, foodstuff, oils and fats, water, detergents drugs, ores, alloys, and polymers. Organic elemental analysis. Nigerian legislation on food, drugs and poisons, Food and Drug Decree 1984 (recent amendments), Safety regulations for industries.
- CHM 639: Instrumental Design and Electronics (2 Units)**
Basic design and electronic instruments used in analytical

chemistry, Detectors, Monochromators, phototube, amplifiers and light sources.

CHM 641: Origin, Petrography and Classification of Coal (2 Units)

Origin and development of coal, chemical composition, types of mining and associated environmental effects. Origin of nitrogen and sulphur compounds in coals Properties of coal. Petrographic composition of coals. Techniques for coal studies. Coal analysis, trace elements, and mineral matter, chemical reactions and constitution of coal; chemical and electrochemical reduction, catalytic dehydrogenation, reductive alkylations, acid-catalyzed depolymerization, alkylation and acylation of coal.

CHM 642: Petrochemicals (2 Units)

Petrochemical raw materials; methane, ethylene, and propylene, the C₄ hydrocarbons, benzene, toluene, and the xylenes, Typical industrial processes for petroleum chemicals: the direct hydration of ethylene to produce ethanol, the production of ethylbenzene by alkylation of benzene with ethylene and its dehydrogenation to styrene; the cracking of liquid hydrocarbons to produce olefins,. Other chemicals derived from crude oil; methane, ethane, propane, butane, higher alkenes, ethane, ethane, propylene, butylenes and butadiene, aromatic hydrocarbons. Prospects of the petrochemical industry in Nigeria.

CHM 643: Crude Oil: Formation, Distribution and Refining (2 Units)

Crude oils, its origin; diagenesis, catagenesis. Occurrence and place of crude oil in the contemporary energy scene. Classification and composition of crude oil (petroleum), petroleum refining techniques for further processing of petroleum fractions; purification of refinery gases, purification of liquid petroleum fractions; hydrodesulphurization, hydrodenitrogenation, deoxygenation, dehydrohalogenation, Processes for increasing the yield of gasoline. Processes for increasing the octane number of gasoline.

CHM 644: Application of Geochemical Techniques in Petroleum Exploration and Exploitation (2 Units)

Methods used in petroleum exploration. Factors involved in the search for oil and gas. Formation of sedimentary rocks, origin of oil-rock types, primary migration, secondary migration, oil traps. The application of urea-adduction technique in geochemical studies for possible hydrocarbon occurrences. Methods involved in geophysical survey, magnetic survey, gravity survey, seismic survey, seismic reflection method, seismic refraction method. Oil drilling: drilling fluids, oil-well cement. Oil production techniques, production from offshore fields, natural gas production and exploitation.

- CHM 645: Chemistry of Coal Utilization (2 Units)**
Fundamentals of coal hydrolysis and hydrolysis. Low/high temperature carbonation. Coal briquetting. Coal combustion. Fundamentals of coal gasification Coal liquefaction. Conversion of coal and gases produced from coal into fuels, chemicals, and other products. Environmental, health and safety implications of coal mining and coal utilization, abatement strategies.
- CHM 647: Selected Topics in Fossil Fuel (Petroleum, Coal and Natural gas) Chemistry (2 Units)**
Environmental, health and safety implications of mining, transportation, storage, refining and marketing of petroleum and petroleum products, Fertilizers.
- CHM 651: Organic Chemistry of Polymers (2 Units)**
Natural and mechanism of condensation, free radical; ionic, coordination and ring opening polymerization reactions. Stereochemistry of polymer structures (both natural and synthetic). Synthesis of commercially important polymers and their monomers. Chemical reactions of polymers including degradative reactions.
- CHM 652: Structure and Properties of Bulk Polymers (2 Units)**
Morphology and order in crystalline polymers. The amorphous state. Rheological and mechanical properties, Rubber like elasticity and viscoelasticity. Mechanical properties of crystalline polymers. Structure-property relations. Thermal, electrical and optical properties.
- CHM 653: Polymerization Kinetics (2 Units)**
Kinetics of free radical, ionic, condensation, stereospecific polymerization and copolymerization. Emulsion, solution suspension, solid state and melt polymerization. Rate equations for reaction mechanism and process design. Equations for molecular weight distribution and control
- CHM 654: Advanced Polymer Technology (2 Units)**
Polymer rheology. Additives for polymers. Processing of thermoplastics, thermosets, fibres and elastomers. Fabrication conditions and effects on structure and performance. Foamed (cellular) polymers. Reinforced polymers (polymer composites).
- CHM 655: Solution Properties of Polymers (2 Units)**

Chain conformations in solution, Polymer solubility
Thermodynamics of polymer solutions. Phase equilibria and
polymer fractionation. Methods of characterization of molecular
weight and size. Fractional and dynamic properties.

CHM 657: Selected Topics in Polymer Chemistry (2 Units)

Advanced treatment of selected topics such as Paper and Pulp
Industry, Paint Industry, Plastic Industry, Rubber Industry,
Advanced polymer Synthesis, Applied Spectroscopy of Polymers.

CHM 661: Industrial Thermodynamics (2 Units)

Application of thermodynamic principles to selected topics,
including equations of state, thermodynamics of non-reaction
systems, complex chemical equilibria, phase stability and
immiscibility. Power cycles.

CHM 662: Chemical Reactor Theory (2 Units)

Survey of kinetic principles and factors which influence reaction
rates, Kinetics of complex homogenous and heterogenous
reactions. Analysis of Chemical Kinetics and transport
phenomena in the design and operation of industrial reactors.
Mass transfer and reaction in porous solids, fixed and fluidized
reactor design catalyst deactivation.

CHM 663: Separation Processes (2 Units)

Users and characteristics of separation processes, Review of
binary separation processes, Multicomponent, multistage
separation. Extractive and azeotropic distillation, Capacity and
efficiency of contacting devices, Energy requirements, selection of
optimal design and operation of separation processes.

CHM 664: Advanced Chemical Process Optimization (2 Units)

Time series, Design of experiments using statistical software e.g.
Design Expert, Minitab etc. Types of Experimental Design-
Complete Randomized Block Design, Factorial Design, and
Response surface Methodology-Rotatable Central Composite
Design, Face-Centred Composite Design and Inscribed Central
Composite Design. Techniques for Optimization: Linear
Programming Techniques, use of software for Optimization.

CHM 665: Transport Phenomena (2 Units)

Properties of fluid momentum and energy equations, vortex
motion in liquids. Friction, types of flow, in open channel,

dimensional analysis, flow measurement devices, pumps, compressors, valves and pipings. Differential equation for transfer processes and their applications. The Fourier equation and application to composites, cylinders and spheres. Analytical and numerical solutions of steady and unsteady state conduction equations. Fick's law, Principles of free and forced convection. Determination of film transfer coefficient. Mechanism of radiative heat transfer, shape factors, heat exchange between radiation

CHM 667: Selected Topics in Industrial Chemistry (2 Units)

Biochemical engineering kinetics, Biochemical reactor and fermentor design, Aeration and mixing, Fermentor operation and control. Homogenous and immobilized enzyme system, Enzyme production and recovery, Sugar technology, Modern brewing technology, Food technology and biological wastewater technology. Pesticide, Pharmaceutical, Fertilizer, Cement, and Process Industries, Glasses and Ceramics.

CHM 671: Hazardous Waste Chemistry and Management (2 Units)

Types and classification of hazardous substances and wastes. Environmental Chemical processes. Chemistry of inorganic and organic hazardous wastes. Collection, storage, transportation, treatment and disposal methods/technologies of hazardous wastes. Environmental effects of hazardous wastes disposal. Hazardous waste control. Waste prevention and minimization, Recycle/ Recovery/ Reuse and cleaner production technology.

CHM 672: Environmental Assessment Techniques (2 Units)

Principles of environmental assessment including Environmental Impact Assessment (EIA) and Environmental auditing. Environmental baseline studies. Environmental modelling GIS methods. Types of environmental impact. Impact identification, prediction, evaluation and mitigation. Environmental monitoring, environmental management plan, Environmental policy and regulations on environmental assessment. Risk assessment.

CHM 673: General Concepts of Environmental Chemistry (2 Units)

Basic Concepts: Environment, Ecosystem, pollution, pollutants surveillance, monitoring, Guidelines, standards, regulations compliance. Transformation of environmental media by anthropogenic activities resulting in priority national and global environmental issues. Institutional and regulatory framework for pollution control, polluters pays principles, precautionary principles, life cycle analysis.

CHM 674: Chemical Environmental Pollution Studies (2 Units)

Principles of chemical pollution of environmental media (air, soil and water) and associated resources. Water/waste water chemistry, soil chemistry and fate of pollutants, air pollution chemistry, fate, effects and monitoring. Environmental toxicology: Chemistry of persistent toxic substances including Persistent Organic Pollutants (POPs). Environmental indicators of chemical pollution and marker compounds. Remediation of contaminated environment.

- CHM 675: National and Global Environmental Issues (2 Units)**
 Climate change and Global warming, Ozone layer depletions trans-bounding movements of toxic wastes, biological diversity, oil and gas pollution, control of international trade in toxic chemicals/ substances; Chemicals pollution in Nigeria strategic approach to the international management of chemicals.
- CHM 676: Seminars/Case Studies in Environmental Chemistry and Pollution Control (2 Units)**
 Literature/ filed search and presentations on topical and special local, national and global environmental issues.
- CHM 690: Seminar (2 Units)**
 Presentation of seminars based on an approved research topic being investigated by the student. It embodies proposal of the research work (30%) and the final presentation after the research has been done (70%)
- CHM 692: Advanced Applied Spectroscopy (2 Units)**
 Basic instrumentation and techniques. Applications of UV, IR, NMR and MS in chemical analysis and structural elucidation. High resolution NMR and ¹³C- NMR and nuclei, shift reagents. All ion structure and fragmentation, Field desorption, Fast atomic bombardment. Recent applications of linked scan Mass spectrometer. Raman Spectroscopy, EPR, Rotational spectroscopy etc.
- CHM 694 Research Project (6 Units)**
 Individual research work supervised by staff.
- PGC 601 Research Methodology and Application of ICT in Research (Masters degree Course) (3 Units)**
 In-depth research work aimed at acquiring full knowledge and presentations in scholarly writing of the concepts, issues, trends in the definition and development of the study area from African and Western perspectives. Major steps in research: Selection of problem, Literature review, Design, Data collection, analysis and interpretation, conclusions. Study of various research designs, Historical, Case studies, Surveys, Descriptive, Cross sectional,

Experimental, etc. Analysis, surveys and synthesis of conceptual and philosophical foundations of different disciplines. Identification of research problems and development of research questions and or hypotheses. Detailed treatment of methods of collecting relevant research data and the format for presenting research results (from designing the table of contents to referencing, bibliography and appendix). Data analysis and result presentation in different disciplines using appropriate analytical tools. Methods of project/dissertation writing. Application of appropriate advanced ICT tools relevant in every discipline for data gathering, analysis and result presentation. Essentials of Spreadsheets, Internet technology, and Internet search engines. All registered Masters Degree students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

LIST OF POSTGRADUATE SUPERVISORS

P. O. Ukoha	B.Sc., M.Sc., (Nig.), Ph.D (ABU)	Professor
U. C. Okoro	B.Sc.(Lagos), Ph.D, (Nig.)	Professor
C. O. B. Okoye	B.Sc., M.Sc.(Ibadan), Ph.D (Ife)	Professor
J. N. Asegbeloyin	B.Sc.(Cal.), M.Sc., Ph.D (Nig.)	Senior Lecturer
P. M. Ejikeme	B.Sc.(Port Harcourt), M.Sc., Ph.D (Nig.)	Senior Lecturer
B. E. Ezema	B.Sc., M.Sc. and Ph.D (Nig.)	Senior Lecturer
L. N. Obasi	B.Sc., M.Sc., Ph.D (Nig).	Senior Lecturer
M. A. Ezeokonkwo	B.Sc.(Cal.), M.Sc., Ph.D (Nig.)	Senior Lecturer
N. R. Ekere	B.Sc., M.Sc.(Nig.), Ph.D (FUTO)	Senior Lecturer
J. N. Ihedioha	B.Sc.(NAU), M.Sc. Ph.D (Nig.)	Senior Lecturer
O. T. Ujam	B.Sc.,M.Sc.(Nig.) Ph.D (Waikato)	Senior Lecturer
V. E. Agbazue	B.Sc., M.Sc. Ph.D (Nig.)	Senior Lecturer

