BENUE STATE UNIVERSITY

CENTER FOR FOOD TECHNOLOGY

AND

RESEARCH

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CENTRE LEADER' WELCOME ADDRESS

It is with great pleasure that I welcome you to the Centre for Food Technology and Research (CEFTER) Benue State University, for the 2020-2021 academic year.

As you might have heard or read about CEFTER, we are a Centre with strong reputation for teaching, research and consultancy. The Centre's research focus is: Development and Utilization of improved technologies to reduce post-harvest food losses.

Your time here at CEFTER will be both demanding and challenging, but I assure you that the coming months or years will be most productive, rewarding, and enlightening in your lifetime. Your education and academic achievements will be a critically important focus during your time here, but there are also many opportunities that allow you to explore your interests, complementing your academic endeavors, and enriching your life.

Whether you are here studying for a PhD or for a Master's degree, it is my sincere hope that your time here will be highly fulfilling for you in both academic and personal terms, as you become an indelible part of the history of this Centre and the University as a whole. As a postgraduate student, you are a crucial and valued part of our academic life and would bring enthusiasm, commitment, and dedication to new and ongoing research projects. You are here to benefit from the experience and knowledge of our Academics and research staff, but also to renew and replenish the research community through your new perspectives. Working in partnership with your supervisory team, you will be instrumental in pushing the frontiers of knowledge in your field.

Our aim, while you are here with us, is to give you the most solid base possible from which you will launch further research and career development. We will endeavor to provide you with relevant and appropriate research skills development and methods training, and we will also support the development of your research-related skills such as IT, presentational skills, career planning, etc. Here at CEFTER you will find fantastic people and lots of resources devoted to your success, and

I encourage you to reach these individuals at times when you might need assistance. Our Academics are usually drawn from Universities, Research Institute and Industry. Our students also spend time at industries during our well-developed internship program. We will provide you with a supervisory team consisting normally of a lead supervisor and at least one other member of staff, who will meet with you regularly to plan and discuss the progress of your work. We will do our best to make you feel part of an intellectual community in your field, in the University as a whole, and with your fellow postgraduate students.

We trust that your time here will be enjoyable and positive and that your efforts will result in the award of a research qualification within the set course duration. I sincerely hope that your time as a postgraduate student in this great Centre of learning is a fulfilling one, in which you follow the tradition of many who have preceded you in adding to the stock of human knowledge and thereby having an impact on Nigeria, Africa, and the wider world. I urge you to actively seek out programs and services that will assist you in capitalizing the most on your great potentials. There will be a lot of hard work ahead of you as you pursue your postgraduate degree with us, but hopefully, there will be a lot of fun as well.

I urge you to also find time and integrate among other cultures that make up the staff and student of the Centre and know a thing or two about Benue state.
I wish you the greatest success this year and look forward to seeing the countless and diverse contributions each of you will add to our CEFTER community.

Barnabas Achakpa Ikyo Ph.D.
Centre Director, CEFTER.
Centre Leader ACE Impact Project

BRIEF HISTORY OF BENUE STATE UNIVERSITY

The idea of establishing a Benue State University was first conceived in the late 1970s by the first Civilian Governor of Benue Sate, His Excellency, Late Mr. Aper A. Aku. The idea was translated into a feasible project during the regime of Governor Fidelis A. Makkah. The University was made real by the Second Civilian State Governor, His Excellency, Rev. Fr. Moses O. Adasu who inaugurated a 13 -member Steering Committee on 8th August, 1991. He charged the Committee to

- Plan for,
- Seek for and obtain approval from the Federal Government for Benue State to run its own University.

The approval was granted on Monday the 15th February, 1993. Benue State University started her academic activities with an inaugural orientation in the 1992/1993 academic session. This was commissioned by the Visitor to the University, the Governor of Benue State, His Excellency Late Rev Fr. Moses O. Adasu.

OBJECTIVES OF THE UNIVERSITY

The University has been established with the following objectives.

a) To provide ready access to Benue State citizens to higher education for self-reliance.
b) To identify and produce man-power that will meet the specific needs of the state.
c) To promote, preserve and propagate the social and cultural heritage of the diverse people of the state
d) To encourage the effective application of higher education to the needs of the state through research and consultancy.
e) To encourage and promote advancement of learning and to hold out to all persons without discrimination of race, creed or political conviction.
f) To engage in any other activity of a growing University.

STATUTE FOR BENUE STATE UNIVERSITY CENTER FOR FOOD TECHNOLOGY AND RESEARCH

1. There is hereby established a Centre to be known as The Centre for Food Technology and Research (hereinafter referred to as "The Centre")
2. To promote research and development of post-harvest technologies to curb post-harvest losses, enhance agricultural productivity, and for services in healthcare delivery and industrial output for the socio-economic advancement of Nigeria and Africa.
3. To be Africa's Leading Academic Centre of Excellence that Provides solutions to challenges in agriculture, health and Industry for sustainable wealth creation. Through biotechnology and post-harvest irradiation
4. To conduct research and carry out related activities on post-harvest irradiation and other technologies and to develop the capacity to service the agricultural, health and industrial sectors.
5. The objectives of the Centre shall be:
    a) To exploit the use of appropriate technologies for preservation of food produce;
    b) To promote the application of biotechnology to improve crop yield;
    c) To build national and regional capacity in biotechnology, post- harvest and allied sciences.
    d) To promote export of agricultural produce from Benue State.
    e) To leverage on institutional collaboration within the region to foster regional integration.
    f) To provide such community oriented services as workshops, seminars, conferences and lectures in order to sensitize the host community and African Region on the benefits of the

use of environmentally friendly techniques in the agricultural, health and industrial sectors.

g) To publish reports, research findings in scholarly journals.

h) To run refresher and post graduate courses in related disciplines.

i) To offer Consultancy services to governments, organizations and Institutions;

j) To promote extension of improved Technologies for the benefit of end users.

k) To promote partnership with industries and businesses to drive the output of research from the Centre.

l) To promote and undertake such other activities which in the opinion of the Centre are necessary or expedient for the purpose of achieving the objectives of the Centre.

6. The Centre shall consist of Research and Collaborations and the Operations departments and any other departments as may be established from time to time by the Board, where necessary.

7. There shall be a Board of Governors for the Centre (hereinafter referred to as "the Board'). The Board shall consist of the following members:

a)	The Vice-Chancellor	-	Chairperson
b)	One Representative of Council	-	Member
c)	Deputy Vice-Chancellor (Admin)	-	Member
d)	Deputy Vice-Chancellor (Academic)	-	Member
e)	Two Representatives of Senate	-	Member
f)	Director of the Centre	-	Member
g)	The Dean, Faculty of Science	-	Member
h)	Registrar	-	Member

i) One Representative each from the Following: Civil Society Organizations, Nigerian Chamber of Industry, Mines and Agriculture (NACIMA), 2 members of Famers Association of Nigeria (Male, Female) - Members

j) Representatives of Principal Partners of the Centre - Member

l) Representative of the Ministry of Science and Technology - Member

m) Representative of the Ministry of Education - Member

n) Representative of the Ministry of Agriculture - Member

o) Representative of the Ministry of Health. - Member

p) Representative of the Ministry of Commerce and Industry - Member

q) Secretary of the Board

8. Members of the Board other than those appointed Ex-Officio shall serve a term of two (2) years and shall be eligible for re-election or reappointment for another term of two years only.

9. The Board shall meet at least twice in each year and shall meet at any other time at the request of the Chairman of the Board, the Director of the Centre or upon requisition by two thirds of members as the exigency of the case may warrant.

10. Subject to the provisions of this statute, the Board shall have the following powers and functions:

a) To provide policy direction to the Centre

b) To consider all proposals involving finance, including the annual estimates of the Centre

c) To request from the Director report on any aspect of the work of the Centre

e) To carry out any other function(s) delegated to the Board of Governors

f) To appoint from among its members or otherwise into relevant committees and to delegate to any such committee as may be deemed expedient to carry out any function which the Board of Governors is competent to perform.

11. There shall be established the Management, Technical and such other Committees as may be considered necessary by the Board for the Centre

12. Management Committee shall consist of the following:

a) Director of the Centre - Chairperson
b) Deputy Director, Operations - Member
c) Deputy Director, Research and Collaboration - Member
d) Chief Accountant - Member
e) Secretary to the Centre - Member/ Secretary

13. The Management Committee shall be responsible for the day to day operations and coordination of activities of the Centre

14. There shall be established a Technical Committee for the Centre

15. The Technical Committee shall consist of the following members:

a) Director of the Centre Chairperson
b) Deputy Director, Research and Collaboration
c) Deputy Director, Operations
d) Heads of relevant academic departments
e) Heads of Research Groups

16. There shall be a Director for the Centre who shall be the Chief Executive Officer (CEO) of the Centre and accountable to the Board of Governors.

About us

The centre for Food Technology and Research (CEFTER) Benue State University is a Centre of Excellence for control of Post-harvest food Losses. With a focus on training both high and lower level manpower to address the menace of food wastes in West and Central Africa Regions. Three years ago 24 Centres were selected through a rigorous competitive exercise among over 150 Universities in the region with the major objective to improve on quality of higher education in the Region.

The Centre adopted a multi-disciplinary approach of training which involves a mix of core university professors and industry based experts. The excellence starts from involving all stakeholders in curriculum development and extends to quality teaching and students spending quality time at various industries during their study period at CEFTER.

The National Universities Commission has accredited the under listed programmes:

- MSc./PhD. Food Science & Technology
- MSc. Bio Statistics
- MSc/PhD. Post-Harvest Physiology of Crops and Management
- MSc./PhD. Food Chemistry
- MSc./PhD. Food Processing Technology
- MSc./PhD. Analytical/Environmental Chemistry
- MSc/PhD Organic/Natural Products Chemistry
- MSc. Post-Harvest Engineering & Technology
- MSc./PhD. Rural Sociology & Agricultural Extension

The Centre has also introduced short term diploma courses in Food Preservation, pest control and produce management mainly to train lower manpower and farmers/food handlers. Since commencement of academic program, the centre has trained over 200 Africans on its Masters' program while a total of 124 are undergoing intensive research leading to award of PhD. At the moment CEFTER students come from Gambia, Liberia, Ghana, Cameroon and Nigeria. The training is manned by an experienced team of over 30 Professors and 43 senior level academics that have received modern training on effective teaching and post graduate supervision coordinated by the University of Copenhagen, Denmark.

The Centre boasts of exceptionally conducive learning environment with fully air conditioned lecture rooms and student hostels. Apart from the fact that CEFTER complex is equipped with smart class room facilities, all academics are trained to use and get rewarded financially if they sign up to using modern teaching techniques.

Our students are exposed to hands on training through a specially designed internship program that takes them to at least three industries and one research institute within three months after course work. This puts our students in a position to easily blend with industrial jobs and to establish small scale industries.

The Centre has also put in place support schemes for students and staff; some of which include funding both academics and students to conferences, covering the full cost of publication, tuition and accommodation support to indigent students and scholarship to non-nationals on PhD and MSc programmes. Over 302 students have benefited from CEFTER student support scheme.

In the last three years CEFTER staff and students have recorded over 65 peer reviewed journal publications and over 10 novel equipment and research outputs that are been reviewed for patents.

The Management of the Centre has been adjudged by the World Bank supervision teams to be great, as our Vice chancellor Prof. Msugh Moses Kembe gives maximum attention and support to the Management team and the Centre generally.

All these make studying at the University exciting and our students would prefer to study here than at any other University in Nigeria.
For those willing to join the CEFTER project as students or visiting academics, please visit **www.cefterbsu.edu.ng** for details on our programs and admission/partnership.

CEFTER partners with industries and research institutes within and outside Nigeria; from where it draws manpower and makes use of laboratory resources.

Student Welfare

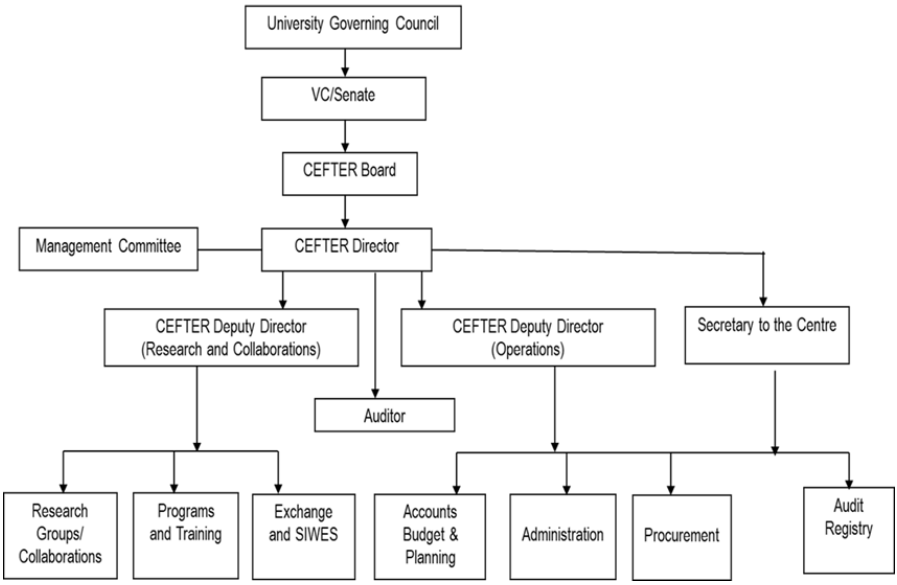
The welfare of our students has been given top priority. Student hostels are fully furnished with CCTV cameras installed and staffed for security purposes. Each hostel also has manned security post 24 hours in a day. All students have self-contained rooms with a kitchen, toilet and Internet services. All students have some form of support. Students are given accommodation support, tuition support or full scholarship.

We are now constructing a 100-bed space hostel which is located next to the Postgraduate Centre. This has better facilities and students will live next to their lecture halls and laboratories. There is also a cafeteria and there are also kitchens for students who might wish to do their own cooking.

There is adequate Internet service within lecture halls and hostels. Our lecture halls are and fully air-conditioned with touch boards and projectors.

The organizational chart provides a template for the management structure and communication lines of CEFTER.

ORGANOGRAM OF CEFTER



The Centre has appointed officers who attend to student in various aspects of their needs and communicate to the Centre management. Any request or concerns in the hostels can be channelled through the portals who report to the hall administrators for further actions. In emergency situations, the student representatives can call the Centre Leader directly or the Deputy Directors for action.

UNIVERSITY RESOURCE CENTRES

Sport Facilities

The following Sport facilities are available in the University:

1. One functional football field
2. Two functional basketball court
3. One table tennis board
4. An outdoor badminton courts
5. One volley ball court
6. Two lawn tennis court
7. Two functional badminton court

https://bsum.edu.ng/w3/sports.php
ternaafella@yahoo.com

Children Nursery

There are two children nursery in the University. One is located at the College of Health Science while the other is at the Eastern wing of the University behind the Academic Office building.
adajnike@gmail.com

Health Care Centre

The University school clinic located near the campus Fidelity bank, first campus is open to every students and staff where they are attended to for common illnesses. The most basic drugs for the most common and frequent illness are provided. For more serious and complex cases, staff and students are referred to the Benue State University Teaching Hospital. The University registers all students with National Health Insurance (NHIS).
https://bsum.edu.ng/w3/healthcenter.php

petermbaave@yahoo.com

ICT Services

Benue State University has a Directorate of ICT with the following department: Network and Internet Service Unit, Management Information Unit (MIS), Systems Development/Web& on-line Application Unit, Training and Development Unit, Maintenance and support services Unit. Student, academic, registry and management records are integrated into the ICT automation plan and policy. The ICT undertakes training by identify training and development need within the University for staff and students. There is decentralization of IT services across the campus with ICT unit existing in different locations in units, departments and faculties. Students and staff are given access codes and passwords after due registration and information can be access anywhere in the world. The ICT Directorate services a well-stocked library with access to Internet service. The University Library has excellent internet connectivity for use by students and faculty. The University has subscribed to NgREM, a nation-wide software managed by the National Universities Commission that provides excellent outreach to e-libraries around the world for use by students and faculty.
https://bsum.edu.ng/w3/ict_directorate.php
tabuul@bsum.edu.ng, tersooanjila@gmail.com

Library

The main University Library is located between the first and second campus directly opposite the College of Health Sciences. Each Faculty has a library in addition to the main library. There is other special collection that can be assessed as well. Each staff and student is given a library login password. Other facilities available in the library are the digital library, virtual library and intuitional repository (offline database) and E-resource, (E-books, E-journals and Open access database. The library opens from 8:00am – 10:00pm, (Mon- Friday)
8:00am -3:00pm (Saturday)
3:00pm- 6:00pm (Sunday)
24hr online presence
https://library.bsum.edu.ng/

Email: asklibrary@bsum.edu.ng **Tel:** 09060084768

Language Support Unit (CEFTER)
The CEFTER is equipped with 50 translation devices which in conjunction with the Languages and Linguistic department offers students and staff language support. A training in intercultural Communication is mandatorily organized for all incoming students and needs identified for further training in English if necessary.
https://bsum.edu.ng/w3/linguistics.php, Email ihomcy2017@gmail.com

Dean of Students
The Dean of Students' office is located in the Student's affairs department, first campus behind the Deputy Vice Chancellor's office. The student Affairs Division of the Benue State University is directly under the office of the Vice Chancellor. The Division is headed by a Dean of Students who is an Academic staff. The Dean of Students is assisted by a Deputy Dean who is responsible to the Dean of Students for the day-to-day administration of the Division. The Division is majorly concerned with student's welfare. The role of the Benue State university student affairs division includes amongst others: The provision of counselling services to students, clubs and societies, allocation of student hostel, coordinating student union matters and handling student bursary and scholarships.
https://bsum.edu.ng/w3/student_affairs.php#

Security services
The security department is located behind the Professorial Offices in the First campus and By the Mass Communication Department in the second campus. This unit is headed by a Chief Security Officer. Some contacts are: oibya2018@gmail.com, +2347038646447.

Link to Key University Policies
Sexual Harassment Policy:
https://www.cefterbsu.edu.ng/download/Sexual%20Misconduct%20Policy%20Statement.pdf

Scholarship Policy:
https://www.cefterbsu.edu.ng/download/CEFTER_Scholarship_Policy.pdf

Research Policy: Draft yet to be approved by University Council

Key Contacts at the University and Centre

Name	Designation/Position	Telephone No.	Email.
Dr. Barnabas A. Ikyo	Centre Leader	08185069529	aikyo@bsum.edu.ng
Dr. (Mrs). Ogbene Gillian Igbum	Deputy Centre Leader	08033116421	iogbene@bsum.edu.ng
Professor Toryina Ayati Varvar	Postgraduate Administration	07030559633	tvavar@bsum.edu.ng
Engr. Ijir Aondosoo	Student Liaison	08093854492	Ijirsam1987@icloud.com
Prof. Bernard Ortwer Atu	Head of Department, Biology	08035362300	batu@bsum.edu.ng
Dr. Benjamin Asen Anhwange	Head of Department, Chemistry	08057050242	banhwange@gmail.com
Dr. Margaret Bai Tachia	Head of Department, Sociology	07030356465	megbai2014@gmail.com
Professor Frederick Gbaoron	Head of Department, Physics	07038635405	fredgbaorun@gmail.com
Dr. Benedict Iorzer Labe	Head of Department, Voc & Tech	08068701986	blabe@bsum.edu.ng
Dr. Musa Egahi	Head of Department, Maths & Computer	07037533071	musaegahi@gmail.com
Professor Isa Okpe	Head of Department, Economics	08032939225	ijpkpe@yahoo.com
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Professor Emmanuel A. Kenen	Head of Training and Research	08136881761	emmanuelkene@yahoo.com
Professor Otor Eriba	Dean of Students	08167218929	ototeribaemmanuel@gmail.com
Mr. Shishi Solomon Sesugh	Graduate Admission	08035859107	shishisesesugh@gmail.com
Dr. (Mrs). Akombo Pauline M.	Examination Coordinator, Biology	07038141372	mbakaanpauline@yahoo.com
Dr. Barnabas Aloo Kyenge	Examination Coordinator, Chemistry	08032914924	donbkyenge@gmail.com
Dr. Daniel Momngu Tiough	Examination Coordinator, Voc & Tech	07037897210	dantiough@yahoo.com
Dr. Innocent Ogwuche	Examination Coordinator, Maths & Comp	08062244326	innocent.ogwuche@yahoo.com
Dr. (Mrs).Agbanugo Agnes Ikwuba	Examination Coordinator, Sociology	07037782511	agikwuba@gmail.com
Dr. Daniel Terver	Examination Coordinator, Physics	08167598988	tdaniel@bsum.edu.ng
Dr. Jerome Andohol	Examination Coordinator, Economics	08035999111	torsaa2002@yahoo.com
Dr. Sylvester Adejo	Grants Manager	08054557652	soadejo@gmail.com
Mr. Simon T. Danbeki	Accounts Officer	08050615342	danbekist2@gmail.com
Mr. Anjila Tersoo	ICT Officer	08066246499	tersooanjila@gmail.com
Mr. Oliver Oraii Ibya	Chief Security Officer	07038646447 08076235422	Oibya20182018@gmail.com

Staff Advisers

Name	Area of Specialisation	Phone	Email
Mr. Isaac Adeyemi	Food Processing and Preservation	09069524244	izakgrrg@gmail.com/winitel@yahoo.uk.com
Ms Cordelia Adamu	Food Fortification and Development	08099601071	corrylad@yahoo.com
Prof. Charles Ariahu	Food processing and Packaging	08036804789	charlesariahu@gmail.com
Prof. Joseph Kur	Patents and Royalties	08035917744	jkur@bsum.edu.ng
Mr. Ben Anani	Export Opportunities	08033024986	Anani74@gmail.com
Dr. Grace Anweh	Product Advertisement and Marketing	08029197075	ganwe@bsum.edu.ng
Prof. Solomon G. Shola	Fish	07037275891	solagabriel@yahoo.co.uk
Prof. Moses Obasi	Corn	09077707000	moses.obasi@aun.edu.ng
Dr. Erdoo Kukwa	Yam	08123287224	ekukwa@bsum.edu.ng
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Prof. Simon Irtwange	Rice	08035885567	svirtwange@yahoo.com
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Dr. Stephanie Adelusi	Soybean	08189892325	astephanie@bsum.edu.ng
Prof. Godwin Obochi	Pepper	08136861988	gobochi@yahoo.com

CHAPTER ONE
BIOLOGICAL SCIENCE DEPARTMENT

M.SC PROGRAMME IN POSTHARVEST PHYSIOLOGY AND MANAGEMENT OF CROPS

PHILOSOPHY

The M.Sc. programme in Postharvest Physiology and Management of Crops is aimed at acquainting students with the basic information on postharvest physiology, postharvest losses and their causes and measures to reduce them, maintaining quality, market value, nutritional value and food safety. Shelf life extension, processing, transportation and storage.

This would be achieved through:

- Introducing students to the basic concepts of crop postharvest physiology
- Creating a better understanding of plants, the storage environment, postharvest losses their causes and measures to minimize them
- Developing a clear understanding of the role of the surrounding condition of the plant in minimizing postharvest losses, increasing shelf-life, processing and storage of produce
- Introduce students to the various cultural practices upon which is laid successful postharvest management of farm produce
- Identification of storage pests, and diseases so that one can select appropriate methods of control
- Identifying the best practices of harvesting, minimizing losses, increasing shelf life, transportation, processing and storage of field crop.

OBJECTIVES

In order to achieve the set aims, certain overall objectives have been set. In each unit specific objectives are set. These are usually included at the beginning of the unit. Students should pay attention to the objectives of each unit before starting to go through them. They can always refer back to the unit's objectives to check their progress. They should also look at them after completing a unit. By so doing you can be sure that you have achieved what the unit expects them to acquire.

Below are the wider objectives of the whole course. By meeting these objectives, the aims of the course as a whole would have been achieved.

- Give classification of maturity and maturity index of field crops and horticultural crops
- Understand the postharvest management and the technical and managerial resources that are utilized in the process of produce harvest, processing and storage
- Identify the most appropriate postharvest technology to apply in processing, extension of shelf life and storage of produce
- Describe the various postharvest practices for minimizing losses, extension of shelf life and storage
- Identify the most critical periods in postharvest life of plant in relation to storage and recommend technologies that are most appropriate.
- Describe methods of processing produce
- Identify the common pest of crop in storage and describe the control measures to effectively tackle the problems of rodents and pest of storage.

Admission Requirements:

Bachelor's degree in Crop Science and any other related Life Sciences

Transcripts

Application by candidate shall be accompanied with undergraduate transcript (M.Sc. programme). This is to ascertain that the candidate has met the admission requirements as stipulated in 3 above.

Residency:

Candidates shall be admitted into this full time basis and shall spend a minimum of four semesters and a maximum of six semesters. The first two semesters shall be for course work.

Probation/Withdrawal:

At the end of course work, a candidate with a CGPA of less than 2.50 shall be withdrawn.

Graduation Requirements:

To qualify for the award of the M.Sc. degree in Post-Harvest Management of the Benue State University, a candidate must have registered for and passed all core courses and earned a minimum of 34 credit units. Students must also take 6 units of electives. An entrepreneurship course is compulsory for all students. A seminar will be presented by each student on completion of the course work.

Grading System

Grading system and weighting of course work will follow the grading system approved by the National Universities Commission (NUC) grading system as follows:

1. Credit Units	2. % Scores	3. Letter Grades	4. Grade Points	5. Grade Point Average (GPA)	6. Cumulative Grade Point Average (CGPA)
Varying according to contact hours assigned to each course per week per semester and according to load carried by student	70 – 100	A	5	Derived by multiplying 1 and 2 and dividing by total credit units.	4.50 - 5.00
	60 – 69	B	4		3.50 - 4.49
	50 – 59	C	3		2.50 - 3.49
	0 – 49	F	0		Below 2.50

Examinations:

All courses will be examined at the end of each semester. Pass mark shall be 50% or above. Candidates must earn a minimum of 34 credit units of course work to qualify for graduation. A failure in a course will require the candidate to rewrite it. A research work and a seminar paper shall be written as dissertation and be reported first in unbound

copies to the supervisor(s). If approved, it will be spiral bound in readiness for oral defence before an external examiner.

Senate shall approve on the recommendation of the Faculty Board a minimum of one external examiner and two internal examiners. Where the topic cuts across two areas of specialization, two supervisors and the HOD of the Department must certify (through written certification) to the effect that the candidate has satisfactorily completed the mandatory requirements for the degree.

At the end of oral examination a candidate shall submit six bound copies of the dissertation with full corrections/amendments as pointed out by the examination board within three months. Failure to do this within the stipulated period the result shall be invalidated and the candidate shall be required to repeat the project.

Course Codes and Course Units

Candidates are required to complete the following credit units of taught courses and research distributed as follows:

FIRST SEMESTER

Core Courses	**Course Title**	**Credit Units**
HPM 801	Post Harvest Physiology, Technology and Management of Crops	2
HPM 803	Seminar in Post Harvest Physiology and Management	2
HPM 805	Post Harvest Storage Pests and Disease Control of Horticultural and Field Crops	2
HPM 807	Postharvest Losses of Agricultural Produce	2
HPM 809	Tropical Environment in Relation to Maturity, Ripening and Senescence of Crops	2
HPM 811	Agricultural Produce packaging	2
	Total	**12**

ELECTIVES

HPM 813	Experiments in Food Engineering	2
HPM 815	Economic Analysis of Agricultural Projects	2

SECOND SEMESTER

Core Courses	**ourse Title**	**Credit Units**
HPM 802	Molecular and Cellular Aspects of Postharvest Biology	2
HPM 804	Harvesting Operations and Techniques of Fresh Fruits	2
HPM 806	Principal Causes and Control of Post Harvest Losses and Quality	2
HPM 808	Microbiology, Temperature Management, Storage and Safety of Fresh Fruits and Vegetables	2
HPM 810	Biostatistics	2
HPM 812	Internship	1
EPS 802	Entrepreneurship I	1
HPM 899	Dissertation	10
	Total	**22**

ELECTIVE

HPM 814	Agricultural Marketing	2

COURSE SYNOPSIS

FIRST SEMESTER

HPM 801: Post Harvest Physiology, technology and Management of Crops (2 Credit Units)

Overview of physiological processes related to maturation, ripening and senescence of plant products and their responses to postharvest stresses. Emphasis on postharvest physiology of vegetables. Compositional changes and physiological disorder. Management approaches and technologies to maintain product quality, prolong shelf life and limit

postharvest disorders. Crop processing. Concepts of research procedures.

HPM 803: Seminar in Postharvest Physiology and Management of Crops (2 Credit Units)

Literature Review: this consists of literature relevant to the seminar subject. Most of it should be current. Where relevant, the conceptual framework, theoretical and empirical studies should be included. The review and power point presentation should be n a special problem area of postharvest physiology and management of crops. Candidates will be assessed based on attendance, active participation in the seminar and preparation of informative review paper with complete bibliography on the seminar subject covered by the candidate.

HPM 805: Postharvest Storage Pests and Disease Control of Horticultural and Field Crops (2 Credit Units)

Identification of storage pests and diseases and evaluation of their impacts. Diagnosis, etiology and epidemiology of storage pests and diseases in relation to postharvest physiology fro stored agricultural produce. Appraisals of storage environment and storage structures in relation to storage losses. Pests and diseases control strategies in stored products.

HPM 807: Postharvest Losses of agricultural Produce (2 Credit Units)

Postharvest losses in tropical crops. Estimates of postharvest losses in developing nations. Current research and future research needs and approaches.

HPM 809: Tropical environment in Relation to Maturity, Ripening and Senescence of Crops (2 Credit Units)

Abiotic and biotic factors in relation to maturity, ripening, senescence and quality of crops. Maturity indices of field crops. Abiotic stress tolerance.

HPM 811: Agricultural Produce Packaging (2 Credit Units)

Principles of produce packaging. Functions of packaging. Proper ties of metal, glass, paper, and plastic materials and packages. Designs, fabrication and applications of produce packaging. Packaging of fresh produce including gains, fruits and vegetables.

HPM 813: Experiments in Food Engineering (2 Credit Units)

Use of temperature sensors, measurement of thermal conductivity and heat transfer in foods, refrigeration, freezing. Concentration and dehydration of foods.

HPM 815: Economic Analysis of Agricultural Projects (2 Credit Units)

Socio-economic and environmental considerations, analysis and synthesis of the theory of consumption, the theory of the firm and the theory of the maximizing behavior with particular reference to farm form and the farmer. Partial and general equilibrium analysis for agricultural outputs, inputs and prices. Analysis of agriculture in a market of centralized economy. Intensity of resource use and profitability.

SECOND SEMESTER

HPM 802: Molecular and Cellular Aspects of Postharvest Biology (2 Credit Units)

Basic concepts and current knowledge of issues relevant to postharvest biology. Mechanisms of fruit ripening, senescence, programmed cell death. Mechanism and functions of phytohormones, carbohydrates, liquids, pigments, flavor compounds and phytonutrients at molecular and cellular levels.

HPM 804: Harvesting Operations and Techniques of Fresh Fruits (2 Credit Units)

Maturity indices of fresh produce. Types of maturity of fruits and vegetables: harvest maturity, physiological maturity, commercial or Horticultural maturity, harvesting techniques and relationship between harvesting and crop quality. Postharvest handling/packing house operations – Cleaning, selection, grading and packaging. Postharvest treatments – Curing, waxing, inhibition of sprouting, fungicide application to minimize produce contamination and maximize quality. Use of growth regulations.

HPM 806: Principal Causes of Control of Postharvest Losses and Quality (2 Credit Units)

Overview of causes of postharvest losses. Physiological factors – Respiratory patterns (perishability). Ripening (climacteric and non-climacteric fruits). Ethylene production and transpiration. The importance of control of postharvest losses. Control and quality measures – Pre-production system and pre-harvesting conditions. Roles of harvesting and handling techniques, packaging, transportation, storage and processing on postharvest losses and quality. Roles of ripening and senescence on compositional changes. Causes and types of mechanical injury. Roles of pests and diseases, changes in pigments, carbohydrates and pectin.

HPM 808: Temperature Management and Storage and Safety of Fresh Fruits and Vegetables (2 Credit Units)

Pre-cooling – meaning and importance. Methods of simple pre-cooling system. Methods of high-speed cooling. Simple refrigeration of fresh produce. Controlled and modified atmospheric storage. Basic elements/components of storage. Factors affecting storage life and classification of storage systems. Description of various storage systems. Specific storage systems for some fruits and vegetables.

Short, medium and long term storage systems for yam, cassava, sweet potato, Irish potato and cocoyam. Storage structures – ventilated store, clamp and barn. Microorganisms of fresh produce, pre and postharvest factors influencing risk of microbial contamination. Hygiene procedures.

HPM 810: Biostatistics (2 Credit Units)

Basic statistical methods and sampling techniques. Statistical parameters – mean, mode, median, frequency and frequency distribution, correlation and regression analysis. Probability and hypothesis testing, binomial distribution. Analysis of variance. Experimental design.

HPM 812: Internship (1 Credit Unit)

Student industrial work experience to be done at a relevant industry. This will be supervised and graded by allocated supervisors.

HPM 814: Agricultural Marketing (2 Credit Units)

The analysis of organizations, costs and performance of markets 9serving various agricultural consumers) and their suitability for developing countries. Government policies towards agricultural markets and the role of marketing in economic development. International aspects of agricultural marketing. The areas of market research and problems of markets management in private firms. The measurement of the various types of elasticity. The measurement of pricing efficiency of food commodity systems. The construction and use of index numbers. Types and basis of government price policies. Methodology in price analysis. Selected empirical applications.

EPS 802: Entrepreneurship I (1 Credit Unit)

HPM 899: Dissertation (10 Credit Units)

This will be taken after course work. It must show evidence of originality and must be satisfactory as regards literary presentation. It

must neither reproduce other people's work nor be a re-submission of previous work. It shall involve original short term research on problems of postharvest physiology and management.

LECTURERS FOR THE PROGRAMME

NAME	QUALIFICATION	RANK	AREA OF SPECIALIZATON	STATUS
Innocent Agbo Adikwu	B.Sc. (Ibadan), M.Sc. (BUK), Ph.D (Stirling, Scotland)	Professor	Aquaculture and Fisheries Management	Tenure
Edward Agbo Omudu	B.Sc (Jos), M.Sc, Ph.D. (UNN).	Professor	Entomology/Pest Management	Tenure
Bernard Ortwer Atu	B.Sc (Benin), M.Sc, Ph.D. (Zaria)	Assoc. Professor	Environmental/ Public Health	Tenure
Elizabeth A. Amuta	B.Sc (Zaria), M.Sc, Ph.D. (Jos)	Professor	Parasitology/ Microbiology	Visiting
Emmanuel Msugh Mbaawuaga	B.Sc (Sokoto), M.Sc. (Jos), Ph.D.	Senior Lecturer	Microbiology	Tenure
B. A. Kalu	B.Sc, M.Sc., PhD.	Professor	Farming Systems	Visiting
E. J. Ekefan	B.Sc, M.Sc., PhD.	Professor	Plant Pathology	Visiting
P. E. Odo	B.Sc, M.Sc., PhD.	Professor	Plant Pathology	Visiting
M. U. Ukwela	B.Sc, PhD.	Professor	Economic Entomology	Visiting
M. O. Obasi	B.Sc, (India) 1981, M.Sc. (India) 1984, PhD. (Nsukka) 1989	Professor	Crop Physiology	Visiting
Terkimbi Vange	B.Sc, M.Sc., PhD.	Professor	Plant Breeding	Sabbatical
J. I. Oluwatayo	B.Sc, M.Sc.	Snr. Lect.	Plant Nematology	Visiting
L. O. Omoigui	B.Sc, M.Sc., PhD.	Ass. Prof	Plant Breeding	Visiting
P. A. Kortse	B.Sc, PhD.	Senior Lecturer	Seed Science	Visiting
F. D. Ugese	B.Sc, M.Sc., PhD.	Snr. Lect	Farming Systems	Visiting
Hosea Zakki Yula	B.Sc, M.Sc (Zaria)	Lecturer I	Veterinary Parasitology and Entomology	Tenure

M. I. Ogbaji	B.Sc, M.Sc PhD. (Ibadan)	Professor	Genetic and Plant Breeding	Visiting
N.I. Odiaka	B.Sc., M.Sc., Ph.D. Ibadan	Professor	Horticulture	Sabbatical

Ph.D. POSTHARVEST PHYSIOLOGY AND MANAGEMENT OF CROPS

PHILOSOPHY

The Ph.D. programme in Postharvest Physiology and Management of Crops is aimed at outlining the biological processes that occur in crops before and after harvest that directly impact product quality and the practical strategies that are used to reduce rates of postharvest decay and maintain quality. The course integrates basic biological knowledge with industry practices and introduces current research topics. The course is focused on examining the key concepts of postharvest biology that can be applied to multiple crops rather than exhaustively detailing handling and storage criteria for specific crops. A key underlying principle of the course is its relevance to society, as it relates to us as consumers, but also more broadly to global food supplies and food security.

OBJECTIVES

The main objective of the course is to identify various post-harvest physiological processes and treatments that could be applied to prolong shelf-life of fresh produce. At the end of the course the students will be able to:

(i) Explain the meaning of post-harvest physiological processes, physiological maturity, harvesting maturity, senescence and post-harvest losses.
(ii) Describe the benefits of effective pre-harvest treatments in the control of post-harvest losses.
(iii) Discuss the underlying causes and control of post-harvest losses.

(iv) Describe the profile of different types of commodities and storage methods.
(v) Develop practical methods on post-harvest physiological processes and storage of food.

ADMISSION REQUIREMENTS

Graduates of Benue State University, Makurdi or any other recognized university who have obtained a minimum of Masters (M.Sc.) degree in Botany, Environmental Sciences, Biology or Biotechnology are eligible. In addition, candidates must also possess five O' Level Credits in not more than two sittings in relevant science subjects including Mathematics and English language to qualify for admission (i.e. Biology, Chemistry, Mathematics or Physics, English language and any other subject). Only candidates with a minimum Cumulative Grade Point Average CGPA of 3.50 at masters are eligible.

i. TRANSCRIPTS

Application by candidate shall be accompanied with Post-Graduate transcript. This is to ascertain that the candidate has met the admission requirements as stipulated above.

ii. DURATION OF PROGRAMME

Candidates admitted into this programme on full time basis shall spend a minimum of six semesters and a maximum of eight semesters. Candidates on part time shall spend a minimum of eight semesters and a maximum of twelve semesters.

GRADUATE REQUIREMENTS

To qualify for the award of the Ph.D. degree in Postharvest Physiology of Crops at the Benue State University, a candidate must have registered for and passed not less than 30 credit units of core courses relevant to his/her area of specialization. In addition the candidate must have completed his/her research work and thesis to the satisfaction of

both internal and external examiners and in accordance with the guidelines of the Postgraduate School of the Benue State University.

GRADING SYSTEM

Grading system and weighting of course work will follow the grading system approved by the National Universities Commission (NUC) grading system as follows:

1. Credit Units	2. % Scores	3. Letter Grades	4. Grade Points	5. Grade Point Average (GPA)	6. Cumulative Grade Point Average (CGPA)
Varying according to contact hours assigned to each course per week per semester and according to load carried by student	70 – 100	A	5	Derived by multiplying 1 and 2 and dividing by total credit units.	4.50 - 5.00
	60 – 69	B	4		3.50 - 4.49
	50 – 59	C	3		2.50 - 3.49
	0 – 49	F	0		Below 2.50

EXAMINATIONS

All courses will be examined at the end of each semester. Pass mark shall be 50% or above. Candidates must make a minimum of 34 credits units of course work to qualify for graduation in M.Sc. programme. A failure in a course will require the candidate to rewrite it. A research project and a seminar paper shall be written as dissertation and be reported first in unbound copies to the supervisor(s). If approved, it will be spiral bound in readiness for oral defense before an external examiner. Senate shall approve, on the recommendation of the Faculty Board a minimum of one external and two internal examiners. Where

the topics cut across two areas of specialization, two supervisors and the HOD of the department must certify (through written certification) to the effect that the candidate has satisfactorily completed the mandatory requirements for the degree.

At the end of Oral Examination, a candidate shall submit six permanently bound copies of the thesis or dissertation with full corrections/amendments as pointed out by the examination board within three months. Failure to do this within the stipulated period, the result shall be invalidated and the candidate will be made to return to the laboratory.

COURSE REQUIREMENT

Candidates are required to complete the following credit units of taught courses and research distributed as follows:

FIRST SEMESTER

Course Code	Course Title	Credit Units
HPM 901	Advances in post harvest Losses and Quality of Agricultural Produce	2
HPM 903	Advances in Post Harvest Physiology, Technology And Management of Crops	2
HPM 905	Advances in Post Harvest Storage Insect Pests and Disease Control of Agricultural Produce	2
HPM 907	Advances in Bio-deterioration and Control Management in Stored Processed Roots and Tubers	2
HPM 909	Advances in Post Harvest Handling and Management Systems of Cereals and Legumes	2
HPM 911	Advances in Post Harvest Handling Systems and Management of Ornamental Crops	2
ELECTIVES		
HPM 913	Advances in Produce Economics	2
HPM 915	Marketing of Agricultural Produce	2

SECOND SEMESTER

Core Courses	Course Title	Credit Units
HPM 902	Advances Post Harvest Pathology and Management of Agricultural Produce	2
HPM 904	Advances in Packaging Systems of Agricultural Produce	2
HPM 906	Design of Storage Structures	2
HPM 908	Advanced Experimental Designs and Analysis	2
HPM 910	Seminar in Post Harvest Physiology and Management	2
HPM 912	Internship	1
EPS 902	Entrepreneurship II	1
HPM 999	Thesis	30

ELECTIVES

HPM 914	Biotechnology	2
HPM 916	Post-Harvest Physiology and Management of Seeds	2

COURSE SYNOPSIS

HPM 901: Postharvest Losses and Quality of Agricultural Produce (2 Credit Units)

Pre and Postharvest practices responsible for losses of agricultural produce. Qualitative (technological, hygienical, nutritional, sensory/physical), Quantitative and socio-economic losses. Physiological factors responsible for produce losses. Loss assessment and estimation techniques and their limitations. Advanced techniques for reducing losses and management strategies for ensuring quality.

HPM 903: Advances in Postharvest Physiology, Technology and Management of Crops (2 Credit Units)

Biochemical, biophysical changes of harvested perishable crops. Methods and techniques to prolong shelf-life and maintain quality of perishable commodities. Storage facilities. Quality evaluation. Physiological mechanisms controlling maturation, ripening and senescence and effects of environmental factors.

HPM 905: Advances in Post Harvest Storage Insect Pests and Disease Control of Agricultural Produce (2 Credit Units)

Biology, ecology, type of damages and behavior of stored insect pests. Major insect pests, current practices for their control. Postharvest insect pest management.

HPM 907: Advances in Bio-deterioration and Control Management in Stored Processed Roots and Tubers (2 Credit Units)

Concepts and advances in bio-deterioration. Causes and appropriate techniques for handling. Group participatory studies for generation of appropriate and applied techniques.

HPM 909: Advances in Post Harvest Handling and Management Systems of Cereals and Legumes (2 Credit Units)

Interrelationship of temperature, moisture, molds, insects in cereals, grains and legumes in storage. Biochemical and nutritive changes during storage. Storage conditions and methods. Roles of containers. Effects of transportation.

HPM 911 Advances in Post Harvest Handling Systems and Management of Ornamental Crops (2 Credit Units)

Growing conditions, harvesting and utilization of ornamental plants. Structural, physiological and metabolic changes associated with

senescence of ornamental plants. Quality evaluation and grading. Preservation techniques. Factors affecting postharvest life. Packaging system, packing house operations, storage. Transportation and marketing. Retail florist care and operation. Care/management of ornamental plants.

HPM 913: Advances in Produce Economics (2 Credit Units)
Advanced topics in agricultural production including aggregation problems, partial equilibrium dynamics of firms and industries.

HPM 915: Marketing of Agricultural Produce (2 Credit Units)
Discussion of advanced topics in marketing of agricultural produce.

SECOND SEMESTER

HPM 902: Advances Post Harvest Pathology and Management of Agricultural Produce (2 Credit Units)
Typical symptoms, characteristics and signs associated with various postharvest diseases. Different groups of micro-organisms that cause deterioration. Major post-harvest diseases of important agricultural produce and their control. Integrated management approaches.

HPM 904: Advances in Packaging Systems of Agricultural Produce (2 Credit Units)
Physical and chemical properties of packaging system. Modified atmosphere packaging. Mathematical models to produce packs. Computerized pallet and container dimensions. Wholesale and retail packaging. Shipping containers and transport systems. Health aspects associated with packaging.

HPM 906: Design of Storage Structures (2 Credit Units)
Traditional/Local storage structures. Advanced and modern storage structures. Advantages and disadvantages. Mathematical models for storage structure design. Lateral loads, theories of failure in non-fluid

masses. Design for container walls for combined loading. Flow properties of bulk materials.

HPM 908: **Advanced Experimental Designs and Analysis (2 Credit Units)**

Experimental designs and analysis. Multiple correlation and regression analysis. Covariances, multiple factor experiments. Time series and multilocational trials. Orthogonal comparison of means. Computer programmes for statistical analysis.

HPM 910: Seminar in Post Harvest Physiology and Management (2 Credit Units)

Students shall be assigned selected topics in postharvest physiology and management for critical appraisal/literature investigation at presentation a seminar.

HPM 912: Internship (1 Credit Unit)

Student industrial work experience to be done at a relevant industry. This will be supervised and graded by allocated supervisors.

EPS 902: Entrepreneurship II (1 Credit Unit)

HPM 999: Thesis (30 Credit Units)

Candidates are required to carry out a detailed and original research in their areas of specialization under their supervisors, and to present analysis of their results and research data embodied in a thesis. As part of their preparation for the thesis, candidates shall be required to give three seminars comprising of proposal progress and result based (postfield) seminars.

ELECTIVES

HPM 914 Biotechnology (2 Credit Units)

HPM 916 Post-Harvest Physiology and Management of Seeds (2 Credit Units)

LECTURERS FOR THE PROGRAMME

NAME	QUALIFICATION	RANK	AREA OF SPECIALIZATON
Innocent Agbo Adikwu	B.Sc. (Ibadan), M.Sc. (BUK) Ph.D(Stirling, Scotland)	Professor	Aquaculture and Fisheries Management
Edward Agbo Omudu	B.Sc (Jos), M.Sc, Ph.D (UNN).	Professor	Entomology/ Pest Management
Bernard Ortwer Atu	B.Sc (Benin), M.Sc, Ph.D (Zaria)	Snr. Lecturer	Environmental/ Public Health
Elizabeth A. Amuta	B.Sc (Zaria), M.Sc, Ph.D (Jos)	Professor	Parasitology/ Microbiology
Emmanuel Msugh Mbaawuaga	B.Sc (Sokoto), M.Sc. (Jos)	Lecturer I	Microbiology
B. A. Kalu	B.Sc, M.Sc PhD	Professor	Farming Systems
E. J. Ekefan	B.Sc, M.Sc PhD	Professor	Plant Pathology
P. E. Odo	B.Sc, M.Sc PhD	Professor	Plant Pathology
M. U. Ukwela	B.Sc, PhD	Professor	Economic Entomology
M. O. Obasi	B.Sc, M.Sc PhD	Ass. Prof	Crop Physiology
T. Vange	B.Sc, M.Sc PhD	Ass. Prof	Plant Breeding
J. I. Oluwatayo	B.Sc, M.Sc.	Snr. Lect.	Plant Nematology
L. O. Omoigui	B.Sc, M.Sc PhD.	Ass. Prof	Plant Breeding
P. A. Kortse	B.Sc, PhD	Lecturer II	Seed Science
J. A. Idoko	B.Sc, M.Sc PhD	Snr. Lecturer	Farming Systems
F. D. Ugese	B.Sc, M.Sc PhD	Snr. Lecturer	Farming Systems
Hosea Zakki Yula	B.Sc, M.Sc (Zaria)	Lecturer I	Veterinary Parasitology and Entomology
M. I. Ogbaji	B.Sc, M.Sc PhD. (Ibadan)	Ass. Prof	Genetic and Plant Breeding

POSTGRADUATE STUDIES IN FISH POST HARVEST TECHNOLOGY

M.Sc. PROGRAMME

Philosophy: The philosophy of this programme is to train prospective candidates to acquire knowledge that will enable them address the problems associated with post-harvest fish spoilage.

RATIONALE

Fish and fish farming are important agricultural products and processes in Benue State. The consumption of fish is important in the provision of proteins, vitamins, minerals and the likes for the overall wellbeing of the human body.

The fisherman derives economic benefits from sale of fish which enables him to meet up with other necessities of life. As important as these may be, fish may lose its value due to spoilage if the knowledge of processing and preservation is lacking when caught in large quantities that cannot be consumed immediately.

In the light of the above therefore, the department thought it wise to design this programme to train the trainers in the areas of fish processing and preservation technology. This is important for the wellbeing of those that consume fish and for the economic emancipation of the Benue fisherman and the world at large.

OBJECTIVES

The M.Sc. Programme in Fish Postharvest Technology has the following specific objectives:

i. To train graduates to acquire skills and knowledge in the field of fish processing and preservation technology in Nigeria, Africa and the World at large.

ii. Produce field extension staff, researchers, fish farm managers and general entrepreneurs in the specialized Agricultural business of fish production for value chain addition to guarantee quality products that can ensure market competition, penetration, fish availability and consumption.

iii. To provide the student with the platform to obtain in-depth training in aquaculture theory and practices, including processing and preservation technologies, both artisanal and advanced, for value chain addition and improvement of incomes and livelihoods for the "aqua-entrepreneur" of the new millennium.

ADMISSION REQUIREMENTS

M.Sc. Programme

i. Graduates of Benue State University, Makurdi or any other recognized university who have obtained a Bachelor's Degree with Second Class honours in Zoology, Environmental Sciences, Biology, Botany or Biotechnology are eligible.
ii. Candidate must also possess five O'/level credits at not more than two sittings in relevant science subjects including Mathematics and English language to qualify for admission (i.e. Biology, Chemistry, Mathematics or Physics, English language and any other relevant subject).

    Candidates that possess post-graduate Diploma in any of the life Sciences with CGPA of not less than 3.50 are also eligible to enrol for the programme.

TRANSCRIPT

Application by candidate for admission shall be accompanied by undergraduate transcript. This is to ascertain that the candidate has met the admission requirements as stipulated in (4i) and (4ii) respectively or

that he/she will have to undertake some remedial courses as stipulated in 5 above.

DURATION OF STUDY

Candidates admitted into this programme on full time basis shall spend a minimum of four semesters and a maximum of six semesters. Candidates on part time shall spend a minimum of six semesters and a maximum of eight semesters.

GRADUATION REQUIREMENTS

To qualify for the award of the M.Sc. degree in Fish Postharvest Technology of the Benue State University, a candidate must have in addition to his/her successful defence of dissertation, registered for and passed all core courses and make a minimum of 34 credits units of core courses with not less than 50% per each course relevant to his/her area of specialization. Students must take 6 units of electives. An entrepreneurship course is compulsory for all students.

GRADING SYSTEM

Grading system and weighting of course work will follow the grading system approved by the National Universities Commission (NUC) grading system as follows:

1. Credit units	2. % Scores	3. Letter grades	4. Grade points	5. Grade point average(GPA)	6. Cumulative grade point average (CGPA)
Varying according to contact hours assigned to each course per week per semester and according to load carried by student	70-100 60- 69 50 – 59 0 - 49	A B C F	5 4 3 0	Derived by multiplying 1 and 2 and dividing by total credit units.	4.50 -5.00 3.50 -4.49 2.50 -3.49 Below 2.50

EXAMINATIONS

All courses will be examined at the end of each semester. Pass mark shall be 50% or above. Candidate must make a minimum of 34 credits units of course work to qualify for graduation in M.Sc. programme. A failure in a course will required the candidate to rewrite it. A research project shall be written as thesis or dissertation and be reported first in unbound copies to the supervisor(s). If approved, it will be spiral bounded in readiness for oral defense before an external examiner. Senate shall approve, on the recommendation of the Faculty Board a minimum of one external and two internal examiners. Where the topic cuts across two areas of specialization, two supervisors and the HOD of the department must certify (through written certification) to the effect that the candidate has satisfactorily completed the mandatory requirements for the degree.

At the end of Oral Examination, a candidate shall submit six permanently bound copies of the thesis or dissertation with full corrections/amendments as pointed out by the examination board within

three months. Failure to do this within the stipulated period, the result shall be invalidated and the candidate will be made to repeat the project.

COURSE REQUIREMENTS FOR M.Sc. FISH POST HARVEST TECHNOLOGY

Candidates are required to complete the following credit hours of taught courses and research as outlined below:

FIRST SEMESTER

S/No	Course Code	Course Title	Credit Units
1	FPT 801	Seminar	2
2	FPT 803	Principle of packaging Technology	2
3	FPT 805	Principles and design of smoking kilns	2
4	FPT 807	Fish distribution, marketing and cooperatives	2
5	FPT 809	Fish biology	2
6	FPT 811	Fish processing techniques	2
		Total Credits	12
ELECTIVE			
7	FPT 813	Fisheries Management	2

SECOND SEMESTER

S/No	Course Code	Course Title	Credit Units
1	FPT 802	Fish Preservation Techniques	2
2	FPT 804	Nutrient composition of commercial fish species	2
3	FPT 806	Employment opportunities in fish and fish products	2
4	FPT 808	Fish gear technology	2
5	FPT 810	Biostatistics	2
6	FPT 812	Internship	1

7	ESP 802	Entrepreneurship	1
8	FPT 814	Dissertation	10
ELECTIVE			
9	FPT 813	Principles of Fisheries Economics	**2**

COURSE SYNOPSIS FOR M.Sc. FISH POST HARVEST TECHNOLOGY

FIRST SEMESTER

FPT 801: Seminar (2 Credit Units)

Each candidate is to write and present a seminar on contemporary topic in Post-harvest technology.

FPT 803: Principle of Packaging Technology (3 Credit Units)

Packaging methods, different packaging materials, Quality control of packaged product, and assessment of customer satisfaction of packaged product. Cost-benefit analysis of packaged fish products

FPT 805: Principles and Design of Smoking Kilns (3 Credit Units)

Appraisal of existing smoking kilns such as traditional smoking kilns; Altona, Waternabe, Kainji Kilns, etc. Design and construction of various model of smoking kilns. Conventional and non-conventional Fuel sources such as Firewood, saw dust, cow dung, briskets etc. and their quality. Chemical quality assessment of smoke-dried fish. Smoke quality analysis. Organoleptic assessment of smoked fish.

FPT 807: Fish Distribution, Marketing and Cooperatives (2 Credit Units)

The scope of fishery business and management, Fisheries value chain, Marketing channels. Major Stakeholders in marketing, Marketing arrangements, Rules of supply and demand. Supply and demand functions. Types and sources of credits and loans; Marketing records, accounting and financial management. Cooperative organization.

FPT 809: Fish Biology (3 Credit Units)

The gross external and internal anatomy of a typical bony and a typical cartilaginous fish. The different types of anatomical systems and basic functions of each system of organs in the fish, embryology and life history of a fish with special reference to commercially important fish e.g. Tilapia and Clarias.

FPT 811: Fish Processing Technology (3 Credit Units)

Handling of fin and shellfishes. Methods of handling before processing such as sorting and grading at fish landing site, canning. Method of handling before processing, degutting, de-scaling filleting, washing etc. Concept, strength and weaknesses of Fish processing methods such as cooking, fermentation and canning. Fishmeal and silage production. Fish by products

SECOND SEMESTER

FPT 802: Fish Preservation Techniques (3 Credit Units)

Concept of Fish preservation methods such as chilling, icing, freezing, drying, smoking and salting. Fishmeal and silage production. Post-harvest losses in fisheries.

FPT 804: Nutritional composition of commercial fish species (3 Credit Units)

Proximate analysis of fish tissue. Laboratory determination of essential and non-essential amino acid profile of fish tissues. Methods for Fatty acid determination. Macro and Micro element composition of fish. Heavy metal analysis of fish tissue, implications of elevated level of heavy metals in fish tissues.

FPT 806: Employment Opportunities in Fish and Fish Products(2 Credit Units)

Career prospect in fisheries. Employment opportunities along the fisheries value chain such as marketing of processed products, fresh

products, fisheries accessories, import and export. Identification and understanding of entrepreneurial opportunities in fish as a commodity.

FPT 808 : Fish Gear and Craft Technology(3 Credit Units)

Fishing gear and methods, characteristics and utilization of different types of fishing gears and craft. Properties of materials used in the construction of fishing gear (Natural and synthetic materials), Principles of design and construction of various fishing gears and craft. Assessment of fishing gear efficiency. Repair and maintenance of fishing gears and craft.

FPT 810: Biostatistics (3 Credit Units)

Data in biology, samples and population, variables in Biology, accuracy and precision of data, derived variables, frequency distribution, presentation of descriptive statistics, probability distributions. Probability, random sampling and hypothesis, binomial distribution, poison distribution, normal distribution. Analysis of variance, linear regression and correlation. Sampling methods, random and stratified sampling.

FPT 814: Dissertation (10 Credit Units)

Each student is required to choose and execute a special project in Post-harvest technology under the supervision of a lecturer.

FPT 812: Fisheries Management (2 Credits)

World find production and utilization. Aims, problems and economics of fisheries management. Biological basis of management i.e. analytical models, fishing efforts, yields, management techniques of natural stocks/populations in marine, brackish and inland waters, international and national fishery laws and regulations. Rights of ownership of aquatic resources basis for formulation of fisheries policies. Multi and bilateral fishing agreement and international co-operation.

FPT 813: Principles of Fisheries Economics (2 Credits)

Major economic constraints in fishery development, free access fishing, sustainable yield curve and total revenue curve, Binomic equilibrium factor, rents, welfare economic theory and its relevance for fisheries, externalities in fisheries. Capital investment and depreciation of equipment, consumer and consumption pattern, fishery resources.

LECTURERS FOR THE PROGRAMME

To qualify to teach the programmes, the lecturer must be a Ph.D. holder in the relevant area(s) and must be of the rank of lecturer 1 or above. Below is the list of staff for the programmes:

Name	Qualification	Rank	Area of Specialization	Status
Innocent AgboAdikwu	B.Sc (Ibadan), M.Sc. (Buk) and Ph.D (Sterling, Scotland)	Professor HOD,	Agriculture and fishing management	Tenure
Paul .A. Annume	B.Sc (UDS) M.Sc (Ibadan), Ph.D (Zaria)	Professor	Fish Toxicology	Visiting
PiusA. Araoye	B.Sc, M.Sc, Ph.D	Professor	Fish Ecology	Tenure
Raphael .W. Anyam	B.Sc, M.Sc, Ph.D	Senior Lecturer	Hydrobiology/ Botany	Contract
P.M. Akombo	B.Sc, 1978 (Zaria) M.Sc, 1983 (Jos) Ph.D 2014 (BSU)	Lecturer I	Fishery Science	Tenure
Ayuba V. O. (Mrs)	B.Sc(ABU) M.Sc, Ph.D(Unijos)	Professor	Ecotoxicology	Visiting
Ogbe F.G.	B.Sc, M.Sc (ABU)	Professor	Fisheries Biology and Management	Visiting
Obande, R.A (Mrs)	PhD (FUT) B.Sc (ABU), M.Sc (Unijos), Ph.D (LASU)	Snr. Lecturer	Aquatic Pollution	Visiting
Okayi R.G.	B.Sc, M.Sc (Unijos), Ph.D (UI)	Professor	Aquatic pollution and	Visiting

			Reproductive Biology	
Solomon S.G.	B.Sc,M.Sc, Ph.D (FUT)	Professor	Aquatic Pollution	Visiting
Cheikyula, J.O.	B.Sc, 1990 (Jos) M.Sc., 2006 (UI), Ph.D, 2009 (Japan)	Associate Professor	Marine Ecology	Visiting

PROPOSED PROGRAMME FOR POSTGRADUATE STUDIES IN FISH POST HARVEST TECHNOLOGY

PhD. PROGRAMME

Philosophy

The philosophy of this programme is to train prospective candidates to acquire knowledge that will enable them address the problems associated with post-harvest fish spoilage.

RATIONALE

Fish and fish farming are important agricultural products and processes in Benue State. The consumption of fish is important in the provision of proteins, vitamins, minerals and the likes for the overall wellbeing of the human body.

The fisherman derives economic benefits from sale of fish which enables him to meet up with other necessities of life. As important as these may be, fish may lose its value due to spoilage if the knowledge of processing and preservation is lacking when caught in large quantities that cannot be consumed immediately.

In the light of the above therefore, the department thought it wise to design this programme to train the trainers in the areas of fish processing and preservation technology. This is important for the

wellbeing of those that consume fish and for the economic emancipation of the Benue fisherman and the world at large.

OBJECTIVES

The PhD. Programme in Fish processing and preservation technology has the following specific objectives:

i. To train graduates to acquire skills and knowledge in the field of fish processing and preservation technology in Nigeria, Africa and the World at large.

ii. Produce field extension staff, researchers, fish farm managers and general entrepreneurs in the specialized Agricultural business of fish production for value chain addition to guarantee quality products that can ensure market competition, penetration, fish availability and consumption.

iii. To provide the student with the platform to obtain in-dept training in aquaculture theory and practices, including processing and preservation technologies, both artisanal and advanced, for value chain addition and improvement of incomes and livelihoods for the "aqua-entrepreneur" of the new millennium.

ADMISSION REQUIREMENTS

i. Candidate applying for this programme must possess a minimum of masters (M.Sc.) degree in Fish processing and Preservation Technology, Fisheries and Hydrobiology as well as Zoology from Benue State University or any other recognized University.
ii. A Minimum Cumulative Grade Point Average (CGPA) of 3.50 at Masters and Credits in five O' level results relevant to the area of study are also required.

TRANSCRIPTS

Application by candidate shall be accompanied with undergraduate transcript (M.Sc. programme) or graduate transcript (Ph.D) as the case maybe. This is to ascertain that the candidate has met the admission requirements as stipulated in 4ai and 4bi respectively or that he/she will have to undertake some remedial courses as stipulated in 5 above.

DURATION OF STUDY

Candidate on full time Ph.D. Programme shall spend a minimum of six semesters and a maximum of eight semesters. Candidates on part time shall be required to spend a minimum of eight semesters and a maximum of twelve semesters.

GRADUATION REQUIREMENTS

To qualify for the award of a Ph.D. degree in Fish Processing and Preservation Technology, a candidate must have obtained 50% or above in the prescribed courses, completed his/her research work and thesis to the satisfaction of both internal and External Examiners and in accordance with the guidelines of the Postgraduate School of the Benue State University. Candidates must also have passed with a minimum of 30 credits in order to graduate.

GRADING SYSTEM

Grading system and weighting of course work will follow the grading system approved by the National Universities Commission (NUC) grading system as follows:

1. Credit Units	2. % Scores	3. Letter grades	4. Grade points	5. Grade point average (GPA)	6. Cumulative grade point average (CGPA)
Varying according to contact hours assigned to each course per week per semester and according to load carried by student	70- 100	A	5	Derived by multiplying 1 and 2 and dividing by total credit units.	4.50 -5.00
	60- 69	B	4		3.50 -4.49
	50 - 59	C	3		2.50 -3.49
	0 - 49	F	0		Below 2.50

EXAMINATIONS

All courses will be examined at the end of each semester. Pass mark shall be 50% or above. Candidate must make a minimum of 30 credit units of course work to qualify for graduation in a Ph.D. programme. A failure in a course will required the candidate to rewrite it. A research project and a seminar paper shall be written as thesis or dissertation and be reported first in unbound copies to the supervisor(s). If approved, it will be spiral bounded in readiness for oral defense before an external examiner. Senate shall approve, on the recommendation of the Faculty Board a minimum of one external and two internal examiners. Where the topic cuts across two areas of specialization, two supervisors and the HOD of the department must certify (through written certification) to

the effect that the candidate has satisfactorily completed the mandatory requirements for the degree.

At the end of Oral Examination, a candidate shall submit six permanently bound copies of the thesis or dissertation with full corrections/amendments as pointed out by the examination board within three months. Failure to do this within the stipulated period, the result shall be invalidated and the candidate will be made to return to the laboratory.

COURSE REQUIREMENTS FOR Ph.D. FISH POSTHARVEST TECHNOLOGY

Candidates are required to complete the following credit hours of taught courses and research as outlined below:

FIRST SEMESTER

S/NO	Course Codes	Course Title	Credit Units
1	FPT 901	Seminar	2
2	FPT 903	Advance Fish Biology	3
3	FPT 905	Solar Technology in fish Processing and Preservation	3
4	FPT 907	Quality Assessment of fish and fish products	2
5	FPT 909	Research Methodology	3
6	FPT 911	Fish market tours and report writing.	1
		Total Credits	**14**

SECOND SEMESTER

S/NO	Course Codes	Course Title	Credit Units
1	FPT 902	International Fish Trade	3

2	FPT 904	Ecosystem Approach to Fisheries	3
3	FPT 906	Fisheries Economics	3
4	FPT 908	Biotechnology Application in Fish and Fish Products	3
5	FPT 910	Fisheries Governance	2
		Total Credits	**14**
6	FPT 999	Thesis	30
7	FPT 912	Fish Production	2

COURSE SYNOPSIS FOR Ph.D. FISH POST HARVEST TECHNOLOGY

FIRST SEMESTER

FPT 901 – Seminar (2 Credit Units):

Each candidate is to write and present a seminar on any topic of current interest in Fish Post harvest Technology.

FPT 903 - Advance Fish Biology (3 Credit Units):

Principles of taxonomy and identification of fresh water, brackish and marine fishes. Taxonomical characteristic of major fish families. Gross external Anatomy of fishes, functional anatomy and physiology of specific systems such as digestive, respiratory, excretory and reproductive systems of fin and shell fishes.

FPT 905 - Solar Technology in Fish Processing and Preservation (3 Credit Units):

Principles of solar harvesting, strength and weaknesses of different model of solar collector, Measure of drying efficiency of solar dryer.

FPT 907 - Quality Assessment of Fish and Fish Product (2 Credit Units):

Nutritional composition of fish. On board handling and primary processing, salting, drying, smoking and canning. Quality assessment –

sensory methods-laboratory and microbiological methods. Chemical and physical structure of fish muscle and its chemistry. Environmental factors affecting fish quality. Fish borne diseases. Review of existing laws on standards.

FPT 909 - Research Methodology (3 Credit Units):
Research design as it relate to fisheries. Concept of Data, samples, population and variables as it relate to fisheries research, Strategies and methods of data collection. Descriptive statistics, probability distributions, Normal distribution, Analysis of variance, linear regression, correlation, Probit analysis, Principal component analysis, Cluster analysis. Non-parametric test such as Kruskalwallis test, Mann Whitney's test. Application of Computer software for fisheries data analysis such as Fisat, Minitab, Genstat, Instat, Glass prism etc. Publication ethics.

FPT 911 - Fish Market Tours and Report Writing (1 Credit Unit)
Students to visit major fish markets in Nigeria. Price monitoring over the semester period and report writing.

SECOND SEMESTER

FPT 902 - International Fish Trade (3 Credit Units)
State of world fisheries, International fish trade channels, World fish export products and their ranking. Concept of Marine stewardship council (MSC) and the benefits of MSC certification. Benchmarking and Tracking Tool (BMT).

FPT 904 - Ecosystem Approach to Fishes (3 Credit Units)
History of Ecosystem approach to Fisheries (EAF), Concept of EAF, FAO toolbox for EAF, the EAF implementation process, development and implementation of management plans, review of performance of management systems, Concept of Maximum sustainable yield, Fisheries resources and right of ownership.

FPT 906 - Fisheries Economics (3 Credit Units)

Major economic constrains in fishery development; free access fishery, sustainable yield curve and total revenue curve. Bioeconomic equilibrium, factor rent, welfare economic theory and its relevance to fisheries; externalities in fisheries; capital investment and depreciation of equipment; consumer and consumption pattern.

FPT 908 - Biotechnology Application in Fish and Fish product (3 Credit Units)

Concept of Biotechnology in fish post-harvest technology. Issues in contemporary Nutritional Biotechnology as it relates to post harvest technology. Molecular diagnostics of relevant organisms relevant in fish processing and storage.

FPT 910 - Fisheries governance (2 Credit Units)

Fisheries Institutions, Conservation strategies, Regional and International Fisheries policies and laws. Sustainable livelihood approach, Code of conduct for responsible fisheries. Exclusive Economic Zone (EEZ) and its implication, territorial water and continental shelf.

FPT 999 – Thesis (24 Credit Units)

Students are required to choose and undertake a special project in Post-harvest technology under the supervision of not less than two (2) lecturers.

FPT 912 – Fish Production (2 Credit Units)

Fish farming systems (Monoculture, Polyculture, Mariculture), Pond, cage and penculture, stocking density and stocking rate, fishing gears and fishing techniques used in inland and marine water bodies, problems of artisanal fishermen.

LECTURERS FOR THE PROGRAMME

To qualify to teach the programmes, the lecturer must be a Ph.D. holder in the relevant area(s) and must be of the rank of Lecturer 1 or above. Below is the list of staff for the programmes:

Name	**Qualification**	**Rank**	**Area of Specialization**
Innocent AgboAdikwu	B.Sc (Ibadan), M.Sc. (Buk) and Ph.D (Sterling, Scotland)	Professor	Agriculture and fishing management
Paul .A. Annume	B.Sc (UDS) M.Sc (Ibadan), Ph.D (Zaria)	Professor	Fish Toxicology
Raphael .W. Anyam	B.Sc, M.Sc, Ph.D (ABU)	Senior Lecturer	Hydrobiology/Botany
P.M. Akombo	B.Sc, (Zaria) M.Sc (Jos) Ph.D (BSU)	Lecturer I	Fishery Science
Ayuba V. O (Mrs)	B.Sc(ABU) M.Sc, Ph.D(Unijos)	Professor	Ecotoxicology
Ogbe F.G.	B.Sc, M.Sc(ABU)	Professor	Fisheries Biology and Management
Tiamiyu L.O	B.Sc, M.Sc (UI) PhD (FUT)	Professor	Fish Nutrition
Obande, R.A (Mrs)	B.Sc(ABU), M.Sc (Unijos),Ph.D (LASU)	Snr. Lecturer	Aquatic Pollution
Okayi R.G.	B.Sc, M.Sc(Unijos), Ph.D(UI)	Professor	Aquatic pollution and Reproductive Biology
Solomon S.G.	B.Sc,M.Sc, Ph.D(FUT)	Ass. Professor	Aquatic Pollution
Cheikyula, J.O.	B.Sc, M.Sc(UI) Ph.D(Japan)	Snr Lecturer	Marine Ecology

CHAPTER TWO
DEPARTMENT OF CHEMISTRY

POSTGRADUATE DIPLOMA IN ANALYTICAL AND INSTRUMENTAL CHEMISTRY

Philosophy

The study of Chemistry supports research and development in areas where demands of modern research are such that training beyond a first degree is becoming progressively more necessary. The need to lay a solid background for graduates whose initial background was not sufficiently Chemistry oriented but wishes to further a career in Analytical and Instrumental Chemistry/Chemistry related disciplines to have an option becomes imperative. More so, analytical skills are very critical in Food Science and need to be upgraded to meet the growing needs of the industry.

Rationale

The postgraduate diploma Analytical and Instrumental Chemistry is targeted at equipping non-graduates of Chemistry and enhance their job performance alongside their research abilities in Chemistry/Chemistry related areas. Furthermore, it will help those who have successfully completed the programme to pursue a higher degree in Chemistry/Chemistry related discipline and upgrade graduates of Chemistry whose overall output appears deficient for a higher degree. Graduates of these programmes can also be self-reliant, creative, innovative and less dependence on government as they will be well-equipped to seek self-employment and as a result create job opportunities for others.

Objectives of the Programme

The postgraduate diploma programme (PGD) is designed to:

(i) Impart a deeper knowledge and training in major areas of chemistry.

(ii) Produce knowledgeable and highly skilled chemists with high level of competence.

(iii) Broaden the understanding of the subject of the students, with emphasis on the applied aspects especially as it relates to water and environment, food, clothing, drugs, paints and adhesives and the chemical nature of materials encountered in everyday life.

(iv) Produce well-equipped chemists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.

Admission Requirements

i) Admission into the PGD programme of the Department is based on a minimum qualification of Third Class degree. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in chemistry/related disciplines shall be eligible for admission.

ii) A candidate seeking admission into any of the PGD Programmes of the Department MUST have O' level credit passes in English Language, Mathematics, Chemistry and two other science subjects.

iii) In addition to (i) and (ii) above, a candidate seeking admission into the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry, biology and Physics.

iv) Candidates can only be admitted for Postgraduate Diploma, if their transcript for certificate is received at Postgraduate School at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue PGD in areas other than those they did their degree would be made to make up such deficiencies along with the PGD courses.

Residency/Duration of This Programme

Candidates admitted to pursue PGD Programmes of the Department on full-time basis shall spend a minimum of **two semesters** and a maximum of **four** semesters. The part-time PGD shall run for a minimum of four semesters and a maximum of six semesters.

Mode of Examination

i. A minimum of 30creditunits as follows: 15 units of core courses, 1unit of Seminar and 6 units of Project.
ii. The scoring system is 30% Continuous Assessment (C.A.) and 70% final examination.

Graduation Requirements

To qualify for the PGD in any of the areas of specialization in chemistry, a candidate must have registered for a minimum of 30 credit units and passed all including 15 units in core courses, 8 credit units in elective programmes, 1 credit unit of seminar and 6 credit units of Dissertation. The minimum pass mark for each course is "C" or 50 percent.

Probation/Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a

CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn.

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 -69	4.00
C	50 - 59	3.00
F	0 – 49	0

Course Code and Course Titles

First Semester

Core Courses

S/No.	Course Code	Course Title	Unit(s)
1	CHM 701	Statistical and Research Methods	2
2	CHM 733	Classical methods of Analysis	3
3	CHM 735	Advanced Electro Analytical methods	2
4	CHM 747	Analytical laboratory techniques I	1
5	SCI 701	Management and Entrepreneurship	2
		Total	**10**
	Elective Courses: **A minimum of 5 units to be taken**		
5	CHM 745	Clinical and Biochemical Methods	2
6	CHM 737	Principles of Electronic Instrumentation	3
7	CHM 749	Qualities of Scientific Measurements	2
		Total	**7**

Second Semester

Core Courses

S/No.	Course Code	Course Title	Unit(s)
1	CHM 700	Analytical Separation Methods	3
2	CHM 732	Instrumentation in Chemical Analysis	3
3	CHM 748	Analytical Laboratory Techniques II	2
4	CHM 752	Seminar	1
		Total	**9**
	Elective Courses: **A minimum of 4 units to be taken**		
5	CHM 734	Laboratory organization and management	2
6	ETE 806	Electronic Equipment, Repairs and Maintenance	3
7	CHM 772	Raw and Waste water processing and Quality Evaluation	2
		Total	**7**
8	CHM 751	Project	6

Course Synopses

CHM 700: Analytical Separation Methods (3units)

General introduction to separation techniques.Distillation and solvent extraction. Chromatography: paper chromatography, thin layer chromatography, column chromatography, ion-exchange chromatrography, Gel-filtration chromatography, Gas chromatography, super-critical fluid chromatography. HPLC and its modern innovations (GC-MS, LC-MS etc), Medium pressure liquid chromatography (MPLC,).

CHM 701: Statistical and Research Methods (2units)
Treatment of analytical data. Sampling and specifications. Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables. Report writing.

CHM 732: Instrumentation in Chemical Analysis (3units)
Automation in electrochemical analysis, polarography, amperometry, coulometry, automated counting in radiometric and X-rays methods of analysis. Automated analytical chromatography including gas, thin-layer, ion-exchange. Automated florescence methods. Continuous discrete flow.Application of computers in analytical chemistry including digital electronics, readout devices, noise, microprocessor. Analytical instruments, components and circuits.Sensitivity and detection limits of instruments.Chemometrics.Amplifiers, power supplies and regulators.

CHM 733: Classical Methods of Analyses (3 units)
Introduction to qualitative and quantitative analysis.Group separation of ions (use of H_2S and other reagents).Titrimetric methods.Acid-base strengths, Acid-base titration, complexometric, precipitation and redox titrations.Titration in non-aqueous solvents/media.Indicators in chemical analysis.Gravimetric analysis, Precipitates, their nature of formation, separation, purification and conversion to a weighing form. Common organic and inorganic precipitants and their applications. Application of classical methods in the characterization of foods.

CHM 734: Laboratory Organization and Management (2 Unit)
Safety in Chemistry Laboratory; Chemical Storage; Instruments and glassware care; Responsibility of the chemical analyst.

CHM 735: Advanced Electroanalytical Methods (2 units)
General introduction and classification of electro-analytical methods. Potentionmetry and potentiom etrictitrations. Polarography. Amperometry. Coulometry. Chromopotentiometry. Stripping Analysis.

CHM 737: Principles of Electronic instrumentation (2 Units)
Linear circuit design: 'Black box' representation, Equivalent circuit, inter-relation between the various parameters. Analysis of commonly used linear circuits, high frequency circuits, large signal circuit design criteria, building block of analogue circuit. Boolean algebra and the physical implementation of its concepts, minimization of Boolean expression. Burning Number codes, digital IC's, Combinational logic circuits and some commonly used MSI functional circuits assemblies, sequential; logic system, mono-stable circuits and clock pulse generation digital memories and micro-processor. Principles of digital analogues and analogue digital converters, appropriate choice of converters for certain applications.

CHM 745: Clinical and Biochemical Methods (2units)
Biologically important molecules, their separation and analysis. Sugars, amino acids, peptides, proteins, lipids, nucleic acids. Clinical analysis including enzyme assays. Immunological methods. Trace metal determination in blood, serum and urine.

CHM 747: Analytical Laboratory Techniques I (1 unit)
Qualitative and quantitative analysis. Experiments in spectroscopic techniques, analysis of air, soil, water and plant samples.

CHM 748: Analytical Laboratory Techniques II (1unit)
Experiments in chromatographic and other separation techniques, instrumental and classical methods of food and drug analysis.

CHM 749: Qualities of Scientific Measurements (2 Units)
Elements of an instrument system, electronic instruments, terminology and standards; statistics and dynamic characteristics, dynamic performance and calibrations. Data acquisition system. Basic Principles, U-tube manometers, Piston type dead- weight tester. Bowdon guage, diaphragm type gauges, indirect measurement methods. Measurement of flow; classification for measurement methods, differential legal instruments, quality and velocity meters, electronic flow meter calibration method.Measurement of Temperature.Basic principles and temperature scales, methods of measurements; chemical and physical change methods, electrical and radiation methods, calibration of temperature measuring instruments.

ETE 806: Electronic Equipment, Repairs and Maintenance (3 units)
Integration system approach, reliability and maintainability, pre-service period; Conceptual phase, development phase and Trials. Maintenance management, factors affecting maintenance; preventive and corrective maintenance, value analysis. Fault diagnostic techniques in electronic system, analogue and digital system. Common defects in electronic system, convectional electronic test tools, dedicated instruments. Fault detection and location, methods of fault location; sequential and non-sequential methods of fault allocation, systematic fault tracing and fault rectification, the complete maintenance circle. Repair system, spare part management and modern trends in fault diagnosis.

CHM 752: Seminar (1 unit).
Students will be required present supervised seminar papers in their areas of specialization. The papers will be graded by a panel of examiners.

CHM 754: Project (6 units)

Each student is expected to carry out original research work culminating to a report or dissertation on which he or she will be examined by a panel of examiners.

CHM 772: Raw and Waste water processing and Quality Evaluation (2 Units)

Water Quality parameters and standards; surface and groundwater quality; Water processing methods; Sources and characteristics of municipal and industrial wastewaters; Wastewater treatment Chemistry: community wastewater treatment system, biological removal of phosphorus and nitrogen from wastewater; methods of water analysis; microbiological composition of water; Packaging of water.

SCI 701: Management and Entrepreneurship (2 Units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

Staff List

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1998 M.Sc-Manchester-2004 Ph.D –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Patrice Anthony Okoye	B.Ed.- Benin-1982 M.Sc-Benin-1987 Ph.D -Nnamdi Azikiwe-2000	Visiting	Professor	Analytical/Environmental Chemistry
3	Casmir Emmanuel	B.Sc,- Zaria – 1983	Visiting	Professor	Analytical Inorganic

	Gimba	M.Sc,- Zaria - 1988 PhD – Zaria - 2001			
4	Raymond Ahulle Wuana	B.Sc,- BSU – 1998 M.Sc,- Benin - 2004 PhD – Benin - 2010	Visiting	Professor	Analytical/Environmental Chemistry
5	Simon Terver Ubwa	B.Sc -Calabar - 1991 M.Sc- Ibadan - 1997 PhD- Nsukka- 2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
6	Godwin Oche Obochi	B. Sc. –UAM- 2002 M.Sc. –Calabar- 2007 Ph.D Calabar- 2014	Tenure	Associate Professor	Biochemistry
7	Sule Philips Ivoms Ogah	B. Sc. Maiduguri -1992 M.Sc. Maiduguri- 1998 Ph.D Maiduguri- 2013	Part Time	Senior Lecturer	Analytical Chemistry
8	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
9	Itodo Udoji Adams	B. Sc. Sokoto 2002 M.Sc. Sokoto 2006 Ph.D Zaria 2011	Part-Time	Senior Lecturer	Analytical Chemistry

10	Sylvester Obaike Adejoh	B.Sc- Jos-1980 M.Sc –Jos-1995 PhD- Jos-2015	Tenure	Senior Lecturer	Physical Chemistry
11	Benjamin Asen Anhwange	B.Sc- Zaria-1992 M.Sc- Zaria-2005 PhD- Zaria-2014	Tenure	Senior Lecturer	Analytical Chemistry
12	Samuel Peter Malu	B. Sc. 1993- Zaria M.Sc. 2007 – Zaria Ph.D 2015- Zaria	Part-Time	Senior Lecturer	Analytical/Industrial Chemistry/Environmental Chemistry and Toxicology
13	Peter Agorye Adie	B.Sc- Calabar-1991 M.Sc- Calabar - 2004 PhD –Calabar-2010	Tenure	Senior Lecturer	Analytical/Environmental Chemistry
14	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD- Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
15	Leke Luter	B.Sc- Jos-2002 M.Sc- Ibadan-2006 PhD -Aberdeen, UK-2015	Tenure	Senior Lecturer	Industrial Chemistry

POSTGRADUATE DIPLOMA IN CONSUMER SCIENCE: FOOD AND NUTRITION

Philosophy

The production, processing and marketing of food to meet nutritional requirements of consumers demand that all stakeholders in food industry should employ ways of updating their technical or managerial skills about all the emerging trends in food and beverage science, nutrition and Health. The Postgraduate Diploma in Consumer Science: Food and Nutrition is tailored to take advantage of the excellent career prospects available in the food industry. It is specifically designed for working professionals or students who want to increase their knowledge of Food Science.

Rationale

There is every need to lay a solid background for graduates whose initial background in Food Science is not sufficient but wish to further a career in this area or related disciplines to have an option. The postgraduate diploma in Consumer Science: Food and Nutrition will equip non-graduates of the field and enhance their job performance alongside their research abilities in Food Science and Nutrition. Furthermore, it will help those who have successfully completed the programme to pursue a higher degree in Food Science and a related discipline and upgrade graduates whose overall output in the same area appears deficient for a higher degree.

Objectives of the Programme

The postgraduate diploma (PGD) programme is designed to:

(i) Impart a deeper knowledge and training in major areas Food Science and Nutrition.

(ii) Produce knowledgeable and highly skilled Food Scientists with high level of competence.

(iii) Broaden the understanding of the subject of the students, with emphasis on the applied aspects especially as it relates to food and human health.
(iv) Produce well-equipped Food chemists required at the universities and other institutions of higher learning.
(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.
(vi) Provide information on the nutritional status of indigenous foods and food products.

Admission Requirements

i) Admission into the PGD programme of the Department is based on a minimum qualification of Third Class degree. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in Chemistry/related disciplines shall be eligible for admission.

ii) A candidate seeking admission into any of the PGD Programmes of the Department MUST have O' level credit passes in English Language, Mathematics, Chemistry and two other science subjects.

iii) Candidates can only be admitted for Postgraduate Diploma, if their transcript for certificate is received at Postgraduate School at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue PGD in areas other than those they did their degree would be made to make up such deficiencies along with the PGD courses.

Residency/Duration of This Programme

Candidates admitted to pursue PGD Programme in Comsumer Science: Food and Nutrition of the Department on full-time basis shall spend a minimum of **two semesters** and a maximum of **four**. The part-time PGD shall run for a minimum of four semesters and a maximum of six semesters.

Mode of Examination

iii. Candidates with deficiency may be required by the department to take additional courses at lower level.

iv. A minimum of 30creditunits as follows: 15 units of core courses, 1unit of Seminar and 6 units of Project.

v. The scoring system is 30% Continuous Assessment (C.A.) and 70% final examination.

Graduation Requirements

To qualify for the PGD in any of the areas of specialization in chemistry, a candidate must have registered for a minimum of 30 credit units and passed all including 15 units in core courses, 8 credit units in elective programmes, 1 credit unit of seminar and 6 credit units of Dissertation. The minimum pass mark for each course is "C" or 50 percent.

Probation/Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn.

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 -69	4.00
C	50 - 59	3.00
F	0 – 49	0

Course Code and Course Titles

First Semester

Core Courses

S/No.	Course Code	Course Title	Units
1	CHM 701	Statistical and Research methods	2
2	FCH 771	Food Science I	3
3	FCH 775	Food Communication I	2
4	FCH 777	Nutrition	2
5	FCH 779	Consumer Behaviour	2
6	SCI 701	Management and Entrepreneurship	2
		Total	**13**
		Elective Courses: A minimum of 5 units to be taken	
8	CHM 723	Advanced Natural Product Chemistry	3
9	CHM 763	Colour Chemistry	3
10	CHM 767	Food Additives	2
11	FCH 769	Food Processing and Preservation	2
		Total	**10**

Second Semester

Core Courses

S/No.	Course Code	Course Title	Units
1	FCH 752	Seminar	1
2	FCH 770	Food Communication II	2
3	FCH 772	Food Science II	3
4	FCH 774	Food and Beverage Studies	2
5	FCH 764	Applied Food Microbiology	3
		Total	**11**
		Elective Courses: **A minimum of 4 Units to be taken**	
5	CHM734	Laboratory Organization & Quality Control	2
6	FCH 768	Food Packaging	2
7	FCH 760	Functional Foods and Nutraceuticals	2
		Total	**6**
8.	FCH 751	Project	6

Course Synopses

CHM 701: Statistical and Research Methods (2 Credit Units)

Treatment of analytical data.Sampling and specifications.Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance.Linear relationships between two variables.Report writing.

BSM 771: Business Management (2 Credit Units).
Introduction to management, planning, organizing, leading, control.Business management, human resources management, starting your own business and entrepreneurship.

CHM 723: Advanced Natural Product Chemistry (3 Credit Units).
More complex examples of natural products than were studied at the undergraduate level: Advanced treatment of terpenoids, steroids, alkaloids and their biogenetic path-ways. Some detailed examples with citations of recent literatures on the structural elucidations using modern spectroscopic techniques. Total synthesis of some natural products and their derivatives. Methods of isolation of natural products including bio-assay directed isolation methodology. Natural polymers (natural rubber) and their biogenesis.

CHM 734: Laboratory Organization and Management (2 Credit Units).
Safety in Chemistry Laboratory; Chemical Storage; Instruments and glassware care; Responsibilities of the Chemical Analyst**.**

FCH 752: Seminar (1 Credit Units).
Students will be required present supervised seminar papers in their areas of specialization. The papers will be graded by a panel of examiners.

FCH 754: Project (6 Credit Units).
Each student is expected to carry out original research work culminating to a report or dissertation on which he or she will be examined by a panel of examiners.

CHM 763: Colour Chemistry (3 Credit Units).
Colour and its features; Types of colours.Pigments; organic, inorganic and metallic pigments. Classification of dyes; Natural dyes and dyeing

processes; Dyeing mechanisms. Linkages between pigments and dyes. Application of dyes and pigments. Synthesis and chemical reactions, anthraquinoneacides and disperse dyes, practical methods of diazotization and coulpling, chemistry of technical dyes containing azo groups dyes of indigo and thioindigo classes. Colour and chemical constitution of organic molecules. Dyes structure and functions of the various components.

FCH 764 Applied Food Microbiology (3 Credit Units).
Qualitative and quantitative aspects of microbiology in relation to behavior and detection of microorganism in foods.Evaluation of sub-lethal food processing techniques e.g freezing, drying, pasteurization on recovery growth and enumeration of microorganisms on foods. Selected topics concerned with the use of micro organisms for the production of substances of industrial, medicinal and/or nutritional value such as amino acids, antibiotics, vitamins and organic acids with emphasis on metabolic regulation of biochemical pathways leading to fermentation products.

CHM 767: Food Additives I (2 Credit Units).
Acids, bases, and buffering salts. Preservatives and antioxidants. Flavouring and sweeteners. Food Colorants. Structure and appearance control agents. Nanoparticles in food.

FCH 769: Food Processing and Preservation (2 Credit Units).
Description of different methods of processing local food materials.Different methods of preservation both traditional (e.g smoking, salting, dehydration) and modern methods (e.g canning, food irradiation and use of phytochemicals).

FCH 770: Food Communication II (2 Credit Units).
Recipe and new product development, promotional copy, Visual merchandising, photography, Assessed sensory laboratory work, two assignments and two major projects given

FCH 771: Food Science I (3 Credit Units).
Theory Recipes: analysis, evaluation, development. Food production: Source: choice/purchasing; composition/structure; preparation/cooking methods; proportion/classics; chemistry/reactions/ properties of: Cereals and grains, dough, batters and leavens, eggs, dairy products, fish, food production: preparation of basic dishes to reinforce theory. Emphasis on proportions, techniques, skills and presentation. Experimental work: The Experimental approach, sensory evaluation, wheat and grains, batters, doughs and raising agents, fruits and vegetables, salads, legumes, eggs dairy products and flour mixtures.

FCH 772: Food Science II (3 Credit Units).
Water, beverages, Frozen Desserts, Sugar and Cookery, Gelatin, Meat, Poultry, Stocks, Soup, Sauces, Fats and Oils, Preservation, Sandwiches.Practicals: Consist of two experiments and 10 practical chosen from approved food science topics.

FCH 774: Food and Beverage (2 Credit Units).
Recipes, cost control, food production equipment, food purchasing, food commodities, safety in food, hygiene in food production, catering for functions, menu planning, banqueting, food production systems, culinary terminology, service styles and techniques, furnishings and decorating, protocol and etiquette, management and supervision of staff. Food production: Mass catering.

FCH 775: Food Communication I (2 Credit Units).

Sensory evaluation, Recipe and Product development, Convenience foods, Cultural foods, Food additives, Food packaging and labeling, Food legislation, Quality assurance, New trends in food preparation, experiments and product development.

FCH 777 Nutrition (2 Credit Units)

Basic Nutrition concepts, Planning a healthy diet, Digestion, Carbohydrates, Vitamins, water, Minerals, energy and metabolism, and alcohol. Nutritional profile of indigenous food and food products

FCH 779: Consumer Behaviour (2 Credit Units).

Introduction to Consumer behavior, Culture & subculture, Consumer decision making, Market research, Sales promotion and effect on consumer behavior.

SCI 701: Management and Entrepreneurship (2 Credit Units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc-Manchester-2004 PhD –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-Fuel
2	Charle Chukuma Ariahu	B.Sc.-Zaria-1979 M.Sc-Ife-1983 PhD –Ife-1990	Part-Time	Professor	Food Engineering
3	Joseph Shian Alakali	B.Sc. –Jos-1987 M.Sc-Nsukka-1990 PhD- UAM- 2004	Part-Time	Professor	Food Engineering

4	Alex Ike Ikeme	B. Sc. 1976 Nsukka M.Sc. 1979 Arkansas Ph.D 1981 Indiana	Part-Time	Professor	Quality Evaluation, Processing and Preservation of Meat, Fish, Poultry and Egg
5	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
6	Simon Terver Ubwa	B.Sc -Calabar - 1991 M.Sc- Ibadan - 1997 PhD- Nsukka-2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
7	Godwin Oche Obochi	B. Sc. –UAM-2002 M.Sc. – Calabar- 2007 Ph.D Calabar-2014	Tenure	Associate Professor	Biochemistry
8	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan-1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
9	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
10	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.

11	Grace Mwuese Gberikon	B. Sc. –Zaria-1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
12	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
13	Ahemen Samuel Aondoaver	B.Eng UAM 1990 M.Sc. Ibandan 2008 PhD Ibadan 2015	Part-Time	Senior Lecturer	Processing and Storage
14	Dinnah Ahure	B. Sc. 1995 UAM M.Sc. 2004 UAM Ph.D 2015 UAM	Part-Time	Lecturer I	Food Processing
15	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD-Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
16	Ogo Ogo	B.Sc. Jos 2003 M.Sc. Jos 2008 Ph.D UK 2015	Tenure	Lecturer I	Clinical Biochemistry
17	Mike Ojotu Eke	B.Sc- UAM -1992 M.Sc- UAM-2009 PhD –UAM – 2015	Part-Time	Lecturer I	Meat Technology

POSTGRADUATE DIPLOMA IN FOOD PRESERVATION

Philosophy

The need to lay a solid background for graduates whose initial background was not sufficiently Chemistry oriented but wishes to further a career in Food Chemistry/Chemistry related discipline to have an option becomes imperative. More so, analytical skills are very critical in Food Science and need to be upgraded to meet the growing needs of the industry.

Rationale

The postgraduate diploma in food preservation is targeted at equipping non-graduates of Food Science and Technology/related disciplinesand enhance their job performance alongside their research abilities in Food Science and Technology. Furthermore, it will help those who have successfully completed the programme to pursue a higher degree in Food Science and Technology and upgrade graduates whose overall output appears deficient for a higher degree. Graduates of this programme can also be self-reliant, creative, innovative and less dependence on government as they will be well-equipped to seek self-employment and as a result create job opportunities for others.

Objectives of the Programme

The postgraduate diploma programme (PGD) is designed to:

(i) Impart a deeper knowledge and training in major areas of chemistry.
(ii) Produce knowledgeable and highly skilled chemists with high level of competence.
(iii) Broaden the understanding of the subject of the students, with emphasis on the applied aspects especially as it relates to water and environment, food, clothing, drugs, paints and adhesives and the chemical nature of materials encountered in everyday life.

(iv) Produce well-equipped chemists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals

Admission Requirements

i) Admission into the PGD programme of the Department is based on a minimum qualification of Third Class degree. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in chemistry/related disciplines shall be eligible for admission.

ii) A candidate seeking admission into any of the PGD Programmes of the Department MUST have O' level credit passes in English Language, Mathematics, Chemistry and two other science subjects.

iii) Candidates can only be admitted for Postgraduate Diploma, if their transcript for certificate is received at Postgraduate School at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue PGD in areas other than those they did their degree would be made to make up such deficiencies along with the PGD courses.

Residency/Duration of this Programme

Candidates admitted to pursue PGD Programmes of the Department on full-time basis shall spend a minimum of **two semesters** and a maximum of **four**. The part-time PGD shall run for a minimum of four semesters and a maximum of six semesters.

Mode of Examination

i. A minimum of 30credit units as follows: 25 units of core courses, 1 units of Seminar and 4 units of Project.

ii. The scoring system is 30% Continuous Assessment (C.A) and 70% final examination.

Graduation Requirements

To qualify for the PGD in any of the areas of specialization in chemistry, a candidate must have registered for a minimum of 30 credit units and passed all including 15 units in core courses, 8 credit units in elective programmes, 1 credit unit of seminar and 6 credit units of Project. The minimum pass mark for each course is "C" or 50 percent.

Probation/Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn.

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 -69	4.00
C	50 - 59	3.00
F	0 – 49	0

Course Code and Course Titles

First Semester
Corse Course

S/No.	Course Code	Course Title	Units
1	CHM 701	Statistical and Research Methods	2
2	FCP 701	Principles of Food freezing	3
4	FCP 703	Food Preservation by Canning	3
6	FCP 705	Preservation of Foods with Chemical Additives	3
8	FCP 707	Preservation of Semi-moist Foods	2
9	SCI 701	Management and Entrepreneurship	2
		Elective Courses: A minimum of 4 units to be taken	
1	FCP 781	Food packaging	2
2	FCP 767	Food Preservation by Ozone	2
3	FCP 769	Food Safety and Quality Control	2
	Total		**19**

Second Semester
Core Courses

S/No.	Course Code	Course Title	Units
1	FCP 702	Food Preservation by drying	3
2	FCP 704	Food Preservation by Fermentation	3
3	FCP 706	Preservation of Food with Ionizing Radiations	2

4	FCP 708	Smoking and Thermal Food Preservation	2
5	FCP 752	Seminar	1
6	FCP 754	Project	6
		Elective Courses: A minimum of 4 units to be taken	
1	FCH 760	Functional Foods and Nutraceuticals	2
2	FCH 762	Practical Approaches to Food Analysis	2
3	FCH 764	Applied Food Microbiology	3
			23

Course Synopses

CHM 701: Statistical and Research Methods (2 Credit Units)
Treatment of analytical data, Sampling and specifications, Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance.Linear relationships between two variables.Report writing.

FCP 701: Principles of Food Freezing (3 Credit Units)
Development of a Frozen Food Industry, The Freezing Point of Foods, Per Cent Water Frozen vs. Temperature of Food and Its Quality, Size of Ice Crystals Formed, Volume Changes During Freezing, Refrigeration Requirements in Freezing Foods, Establishing the Refrigeration Requirements to Freeze Food, Freezing in Air, Freezing by Indirect Contact with Refrigerants Direct Immersion Freezing, Freezer burn, Packaging requirements for Frozen Foods, Influence of Freezing on Micro-organisms, Influence of Freezing on Proteins, Influence of Freezing on Enzymes, Influence of Freezing on Fats, Influence of

Freezing on Vitamins, Influence of Freezing on Parasites, Thawing Damage to Frozen Foods

FCP 702: Food Preservation by drying (3 Credit Units)
Drying a Natural Process, Dehydration-Artificial Drying, Dehydration vs. Sun Drying, Why Dried Foods, Dehydration Permits Food Preservation, Humidity-Water Vapor Content of Air, Air-The Drying Medium, Adiabatic Driers, Heat Transfer Through a Solid Surface, Criteria of Success in Dehydrated Foods, Freeze-Dehydration (Freeze Drying), Triple Point of Water, Temperature Changes in Meat Freeze-Dehydration, Influence of Dehydration on Nutritive Value of Food, Influence of Drying on Micro-organisms, Influence of Drying on Enzyme Activity, Influence of Drying on Pigments in Foods, Dehydration of Fruits, Dehydration of Vegetables, Dehydration of Meat, Dehydration of Fish, Dehydration of Milk, Dehydration of Eggs, Packing of Dehydrated Foods, Influence of Drying on Food Acceptance

FCP 703: Food Preservation by Canning (3 Credit Units)
The Art of "Appertizing", Temperature vs. Pressure of Boiling Water, Spoilage of Food Caused by Micro-organisms, Evolution of Containers for Canning, Important Food Groups, Micro-organisms Associated with the Food Groups, Sources of Spoilage Organisms, Heat Resistance of Micro-organisms Important in Canning, Factors Influencing the Heat Resistance of Spores Influence of Food Ingredients on Heat Resistance of Spores, Heat Resistance of Enzymes in Food, Heat Penetration into Food Containers and Contents, General Method for Calculating the Process Time for Canned Foods, Inoculated Pack Studies, Adequacy of Heat ProcessesSpoilage of Canned Foods, Microbial Spoilage, Failure of Glass ContainersSurface Markings on Broken Glass, Vacuum-pressure Relations in Canning Process, Storage of Canned Foods, External Corrosion of Cans, Coding the Pack, Influence of Canning on the Quality of Food; Colour Flavor and Texture

FCP 704: Food Preservation by Fermentation (3 Credit Units)

Fermentation of Carbohydrates, Industrially Important Organisms in Food Preservation, Order of Fermentation, Types of Fermentations of Sugar, Fermentation Controls, Sources of Salt, Wine and Beer Salted-Fermented Foods, Deterioration of Fermented and Pickled Products, Nutritional Value of Pickled Products, Future Trends

FCP 705: Preservation of Foods with Chemical additives (3 Credit Units)

Definition of Chemical Additive, Importance of Chemical Additives, Legitimate Uses in Food Processing, Undesirable Uses of Additives, Safety of a Food Additive, Functional Chemical Additive Applications, Historical Significance, Specific Uses of Chemical Additives, Additives Permitted and Prohibited in Nigeria, Antibiotics, Quality Improving Agents, Other Chemical Additives, Artificial Flavoring, Artificial Coloring, Other Agents, Chemical Additives and the Future.

FCP 706: Preservation of Food with Ionizing Radiations (2 Credit Units)

A Place for Radiation Stablized Foods, Discovery of Radioactivity, Alpha, Beta and Gamma Radiations, Dosimetry, Dose Distribution, Induced Radio-Activity in Treated Food, Mode of Action of Ionizing Radiations, Radiation Effects on Micro-organisms, Radiation Effects on Proteins Radiation Effects on Enzyme Systems, Effects of Radiation on Amino Acids, Effects of Radiation on Vitamins, Radiation, Effects on Carbohydrates, Radiation Effects on Lipids, Radiation Effect on Pigments, Radiation Effect on Parasites and Insects, Packaging of Radiation Stabilized Foods, General Methods for establishing Radiation , Stabilization Process for Foods, The Food Product-Micro-organism Destruction, Dose Requirements for the Radiation Sterilization of Foods, Some Public Health aspects of the Microbiology of Irradiated Foods, Acceptability of Radiation Stabilized Foods, Quality Control

with Radiation Stabilized Foods, Ionizing Radiations as a Unit Operation in the Food Industry

FCP 707: Preservation of Semi-moist Foods (2 Credit Units)
Introduction, Canned white bread, Storage stability, Sponge and Dough, Filling and Proofing Processing, Finished Product, Fungistatic and fungicidal agents, Polyethylene Semi-moist Pet Foods, Process for Semi-moist Pet Foods Marbled, Textured Product, Water Activity, Production of Semi-moist Products Growing, Semi-moist Human Foods, Coarse Ground Beef and Beef Cubes Other Products being developed

FCP 708: Smoking and Thermal Food Preservation (2 Credit Units)
Types of Smoking, the difference between Curing and Smoking, Meat Curing and Smoking, Types of Smokers, Effect of Preservation Temperatures, Effect of Processing on Nutrients in Foods, Thermal Preservation Methods.

FCP 752: Seminar (1 Credit Units)
Students are expected to present a well research Seminar paper on any area of food preservation; this will be assessed by a panel of examiners.

FCP 667: Food Preservation Using Ozone (2 Credit Units)

FCP 754 Project (4 Credit Units)
Each student is expected to carry out original research work culminating to a report or project on which he or she will be examined by a panel of examiners.

FCH 760 Functional Foods and Nutraceuticals (2 Credit Units)
The course covers the issues and challenges in the development, evidence testing, marketing and changing regulations controlling functional foods and nutraceuticals.

FCH 762: Practical Approaches to Food Analysis (2 Credit Units)
Selected topics concerned with the theory and application of chemical, physical and instrumental methods of analysis. Modern separation and instrumental analytical techniques that are used for detection of food constituents (e.g moisture, ash, lipids, proteins, carbohydrates, vitamins, minerals etc) as well as contaminants (e.g mycotoxins, pesticide residues, antimicrobial agents, anti-nutritional factors, heavy metals etc). Topics will include; sample handling, preparation and analysis; evaluation and reporting of data. Key analytical and separation techniques such as; gas liquid chromatography, High Performance Liquid Chromatography, gel permeation and ion exchange chromatography, electrophoresis, polarimetry, spectophotometry (visible, ultraviolet, infrared and fluorimetry in food analysis).

FCH 763 Applied Food Microbiology (3 Credit Units)
Qualitative and quantitative aspects of microbiology in relation to behavior and detection of microorganism in foods.Evaluation of sub-lethal food processing techniques e.g freezing, drying, pasteurization on recovery growth and enumeration of microorganisms on foods. Selected topics concerned with the use of microorganisms for the production of substances of industrial, medicinal and/or nutritional value such as amino acids, antibiotics, vitamins and organic acids with emphasis on metabolic regulation of biochemical pathways leading to fermentation products.

FCP 767: Food Preservation Using Ozone (2 Credit Units)
Introduction, Physicochemical Properties of Ozone, Use of Ozone in Storage and Packing Facilities, Extension of Storage Life with Ozone, Ozonation to Sanitize packing Line Process Water, The Commercial Production of Ozone, Importance of Ozone in Fishing Industry, Future Perspectives

FCP 769: Food Safety& Quality Control (2 Credit Units)
Food Safety Management Systems, Effective Cleaning and Sanitation Techniques, Food Processing Traceability, International Food Safety Laws and Regulations, Principles of Quality Assurance, Food Quality Assurance Management Systems, Food Safety Project, Good Agricultural Practices and Project Management.

FCP 781: Food packaging (2 Credit Units)
This course provides the students with the basic knowledge regarding food packaging materials, machinery and technology. It provides an overview of the elements of packaging science and engineering applied to the preservation, distribution and marketing of various food products. This course also explains the different procedures and food safety requirements for developing, evaluating and testing of food packages in accordance to international standards.

SCI 701: Management and Entrepreneurship (2 Credit Units)
The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc- Manchester-2004 PhD –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Dick Iorwuese	B.Sc. – Ibadan-1978 M.Sc- Edinburgh-	Part-Time	Professor	Food Prod/Develop.

	Gernah	1982 PhD- UAM-2009			
3	Bibiana Dooshima Igbabul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
4	Joseph Shian Alakali	B.Sc. –Jos-1987 M.Sc-Nsukka-1990 PhD- UAM-2004	Part-Time	Professor	Food Engineering
5	Charle Chukuma Ariahu	B.Sc.-Zaria-1979 M.Sc-Ife-1983 PhD –Ife-1990	Part-Time	Professor	Food Engineering
6	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Ahemen Samuel Aondoaver	B.Eng UAM 1990 M.Sc. Ibandan 2008 PhD Ibadan 2015	Part-Time	Senior Lecturer	Processing and Storage
10	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
11	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
12	Grace Mwuese Gberikon	B. Sc. –Zaria- 1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology

13	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD- Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
14	Dinnah Ahure	B. Sc. 1995-UAM M.Sc. 2004-UAM Ph.D 2015-UAM	Part-Time	Lecturer I	Food Processing
15	Mike Ojotu Eke	B.Sc- UMA -1992 M.Sc- UMA-2009 PhD –UAM – 2015	Part-Time	Lecturer I	Meat Technology

POSTGRADUATE DIPLOMA IN FOOD CHEMISTRY

Philosophy

This programme is designed to lay a solid foundation for graduates whose initial background was not sufficiently chemistry or food chemistryoriented but wish to further career in Food Chemistry.

Rationale

The need to address challenges related to food production; particularly in reducing food spoilage at postharvest periods necessitates the training of middle and senior level scientists capable of working effectively in the food industry, food commodity research institutes, universities and other establishments. Graduates of this progamme can be self-employed and create job opportunities as well as manpower for emerging food industries.

The postgraduate diploma in Food Chemistry is targeted at equipping graduates and non-graduates in Chemistry and enhance their job performance alongside their research abilities in Chemistry/Chemistry related areas. Furthermore, it will help those who have successfully completed the programme to pursue a higher degree in Chemistry/Chemistry related discipline and upgrade graduates of

Chemistry whose overall output appears deficient for a higher degree. Graduates of these programmes can also be self-reliant, creative, innovative and less dependence on government as they will be well-equipped to seek self-employment and as a result create job opportunities for others.

Objectives of the Programme

The postgraduate diploma programme (PGD) is designed to:

(i) Impart a deeper knowledge and training in major areas of Food Chemistry.

(ii) Produce knowledgeable and highly skilled chemists with high level of competence.

(iii) Broaden the understanding of the subject of the students, with emphasis on the applied aspects especially as it relates to water and environment, food, clothing, drugs, paints and adhesivesand the chemical nature of materials encountered in everyday life.

(iv) Produce well-equipped chemists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.

(vi) Develop an understanding of how individual food components contribute to the overall quality of foods.

(vii) Achieve an understanding of the chemical changes that take place with food components during processing and storage.

(viii) Recognize reactions and mechanisms important in food chemistry.

(ix) Be capable of designing and conducting experiments and interpreting data to understand important food chemistry principles.

Admission Requirements

i) Admission into the PGD programme of the Department is based on a minimum qualification of a third class degree. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in chemistry/related disciplines shall be eligible for admission.

ii) A candidate seeking admission into any of the PGD programmes of the Department MUST have O' level credit passes in English Language, Mathematics, Chemistry and two other science subjects.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue PGD in areas other than those they did their degree would be made to make up such deficiencies along with the PGD courses.

Transcripts

Candidates can only be admitted for Postgraduate Diploma, if their transcript for certificate is received at Postgraduate School at the time of consideration of application for admission.

Residency/Duration of the Programme

Candidates admitted to pursue PGDprogrammes of the Department on full-time basis shall spend a minimum of **twosemesters** and a maximum of **four semesters**. The part-time PGD shall run for a minimum of four semesters and a maximum of six semesters.

Mode of Examination

i. Candidates with deficiency may be required by the department to take additional courses at lower level.

ii. A minimum of 30creditunits as follows: 15 units of core courses, 1unit of Seminar and 6 units of Project.

iii. The scoring system is 30% Continuous Assessment (C.A.)and 70% final examination.

Graduation Requirements

To qualify for the PGD in Food Chemistry, a candidate must have registered for a minimum of 30 credit units and passed all including 15 units in core courses, 8 credit units in elective courses, 1 credit unit of seminar and 6 credit units of Dissertation. The minimum pass mark for each course is "C" or 50 percent.

Probation/Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn.

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0.00

Course Code and Course Titles

First Semester

Core Courses

S/NO	Course Code	Course Title	Units
1	CHM 701	Statistical and Research Methods	2

2	CHM 731	Spectrochemical Methods of Analysis	2
3	FCH 761	Biochemistry of Foods I	3
4	FCH 763	Colour Chemistry	3
5	FCH 769	Food Processing and Preservation	2
6	SCI 701	Management and Entrepreneurship	2
		Total	**15**
Elective Courses:		**A minimum of 2 units o be taken**	
1	FCH 767	Food Additives	2
2	CHM 723	Advanced Natural ProductChemistry	3
		Total	**5**

Second Semester

Core Courses

S/NO	**Course Code**	**Course Title**	**Units**
1	CHM 700	Analytical Separation Techniques	3
2	FCH 762	Practical Approaches to Food Analysis	2
3	FCH 764	Bochemistry of Foods II	2
4	CHM 766	Fibre and Colour Chemistry	3
5	FCH 752	Seminar	1
		Total	**17**
Elective Courses: A minimum of 2 units to be taken			
1	FCM 768	Food Packaging	2
2	FCH 760	Functional Foods and Neutraceuticals	2
		Total	**4**
	FCP 751	Project	6

Course Synopses

CHM 700: Analytical Separation Methods (3 Credit Units)

General introduction to separation techniques.Distillation and solvent extraction. Chromatography: paper chromatography, thin layer chromatography, column chromatography, ion-exchange

chromatrography, Gel-filtration chromatography, Gas chromatography, super-critical fluid chromatography. HPLC and its modern innovations (GC-MS, LC-MS etc), Medium pressure liquid chromatography (MPLC,).

CHM 701: Statistical and Research Methods (2 Credit Units)
Treatment of analytical data.Sampling and specifications.Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance.Linear relationships between two variables. Report writing.

CHM 723: Advanced Natural Product Chemistry (3 Credit Units)
More complex examples of natural products than were studied at the undergraduate level: Advanced treatment of terpenoids, steroids, alkaloids and their biogenetic path-ways. Some detailed examples of recent literatures on the structural elucidations using modern spectroscopic techniques. Total synthesis of some natural products and their derivatives. Methods of isolation of natural products including bio-assay directed isolation methodology. Natural polymers (natural rubber) and their biogenesis.

CHM 731: Spectrochemical Methods of Analysis (3 Credit Units)
General introduction to applications of spectroscopy in analytical chemistry. Flame photometry, Atomic Absorption spectrophotometry, Atomic fluorescence, UV fluorescence, X-ray fluorescence, X-ray diffraction, UV-visible spectrophotometry (colorimetry), Emission spectroscopy. The use of Arc and spark.

FCH 752: Seminar (1 Credit Units).
Studentsare required to present supervised seminar papers in their areas of specialization. The papers will be graded by a panel of examiners.

FCH 754: Project Report (4 Credit Units)
Each student is expected to carry out original research work culminating to a report or dissertation on which he or she will be examined by a panel of examiners.

FCH 760 Functional Foods and Nutraceuticals (2 Credit Units)
The course covers the issues and challenges in the development, evidence testing, marketing and changing regulations controlling functional foods and nutraceuticals

FCH 761: Biochemistry of Foods I (3 Credit Units).
Carbohydrates: classification, properties and functions in food systems. Lipids: types, structure and function in food systems. Protein: amino acid composition, structure, classification and nutrition value. Vitamins and Minerals. Water: moisture content; water activity and food spoilage.

FCH 762: Practical Approaches to Food Analysis (2 Credit Units)
Selected topics concerned with the theory and application of chemical, physical and instrumental methods of analysis. Modern separation and instrumental analytical techniques that are used for detection of food constituents (e.g moisture, ash, lipids, proteins, carbohydrates, vitamins, minerals etc) as well as contaminants (e.g mycotoxins, pesticide residues, antimicrobial agents, antinutritional factors, heavy metals etc). Topics will include; sample handling, preparation and analysis; evaluation and reporting of data. Key analytical and separation techniques such as; gas liquid chromatography, High Performance Liquid Chromatography, gel permeation and ion exchange chromatography, electrophoresis, polarimetry, spectophotometry (visible, ultraviolet, infrared and fluorimetry in food analysis).

CHM 763: Colour Chemistry (3 Credit Units)

Colour and its features; Types of colours.Pigments; organic, inorganic and metallic pigments. Classification of dyes; Natural dyes and dyeing processes; Dyeing mechanisms. Linkages between pigments and dyes. Application of dyes and pigments. Synthesis and chemical reactions, anthraquinoneacides and disperse dyes, practical methods of diazotization and coulpling, chemistry of technical dyes containing azo groups dyes of indigo and thioindigo classes. Colour and chemical constitution of organic molecules. Dyes structure and functions of the various components.

FCH 764: Biochemistry of Foods II (3 Credit Units).

Enzymes and Enzymes reactions: Mechanism and kinetics of enzyme reactions, Endogenous enzymes and enzymes reaction leading to food quality alteration, postharvest metabolism in fruits and vegetables, post-Mortem changes in meat and fish. Nonenzymatic reactions in food: Oxidation-mechanism of autoxidation, prooxidants and antioxidants.

CHM 766: Fibre and Colour Chemistry (3 Credit Units)

Micro-and nanostructure of fibres; Cellulose and cellulose derivative fibres; Different Polyesters, polyamide, acrylic, and polypropylene fibres; Biobasedfibres, as PLA, PHB and PTT; properties of fibres. Thermodynamic and surface chemistry of fibres. Diffusion, adsorption and swelling in water; the effect of fibre structure on reactivity; Thermodynamics of molecular sorption. Colourants insoluble in water; Adsorption properties of fibres; Bonding of non-ionic and ionic colourants; Diffusion phenomena in interaction; Bonding of reactive dyes on cellulose; the use of solvents and swelling agents. Cross-bonding in processing of cellulose; Use of N-methylol compounds; Functional finishes; Antimicrobial finishing agents; Application of plasma technology; Use of enzymes in textile finishing.

FCH 767: Food Additives (2 Credit Units).

Acids, bases, and buffering salts. Preservatives and antioxidants. Flavouring and sweeteners.Food Colorants. Structure and appearance control agents. Nanoparticles in food.

FCH 768 Food Packaging (2 Credit Units)

The relevance of packaging.Types and characteristics of packaging materials.Testing for structural quality and performance.Packaging requirements for fresh and processed foods for local and foreign markets.Technical and cost benefit consideration for packaging materials.Disposal of packaging materials.

FCH: 769 Foods Processing and Preservation (2 Credit Units)

Description of different methods of processing local food materials. Different methods of preservation both pre-historic (e.g smoking, salting, dehydration) and modern methods (e.g canning and food irradiation).

SCI 701: Management and Entrepreneurship (2 Credit Units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1998 M.Sc-Manchester-2004 Ph.D –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and

					Technology
3	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UAM-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
4	John Obaji Igoli	B.Sc - Nsukka - 1985- M.Sc - Nsukka 1990 Ph.D- Nsukka 2003	Visiting	Professor	Organic Chemistry
5	Simon Terver Ubwa	B.Sc -Calabar - 1991 M.Sc- Ibadan - 1997 PhD- Nsukka-2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
6	Godwin Oche Obochi	B.Sc. –UAM-2002 M.Sc. –Calabar-2007 Ph.D Calabar-2014	Tenure	Associate Professor	Biochemistry
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan-1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
10	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba	Part-Time	Senior Lecturer	Human Nutrition

		2013			
11	Benjamin Asen Anhwange	B.Sc- Zaria-1992 M.Sc- Zaria- 2005 PhD- Zaria-2014	Tenure	Senior Lecturer	Analytical Chemistry
12	Grace Mwuese Gberikon	B. Sc. –Zaria-1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
13	Itodo Udoji Adams	B. Sc. Sokoto 2002 M.Sc. Sokoto 2006 Ph.D Zaria 2011	Part-Time	Senior Lecturer	Analytical Chemistry
14	Peter Agorye Adie	B.Sc- Calabar-1991 M.Sc- Calabar - 2004 PhD –Calabar-2010	Tenure	Senior Lecturer	Analytical/Environmental Chemistry
15	Ogo Ogo	B.Sc. Jos 2003 M.Sc. Jos 2008 Ph.D UK 2015	Tenure	Lecturer I	Clinical Biochemistry
16	Moses Ukeyima	B.Tech (Yola) 2002 M.Sc (IIe-Ife) 2008 PhD (Reading, UK) 2016	Part-Time	Lecturer I	Food and Nutritional Science
17	Ngozi Chukwuka Igoli	B.Sc. Nsukka 1983 B.Sc. Nsukka 1989 Ph.D Nsukka 2009	Part-Time	Lecturer II	Food Chemistry

MASTER OF SCIENCE DEGREE (M.Sc) PROGRAMME IN FOOD SCIENCE AND TECHNOLOGY

Philosophy

The training of Food Scientists and Technologists and professionals involves broad strategy of human resources development aimed at achieving economic emancipation and socio-political modernization. The programme is aimed at encompassing educational, cultural and socio-political development. It would also ensure self-reliance, employment opportunities, creativity, innovation and development of methods in the prevention of post – harvest losses of foods. Through this training, such graduates would achieve high level of social relevance and acceptability and therefore be strategically equipped to render quality services to the community.

Rationale

The M. Sc in Food Science and Technology is anchored on training scientists capable of working effectively in the food industry, food research institutes, universities and other government establishments with the purpose of address challenges related to food production; particularly in reducing food spoilage at postharvest periods. In addition, graduates of this programme can create self employment and job opportunities for others as well as serve as manpower for emerging food industries.

Objectives of the Programme

The M.Sc programme is designed to:

(i) Impart a deeper knowledge and training in the major areas of Food Science and Technology.

(ii) Produce knowledgeable and highly skilled Food Scientists and Technologist with high level of competence.

(iii) Broaden the understanding of the subject by the students, with emphasis on the applied aspects especially as it relates to the environment, food and allied products and the chemical nature of materials encountered in the control of post – harvest losses of food.

(iv) Produce well-equipped Food Scientists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.

Admission Requirements

i) Admission into the M.Sc. programme of the Department is based on a minimum qualification of second class (honours) lower division with a CGPA of not less than 3.0 on a 5 - point scale. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in Food Science and Technology, Chemistry/related disciplines shall be eligible for admission.

ii) Post Graduate Diploma (PGD) in Food Science and Technology, Chemistry or any related field at a minimum pass level of CGPA of 3.00 on a 5.00 scale from any Institution recognized by the Senate of Benue State University, with relevant experience shall also be considered for admission.

iii) In addition to (i) and (ii) above, a candidate seeking admission into the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry, Biology and Physics.

iv) Candidates can only be admitted for Master's degree, if their transcripts or certificates obtained are received at Postgraduate school at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue M.Sc in areas other than those they did their degree would be made to make up such deficiencies along with the M.Sc courses.

Residency/Duration of Programme

Candidates admitted to pursue the Programme on full-time basis shall spend a minimum of **three semesters** and a maximum of **four semesters.** Candidates on part-time shall spend a minimum of **five semesters** and a maximum of **eight semesters.**

Mode of Examination

i. Any course(s) specified on entry to remedy apparent deficiencies.

ii. A minimum of 42 credit units as follows: 22 units of core courses, 8 units of elective courses, 2 units of Seminar and 10 units of Dissertation.

iii. The scoring system is 30% Continuous Assessment (C.A) and 70% final examination.

Graduation Requirements

To qualify for the M.Sc. degree in any of the areas of specialization in Food Science and Technology, a candidate must have registered for a minimum of 42 credit units and passed not less than 36 units including core courses, seminar and Dissertation. The minimum pass mark for each course is "C" or 50 percent and CGPA of not less than 3.0.

Probation/ Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of

the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0

Course Codes and Course Titles

First Semester

Core Courses

Course Code	Course Title	Units
CHM 801	Statistical ans Research Methods	2
SCI 801	Management and Entreprenuership I	2
FPT 801	Cereals, Grains and Legumes Processing Technology	3
FST 801	Fats and Oils Technology I	3
FST 803	Food Product Development	2
FST 805	Postharvest Physiology and Storage Technology	2
FST 851	Seminar	2
	Total	**16**
Elective Courses	**At least 2 units to be taken**	
FPT 805	Meat and Poultry Technology	2
FST 807	Milk and Dairy Products Technology	2
FST 809	Aquatic Foods and Processing Technology	2
	Total	**6**

Second Semester

Core Courses

Course Code	**Course Title**	**Units**
FPM 800	Food Packaging Technology I	2
FPT 802	Food Standards, Quality Control and Assurance	3
FPT 806	Advanced Food Processing Technology	3
FCP 864	Applied Food Microbiology	3
FPT 810	Advanced Food Engineering	2
	Total	**13**
Elective Courses	**At least 2 units to be taken**	
FST 804	Fruits and Vegetable Processing Technology	2
FPT 812	Food and Energy Conservation	2
FPT 814	Food Plant Design, Sanitation & Hygiene	2
	Total	**6**
FST 891	Dissertation	10

Course Synopses

CHM 801: Statistical and Research Methods (2 Credit Units)
Research design, data collection and treatment of analytical data. Sampling and specifications.Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables. Report writing.

FPM 800: Food Packaging Technology I (2 Credit Units)
Definition of packaging, Functions of packaging, Requirements for packaging materials for fresh processed food for local and international markets, classification/types of packaging materials, permeability characteristics of plastic packaging materials, interactions between

packaging materials and food, packaging systems, package closures and integrity environmental impacts of packaging. Quality Assurance: Testing of structural quality and performance of packages

FPT 801: Cereals and Grains Legumes Processing Technology (3 Credit Units)

Structure of cereal grains; Nutritional quality of cereals; Traditional methods of milling, modern methods of milling the quality evaluation of wheat flour, wheat flour proteins, Rheology of dough; Chemistry and technology of baking including bread, biscuits and other soft wheat products; Processing and utilization of rice, maize sorghum, millet, barley, triticale and rye

FPT 802: Food Standards Quality Control and Assurance (3 Credit Units)

The importance of food quality standards and legislation; the food standards and legislation of Nigeria; Codex Allimentarius Commission (CAC); Principles and methods of food quality control; Fundamentals of food law, food quality management systems statistical quality control.

FPT 805: Meat and Poultry Technology (2 Credit Units)

Design and layout of poultry slaughter plants, grading of poultry meat, freezing curing, smoking, and frying of poultry products, problems associated with poultry meat processing, egg and egg quality identification, modern techniques of egg dehydration and processing; Modern methods of meat preservation and processing, enzyme treatment of meat, flavour constituents in meat and their evaluation, meat by-products, Microbial interaction with meat and meat stability, role of meat fats in nutrition, methods of analysis of processed meat. Legislation relating to meat and meat products.

FPT 806: Advanced Food Processing Technology (3 Credit Units)

Detailed consideration of selected food processing methods from the point of view of scientific and engineering principles physical and chemical changes occurring during processing and storage and their control; Process design and problems integrating various unit operations; Advanced Food Processing Techniques, Powder and bulk-solids processing; Convenience foods. Fast cooking foods, frozen foods, Advances in food purification (Membrane-based separation, Irradiating foods), Genetically modified foods, Emerging novel processes (microwave heating, Ohmic heating, High-pressure Processing, Pulsed Electric Fields, Hurdle technology in food processing), Edible films, Protein isolates, Modified atmosphere packaging, Lesser known foods, Controversies about processed foods.

FPT 810: Advanced Food Engineering (2 Credit Units)

Heat transfer theory, mechanisms, and its application in the food processing industry; Thermodynamic properties of food materials. Basic concepts of flow of fluids food methods of calculating lethal rates, heat penetration value; Newtonian and Non-Newtonian fluid foods

FPT 812: Food and Energy Conservation **(2 Credit Units)**

The scientific and technological aspects namely food processing unit operations, different food preservation methods, food legislation and nutritional tables of the following major food categories as processed in the food industry: fats and oils, dairy products, fish and seafood, beverages (wine, beer, coffee, tea and carbonated soft drinks), chocolate and sugar confectionery. Manufacturing of butter, mayonnaise, feta cheese as well as a variety of industry visits will be the focus of practicals. DVD sessions will be used as learning aids. New

developments in food packaging, selected food technologies, chemical and physical changes in foods, nutritional and nutraceutical properties of food, fortification and enrichment, legislation regarding claims made for nutritional and nutraceutical properties of food.

FST 801: Fats and Oils Technology I (3 Credit Units)

Importance of oil seeds processing in Nigeria, Commercial edible oil sources. Processing of crude oils - oil extraction/expression and solvent extraction.Refining of crude oil- degumming, bleaching, deodourization.Preparation of protein concentrates and isolates and their use in high protein foods.Hydrogenation and interesterification, Shortening-introduction, manufacturing and uses of shortening, types of shortening. Margarine-manufacturing and uses of argarine. Confectionery coatings. Immitation dairy products - peanut butter and vegetable ghee. Chemical adjuncts lecithins, GMS.Packing and storage of fats and oils, Cocoa butter, fat substitutes and low-calorie foods.

FST 864 Applied Food Microbiology (3 Credit Units)

Qualitative and quantitative aspects of microbiology in relation to behavior and detection of microorganism in foods.Evaluation of sub-lethal food processing techniques e.g freezing, drying, pasteurization on recovery growth and enumeration of microorganisms on foods. Selected topics concerned with the use of micro organisms for the production of substances of industrial, medicinal or nutritional value such as amino acids, antibiotics, vitamins and organic acids with emphasis on metabolic regulation of and biochemical pathways leading to fermentation products.

FST 803: Food Product Development (*2* Credit Units)

Marketing principles.Introduction to the food product development process.Idea generation, screening of ideas from concept to product, sensory and safety analysis, and launching the new product.

Retrospection: problems and constraints during the development process. Future trends and intellectual property.

FST 804: Fruits and Vegetable Processing Technology (2 Credit Units)

Principles and methods of fruit and vegetable preservation. Principles of storage of fruits and vegetables. Types of storage: natural, ventilated low temperature storage. Freezing and freeze-drying of fruits and vegetables. Drying and dehydration of fruits and vegetables, problems related to storage of dehydrated products., Canning of fruits and vegetables, tin cans, glass containers, aseptic canning technology. Fruit and vegetable juices, preparation of syrups, cordials and nectars, juice concentrates, pectin and related compounds, jams, jellies, marmalades, preserves. pickles, chutneys, tomato products. Fruit product order and quality control, Carbonated beverages. Processing of mineral water and water standards for food processing plants.

FST 805: Post-harvest Physiology and Storage Technology (2 Credit Units)

Post-harvest physiology of horticultural commodities; Control of post-harvest losses; Refrigeration and cooling systems; Handling and storage of roots, tubers, cereals grains and fruits and vegetables and legumes; Management of environmental factors on the quality parameters of stored products; Buildings and other structures for food storage.

FST 807: Milk and Diary Products Technology (2 Credit Units)

Sources, and composition of milk, processing of market milk, standardization, toning of milk, homogenization, pasteurization, sterilization, storage, transportation and distribution of milk. Milk product processing-cream, butter, condensed milk, evaporated milk, whole and skimmed milk powder. Instantization of milk and milk

products (e.g ice cream, milk sweets). Judging and grading of milk and its products. Fermented milk products; cheese, cheese spread, Yoghurt, and similar products. Dairy equipments and sanitization.

FST 809 Aquatic Foods and Processing Technology (2 Credit Units)
Overview of processing and storage conditions influencing the quality and shelf life of aquatic food. Handling of landed fresh fish and shell fish – marine and fresh water, fish processing equipment, modern methods of fish curing, dehydration, canning and frying oils, savoury, granted fish products, fish irradiation, industrial development and fish quality, pesticide residues in fish, legislation relating to fish processing; Introduction to fish muscle as a raw material for different processing procedures. Review of muscle structure, muscle biochemistry, and biochemical processes after death (rigor) in relation to quality and processability. An overview of different processing methods, both traditional and novel; Packaging of fish and fish products.

FST 851: Seminar (2 Credit Units).
Students will be required to present supervised seminar papers in their areas of specialization. The papers will be graded by a panel of examiners.

FST 891: Dissertation (10 Credit Units)
Each student is expected to carry out original research work culminating to a dissertation on which he or she will be examined by a panel of examiners.

SCI 801: Management and Entrepreneurship I (2 Credit Units)
The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc- Manchester-2004 PhD –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-Fuel
2	Charle Chukuma Ariahu	B.Sc.-Zaria-1979 M.Sc-Ife-1983 PhD –Ife-1990	Part-Time	Professor	Food Engineering
3	Joseph Shian Alakali	B.Sc. –Jos-1987 M.Sc-Nsukka-1990 PhD- UAM- 2004	Part-Time	Professor	Food Engineering
4	Alex Ike Ikeme	B. Sc. 1976 Nsukka M.Sc. 1979 Arkansas Ph.D 1981 Indiana	Part-Time	Professor	Quality Evaluation, Processing and Preservation of Meat, Fish, Poultry and Egg
5	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
6	Simon Terver Ubwa	B.Sc -Calabar -1991 M.Sc- Ibadan -1997 PhD- Nsukka-2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
7	Godwin Oche Obochi	B. Sc. –UAM- 2002 M.Sc. –Calabar-2007 Ph.D Calabar-2014	Tenure	Associate Professor	Biochemistry
8	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics

9	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
10	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
11	Grace Mwuese Gberikon	B. Sc. –Zaria- 1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
12	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
13	Ahemen Samuel Aondoaver	B.Eng UAM 1990 M.Sc. Ibandan 2008 PhD Ibadan 2015	Part-Time	Senior Lecturer	Processing and Storage
14	Dinnah Ahure	B. Sc. 1995 UAM M.Sc. 2004 UAM Ph.D 2015 UAM	Part-Time	Lecturer I	Food Processing
15	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD-Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
16	Ogo Ogo	B.Sc. Jos 2003 M.Sc. Jos 2008 Ph.D UK 2015	Tenure	Lecturer I	Clinical Biochemistry
17	Mike Ojotu Eke	B.Sc- UMA -1992 M.Sc- UMA-2009 PhD –UAM – 2015	Part-Time	Lecturer I	Meat Technology

MASTER OF SCIENCE DEGREE (M.Sc.) PROGRAMME IN FOOD PROCESSING TECHNOLOGY

Philosophy

The training of Food processing Technologist involves broad strategy of human resources development aimed at achieving economic emancipation and socio-political modernization. The programme is aimed at encompassing educational, cultural and socio-political development. It would also ensure self-reliance, graduate employment opportunities, creativity, innovation and development of methods of preventing post – harvest losses of food. Through this training, such graduates would achieve high level of social relevance and acceptability and therefore be strategically equipped to render quality service to the community.

Rationale

The M.Sc in Food Processing Technology is anchored on training scientists capable of working effectively in the food industry, food commodity research institutes, universities and other government and non-governmental establishments to address challenges related to the technology of food processing; particularly in reducing food spoilage at postharvest periods. In addition, graduates of this programme can create self employment and job opportunities for others as well as serve as manpower for emerging food industries.

Objectives

The M.Sc. programme is designed to:

(i) Impart a deeper knowledge and training in major areas of Food Processing Technology

(ii) Produce knowledgeable and highly skilled Food Processing Technologists with high level of competence.

(iii) Broaden the understanding of the subject by the students, with emphasis on the applied aspects especially as it relates to the environment, food and allied products and the chemical nature of materials encountered in the control of post – harvest losses of food.

(iv) Produce well-equipped Food Scientists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.

Admission Requirements

i) Admission into the M.Sc. programme of the Department is based on a minimum qualification of second class (honours) lower division with a CGPA of not less than 3.0 on a 5 - point scale. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in Food Science and Processing Technology, Chemistry/related disciplines shall be eligible for admission.

ii) Post Graduate Diploma (PGD) in Food Science and Technology, Chemistry or any related field at a minimum pass level of CGPA of 3.00 on a 5.00 scale from any Institution recognized by the Senate of Benue State University, with relevant experience shall also be considered for admission.

iii) In addition to (i) and (ii) above, a candidate seeking admission into the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry, Biology and Physics.

iv) Candidates can only be admitted for Master's degree, if their transcripts or certificates obtained are received at Postgraduate school at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue M.Sc in areas other than those they did their degree would be made to make up such deficiencies along with the M.Sc courses.

Residency/Duration of Programme

Candidates admitted to pursue the Programme on full-time basis shall spend a minimum of **three semesters** and a maximum of **four semesters.** Candidates on part-time shall spend a minimum of **five semesters** and a maximum of **eight semesters.**

Mode of Examination

iii. Any 400 level course(s) specified on entry to remedy apparent deficiencies.

iv. A minimum of 42 credit units as follows: 22 units of core courses, 8 units of elective courses, 2 units of Seminar and 10 units of Dissertation.

v. The scoring system is 30% Continuous Assessment (C.A) and 70% final examination.

Graduation Requirements

To qualify for the M.Sc. degree in any of the areas of specialization in Food Processing Technology, a candidate must have registered for a minimum of 42 credit units and passed not less than 36 units including core courses, seminar and Dissertation. The minimum pass mark for each course is "C" or 50 percent and CGPA of not less than 3.0.

Probation/ Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of

the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0

Course Code and Course Title

First Semester

Core Course

Course Code	Course Title	Credit Unit(s)
CHM 801	Statistical and Research Methods	2
SCI 801	Management and Entrepreneurship I	2
FPT 801	Cereals and Grain Legumes Processing Technology	3
FPT 803	Food Products Development	2
FPT 805	Meat and Poultry Processing	2
FPT 851	Seminar	2
FST 809	Aquatic Foods and Processing Technology	2
	Total	***15***

Electives Course: At least 2 units to be taken

FPM 803	Food Hygiene and Safety	2
FST 805	Post – Harvest Physiology and Storage Technology	3
FST 801	Fats and Oils Technology I	3
	Total	**8**

Second Semester

Core Course

Course Code	Course Title	Credit Unit(s)
FPM 800	Food Packaging Technology I	2
FPT 802	Food Standards, Quality Control and Assurance	3
FST 804	Fruits and Vegetable Processing Technology	2
FPT 806	Advanced Food Processing Technology	*3*
FPT 808	Roots and Tubers Processing Technology	2
FPT 810	Advanced Food Engineering	*2*
	Total	**11**
Electives Course:	**At least 2 units to be taken**	
FST 807	Milk and Dairy Products Technology	2
	Total	**2**
FPT 891	Dissertation	10

Courses Synopses

CHM 801: Statistical and Research Methods (2 Credit Units)
Research Design, data collection and treatment of analytical data; Sampling and specifications. Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts; Analysis of variance; Linear relationships between two variables; Report writing.

FPM 800: Food Packaging Technology I (2 Credit Units)
Definition of packaging, Functions of packaging, Requirements for packaging materials for fresh processed food for local and international markets, classification/types of packaging materials, permeability characteristics of plastic packaging materials, interactions between packaging materials and food, packaging systems, package closures and integrity environmental impacts of packaging. Quality Assurance:

Testing of structural quality and performance of packages. Shelf life predictions.

FPM 803: Food Hygiene and Safety (2 Credit Units)

Identification of vulnerabilities to contamination along the food supply chain; Types of food contamination; Food poisoning; Food borne diseases; Regulatory Toxicology; Chemical hazards in food.

FPT 801: Cereals and Grains Legumes Processing Technology (3 Credit Units)

Structure of cereal grains; Nutritional quality of cereals; Traditional methods of milling, modern methods of milling the quality evaluation of wheat flour, wheat flour proteins, Rheology of dough; Chemistry and technology of baking including bread, biscuits and other soft wheat products; Processing and utilization of rice, maize sorghum, millet, barley, triticale and rye

FPT 802: Food Standards Quality Control and Assurance (3 Credit Units)

The importance of food quality standards and legislation; the food standards and legislation of Nigeria; Codex Allimentarius Commission (CAC); Principles and methods of food quality control; Fundamentals of food laws, food quality management systems and statistical quality control.

FPT 803: Food Products Development (3 Credit Units)

Marketing principles.Introduction to the food product development process.Idea generation, screening of ideas from concept to product, sensory and safety analysis, and launching the new product. Retrospection: problems and constraints during the development process. Future trends and intellectual property.

FST 804: Fruit and Vegetables Processing Technology (2 Credit Units)

Principles and methods of fruit and vegetable preservation. Principles of storage of fruits and vegetables. Types of storage: natural, ventilated low temperature storage. Freezing and freeze-drying of fruits and vegetables. Drying and dehydration of fruits and vegetables, problems related to storage of dehydrated products., Canning of fruits and vegetables, tin cans, glass containers, aseptic canning technology. Fruit and vegetable juices, preparation of syrups, cordials and nectars, juice concentrates, pectin and related compounds, jams, jellies, marmalades, preserves. pickles, chutneys, tomato products. Fruit product order and quality control, Carbonated beverages. Processing of mineral water and water standards for food processing plants.

FPT 805: Meat and Poultry Processing (2 Credit Units)

Design and layout of poultry slauter plants, grading of poultry meat, freezing curing, smoking, and frying of poultry products, problems associated with poultry meat processing, egg and egg quality identification, modern techniques of egg dehydration and processing; Handling of landed fresh fish and shell fish – marine and fresh water, fish processing equipment, modern methods of fish curing, dehydration, canning and frying oils, savoury, granted fish products, fish irradiation, industrial development and fish quality, pesticide residues in fish, legislation relating to fish processing; Modern methods of meat preservation and processing, enzyme treatment of meat, flavour constituents in meat and their evaluation, meat by-products, Microbial interaction with meat and meat stability, role of meat fats in nutrition, methods of analysis of processed meat. Legislation relating to meat and meat products.

FPT 806: Advanced Food Processing Technology (3 Credit Units)
Detailed consideration of selected food is processing methods from the point of view of scientific and engineering principle; physical and chemical changes occurring during processing and storage and their control; Process design and problems integrating various unit operations; Advanced Food Processing Techniques, Powder and bulk-solids processing; Convenience foods. Fast cooking foods, frozen foods, Advances in food purification (Membrane-based separation, Irradiating foods), Genetically modified foods, Emerging novel processes (microwave heating, Ohmic heating, High-pressure Processing, Pulsed Electric Fields, Hurdle technology in food processing), Edible films, Protein isolates, Modified atmosphere packaging, Lesser known foods, Controversies about processed foods.
The scientific and technological aspects namely food processing unit operations, different food preservation methods, food legislation and nutritional tables of the following major food categories as processed in the food industry: fats and oils, dairy products, fish and seafood, beverages (wine, beer, coffee, tea and carbonated soft drinks), chocolate and sugar confectionery. Manufacturing of butter, mayonnaise, feta cheese as well as a variety of industry visits will be the focus of practicals. DVD sessions will be used as learning aids. New developments in food packaging, selected food technologies, chemical and physical changes in foods, nutritional and nutraceutical properties of food, fortification and enrichment, legislation regarding claims made for nutritional and nutraceutical properties of food.

FPT 808: Roots and Tubers Processing Technology (2 Credit Units)
Production, types, sources, economic and nutritional importance of roots and tubers; Harvesting, storage and pre-processing operations; Local and industrial processing methods for roots tubers; Effects of processing on quality; Utilization of processed products.

FPT 810: Advanced Food Engineering (2 Credit Units)

Heat transfer theory, mechanisms, and its application in the food processing industry; Thermodynamic properties of food materials. Basic concepts of flow of fluids food methods of calculating lethal rates, heat penetration value; Newtonian and Non-Newtonian fluid foods Elastic solid and textural characteristics of fluid; Kinetics of biological reactions; Elements of mass transfer and its application; Contact equilibrium separation process including absorption; Methods of food freezing and methods of predicting freezing time; Graphical methods of unsteady state cooling of food stuffs; Calculation of refrigeration load requirements.

FPT 814: Food Plant Design, Sanitation and Hygiene (2 Credit Units)

Food processing plant location; Design consideration of the food processing plant; Raw materials handling; Basic methods of food processing and preservation: thermal, low temperature, dehydration, concentration fermentation, irradiation.

FPT 851: Seminar (2 Credit Units)

Presentation and discussion of research problems and findings in the area of Food Science and Technology

FPT 891: M.Sc. Dissertation (10 Credit Units)

Each student is expected to carry out original research work culminating to a dissertation on which he or she will be examined by a panel of examiners.

FST 801: Fats and Oils Technology I (3 Credit Units)

Importance of oil seeds processing in Nigeria, Commercial edible oil sources. Processing of crude oils - oil extraction/expression and solvent extraction.Refining of crude oil- degumming, bleaching, deodourization.Preparation of protein concentrates and isolates and

their use in high protein foods.Hydrogenation and interesterification, Shortening-introduction, manufacturing and uses of shortening, types of shortening. Margarine-manufacturing and uses of Margarine. Confectionery coatings.Immitation dairy products - peanut butter and vegetable ghee.Chemical adjuncts lecithins, GMS.Packing and storage of fats and oils, Cocoa butter, fat substitutes and low-calorie foods.

FST 805: Post-harvest Physiology and Storage Technology (3 Credit Units)

Post-harvest physiology of horticultural commodities; Control of post-harvest losses; Refrigeration and cooling systems; Handling and storage of roots, tubers, cereals grains and fruits and vegetables and legumes; Management of environmental factors on the quality parameters of stored products; Buildings and other structures for food storage.

FPT 892: Seminar (2 Credit Units)

Presentation and discussion of research problems and findings in the area of Food Science and Technology

SCI 801: Management and Entrepreneurship I (2 Credit Units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc-Manchester-2004 PhD –Nsukka-	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel

		2013			
2	Dick Iorwuese Gernah	B.Sc. – Ibadan-1978 M.Sc- Edinburgh-1982 PhD- UAM-2009	Part-Time	Professor	Food Prod/Develop.
3	Bibiana Dooshima Igbabul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
4	Joseph Shian Alakali	B.Sc. –Jos-1987 M.Sc-Nsukka-1990 PhD- UAM-2004	Part-Time	Professor	Food Engineering
5	Charle Chukuma Ariahu	B.Sc.-Zaria-1979 M.Sc-Ife-1983 PhD –Ife-1990	Part-Time	Professor	Food Engineering
6	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Ahemen Samuel Aondoaver	B.Eng UAM 1990 M.Sc. Ibandan 2008 PhD Ibadan 2015	Part-Time	Senior Lecturer	Processing and Storage
10	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
11	Abraham	B.Sc. –UAM 1992	Part-	Senior	Human Nutrition

	Tartenger Girgih	M.Sc-UAM 2001 PhD- Manitoba 2013	Time	Lecturer	
12	Grace Mwuese Gberikon	B. Sc. –Zaria- 1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
13	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD- Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
14	Dinnah Ahure	B. Sc. 1995-UAM M.Sc. 2004-UAM Ph.D 2015-UAM	Part-Time	Lecturer I	Food Processing
15	Mike Ojotu Eke	B.Sc- UMA - 1992 M.Sc- UMA-2009 PhD –UAM – 2015	Part-Time	Lecturer I	Meat Technology

M.Sc. FOOD CHEMISTRY

Philosophy

The training of Food Chemists and indeed other Food scientists and professionals involves broad strategy of human resources development aimed at achieving economic emancipation and socio-political modernization. This programme is aimed at encompassing educational, cultural and socio-political development. It would also ensure self-reliance, graduate employment opportunities, creativity, innovation and less dependence on government. Graduates of the programme would be creative, innovative and well-equipped to seek self-employment and as a result create job opportunities. Through this training, such graduates would achieve high level of social relevance and acceptability and therefore be strategically equipped to render quality service to mankind.

Rationale

The need to address challenges related to food production; particularly in reducing food spoilage at postharvest periods necessitates the training of middle level scientists capable of working effectively in the food industry, food commodity research institutes, universities and other establishments. Graduates of this progamme can be self-employed and create job opportunities as well as manpower for emerging food industries.

Objectives of the Programme

The postgraduate programme is designed to:

(i) Impart a deeper knowledge and training in major areas of Food Chemistry.

(ii) Produce knowledgeable and highly skilled Food Chemists with high level of competence.

(iii) Broaden the understanding of the subject by the students, with emphasis on the applied aspects especially as it relates to the environment, food, clothing, drugs and the chemical nature of materials encountered in everyday life.

(iv) Produce well-equipped chemists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.

(vi) Develop an understanding of how individual food components contribute to the overall quality of foods.

(vii) Achieve an understanding of the chemical changes that take place with food components during processing and storage.

(viii) Recognize reactions and mechanisms important in food chemistry.

(ix) Be capable of designing and conducting experiments and interpreting data to understand important food chemistry principles.

Admission Requirements

i) Admission into the M.Sc. programme of the Department is based on a minimum qualification of second class (honours) lower division with a CGPA of not less than 3.0 on a 5 – point scale. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in chemistry/related disciplines shall be eligible for admission.

ii) Post Graduate Diploma (PGD) in Chemistry or any related field with a minimum CGPA of 3.00 points on a 5.00 point scale from any Institution recognized by the Senate of Benue State University and with relevant experience shall also be considered for admission.

iii) In addition to (i) and (ii) above, a candidate seeking admission the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry and two other science subjects.

iv) Candidates can only be admitted for Master's degree, if their transcripts for certificates are received at Postgraduate school at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree or who wish to pursue M.Sc in areas other than those they did their degree would be made to make up such deficiencies along with the M.Sc courses.

Residency/Duration of Programme

Candidates admitted to the Programme on full-time basis shall spend a minimum of **three semesters** and a maximum of **four semesters.** Candidates on part-time shall spend a minimum of **five semesters** and a maximum of **eight semesters.**

Mode of Examination

i. Any 400 level course(s) specified on entry to remedy apparent deficiencies.

ii. A minimum of 42credit units as follows: 22 units of core courses, 8 units of elective courses, 2 units of Seminar and 10 units of Dissertation.

iii. The scoring system is 30% Continuous Assessment (C.A) and 70% final examination.

Graduation Requirements

To qualify for the M.Sc. degree in Food Chemistry, a candidate must have registered for a minimum of 42 credit units and passed not less than 36 units including core courses, seminar and Dissertation. The minimum pass mark for each course is "C" or 50 percent.

Probation/ Withdrawal

A student whose CGPA is below 3.00 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.00 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 2.50 shall be withdrawn

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0.00

Course Code and Course Titles

First Semester

Core Courses

S/No.	Course Code	Course Title	Units
1	CHM 801	Statistical and Research Methods	2
2	SCI 801	Management and Entrepreneurship I	2
3	FCH 861	Chemistry of Foods	3
4	FCH 863	Applied Food Microbiology	3
5	FCH 865	Food Quality Control	3
6	FCH 867	Food Processing and Preservation	2
7	FCH 851	Seminar	2
		Total	**17**

Elective Courses: At least two units to be taken

1	FCH 869	Food Additives	2
2	CHM 823	Advanced Natural Product Chemistry	3
		Total	**5**

Second Semester

S/No.	Course Code	Course Title	Units
1	CHM 820	Applied Spectroscopy	3
2	FCH 862	Practical Approaches to Food Analysis and Instrumentation Techniques	3
3	FCH 864	Biochemistry of Foods	3
4	FCH 866	Food Fermentation and Beverage Manufacturing	2
5	FCH 868	Food Packaging	2
		Total	**13**

Elective Courses: At least two units to be taken

1.	FCH 860	Functional Foods and Neutraceucals	2
		Total	**2**
	FCH 891	Dissertation	10

Course Synopses

CHM 801: Statistical and Research Methods (2Credit units)
Treatment of analytical data.Sampling and specifications. Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables.Report writing.

CHM 820: Applied Spectroscopy (3 Credit units)
Applications of spectroscopic techniques, especially in the use of combined UV-VIS, IR, ^{1}HNMR, ^{13}CNMR and MS in structural determination of organic, inorganic and organometallic compounds.

CHM 823: Advanced Natural Product Chemistry (3 Credit units)
More complex examples of natural products than were studied at the undergraduate level: Advanced treatment of terpenoids, steroids, alkaloids and their biogenetic path-ways. Some detailed examples with citations of recent literatures on the structural elucidations using modern spectroscopic techniques. Total synthesis of some natural products and their derivatives. Methods of isolation of natural products including bio-assay directed isolation methodology. Natural polymers (natural rubber) and their biogenesis.

FCH 851: Seminar (2 Credit units).
Students will be required to present supervised seminar papers in their areas of specialization. The papers will be graded by a panel of examiners.

FCH 891 Dissertation (10 Credit units)
Each student is expected to carry out original research work culminating to a report or dissertation on which he or she will be examined by a panel of examiners.

FCH 860: Functional Foods and Nutraceuticals (2 Credit units)
The course covers the issues and challenges in the development, evidence testing, marketing and changing regulations controlling functional foods and nutraceuticals.

FCH 861: Chemistry of Foods (3units).
Carbohydrates: classification, properties and functions in food systems. Lipids: types, structure and function in food systems. Protein: amino acid composition, structure, classification and nutrition value. Vitamins and Minerals.Water: moisture content; water activity and food spoilage.

FCH 862: Practical Approaches to Food Analysis and Instrumentation (3 Credit units)
Health safetyGood laboratory practice. Good manufacturing practice (GMP).Selected topics concerned with the theory and application of chemical, physical and instrumental methods of analysis. Modern separation and instrumental analytical techniques that are used for detection of food constituents (e.g moisture, ash, lipids, proteins, carbohydrates, vitamins, minerals etc) as well as contaminants (e.gmycotoxins, pesticide residues, antimicrobial agents, antinutritional factors, heavy metals etc). Topics will include; sample handling,

preparation and analysis; evaluation and reporting of data. Key analytical and separation techniques such as; gas liquid chromatography, High Performance Liquid Chromatography, gel permeation and ion exchange chromatography, electrophoresis, polarimetry, spectrophotometry (visible, ultraviolet, infrared and fluorimetry in food analysis).

FCH 863: Applied Food Microbiology (3 Credit units).
Qualitative and quantitative aspects of microbiology in relation to behavior and detection of microorganism in foods.Evaluation of sub-lethal food processing techniques e.g freezing, drying, pasteurization on recovery growth and enumeration of microorganisms on foods. Selected topics concerned with the use of micro organisms for the production of substances of industrial, medicinal or nutritional value such as amino acids, antibiotics, vitamins and organic acids with emphasis on metabolic regulation of and biochemical pathways leading to fermentation products.

FCH 864: Biochemistry of Foods (3 Credit units)
Enzymes and Enzymes reactions: Mechanism and kinetics of enzyme reactions, Endogenous enzymes and enzymes reaction leading to food quality alteration, postharvest metabolism in fruits and vegetables, post-Mortem changes in meat and fish. Nonenzymatic reactions in food: Oxidation-mechanism of autoxidation, prooxidants and antioxidants; Maillard Reaction mechanism and products; Caramelization.

FCH 865: Food Quality Control (3 Credit units)
The importance of Sensory quality attributes of food and beverage and their perceptions: appearance, flavor, taste, aroma, texture/mouth-feel, trigeminal sensations.Mechanism of taste and perception.Sensory evaluation methodology: threshold measurements, difference tests, scaling procedures, descriptive analytical methods, consumer tests;

selection, size and use of taste panel in sensory evaluation of food. Training of tasters. The statistical methods used in taste panel and in quality control. Analysis of data from taste panel results. Flavour profile technique in sensory evaluation. Instrumental measurements: colour, texture, flavor. Correlation of sensory and instrumental measures. Applications of sensory tests for quality assurance, product development, product optimization and marketing. Food standards and legislation. Food labeling its value and limitations.

FCH 866: Food Fermentation and Beverage Manufacturing (2 Credit units)

Definition of fermentation. Types of fermentation processes. Fermentation kinetics and control. Fermentors and scale up. Recovery of fermentation products.Enzyme reactors. Industrially important moulds and their use in fermentation. Wastewater treatment by fermentation methods. Novel types of food fermentation. Fermentation products cell mass, antibiotics, acids, alcohols enzymes. Microbial cultivation in fermentors. Production of carbonated and non-carbonated beverages: coffee, Tea, cocoa-chocolate, wine, distilled liquors, etc.

FCH 867: Food Processing and Preservation (2 Credit units)

Description of different methods of processing local food materials.Different methods of preservation both traditional (e.g smoking, salting, dehydration) and modern methods (e.g canning, food irradiation and use of phytochemicals).

FPM 800: Food Packaging Technology I (2 Credit units)

Definition of packaging, Functions of packaging, Requirements for packaging materials for fresh processed food for local and international markets., classification/types of packaging materials, permeability characteristics of plastic packaging materials, interactions between

packaging materials and food, packaging systems, package closures and integrity environmental impacts of packaging. Quality Assurance: Testing of structural quality and performance of packages

FCH 869: Food Additives (2 Credit units).

Acids, bases, and buffering salts. Preservatives and antioxidants.Flavouringand sweeteners. Food Colorants. Structure and appearance control agents. Nanoparticles in food.

SCI 801: Management and Entrepreneurship *I* (2 Credit units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1998 M.Sc- Manchester-2004 Ph.D –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
3	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
4	John Obaji Igoli	B.Sc - Nsukka - 1985- M.Sc - Nsukka 1990	Visiting	Professor	Organic Chemistry

		Ph.D- Nsukka 2003			
5	Simon Terver Ubwa	B.Sc -Calabar - 1991 M.Sc- Ibadan - 1997 PhD- Nsukka-2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
6	Godwin Oche Obochi	B. Sc. –UAM-2002 M.Sc. –Calabar-2007 Ph.D Calabar-2014	Tenure	Associate Professor	Biochemistry
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
10	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
11	Benjamin	B.Sc- Zaria-1992	Tenure	Senior	Analytical

	Asen Anhwange	M.Sc- Zaria- 2005 PhD- Zaria-2014		Lecturer	Chemistry
12	Grace Mwuese Gberikon	B. Sc. –Zaria-1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
13	Itodo Udoji Adams	B. Sc. Sokoto 2002 M.Sc. Sokoto 2006 Ph.D Zaria 2011	Part-Time	Senior Lecturer	Analytical Chemistry
14	Peter Agorye Adie	B.Sc- Calabar-1991 M.Sc- Calabar - 2004 PhD –Calabar-2010	Tenure	Senior Lecturer	Analytical/Environmental Chemistry
15	Ogo Ogo	B.Sc. Jos 2003 M.Sc. Jos 2008 Ph.D UK 2015	Tenure	Lecturer I	Clinical Biochemistry
16	Moses Ukeyima	B.Tech (Yola) 2002 M.Sc (IIe-Ife) 2008 PhD (Reading, UK) 2016	Part-Time	Lecturer I	Food and Nutritional Science
17	Ngozi Chukwuka Igoli	B.Sc. Nsukka 1983 B.Sc. Nsukka 1989 Ph.D Nsukka 2009	Part-Time	Lecturer II	Food Chemistry

M.Sc. ANALYTICAL AND ORGANIC CHEMISTRY

Philosophy

Manpower development in Nigeria, a third world country, should take into consideration the overall improvement of the quality of life of its citizens. The training of chemists and indeed other scientists and professionals should involve the broad strategy of human resources development with the aim of achieving broader goals of economic emancipation, political and social modernization. The M.Sc. Programme of the Department is aimed at encompassing educational, cultural and socio-political development. This strategy would enhance reasonable contributions (by products of the training) to nation-building and national identity and integrity.

Rationale

Chemistry is the central discipline in science and technology. The training of chemists thus needs to be thorough and broad based, aimed at producing self-confident personalities. This would ensure self-reliance, graduate employment opportunities, creativity, innovation and less dependence on government. Beneficiaries of the postgraduate programme should be creative, innovative and well-equipped to seek self-employment and as a result create job opportunities for others. Through such training, individuals would achieve a great level of social relevance and acceptability and therefore be strategically equipped to render service to mankind.

Objectives of the Programme

The postgraduate programme is designed to:

(i) Impart a deeper knowledge and training in major areas of chemistry.

(ii) Produce knowledgeable and highly skilled chemists with high level of competence.

(iii) Broaden the understanding of the subject of the students, with emphasis on the applied aspects especially as it relates to the environment, food, clothing, drugs and the chemical nature of materials encountered in everyday life.

(iv) Produce well-equipped chemists required at the universities and other institutions of higher learning.

(v) Meet the man-power needs of research institutes, industries and government ministries and parastatals.

Admission Requirements

i) Admission into the M.Sc. programme of the Department is based on a minimum qualification of second class (honours) lower division. Holders of the Benue State

University degree or a degree from any other university recognized by the Senate of the Benue State University in chemistry/related disciplines shall be eligible for admission.

ii) Post Graduate Diploma (PGD) in Chemistry or any related field at a minimum pass level of CGPA of 3.00 on a 5.00 scale from any Institution recognized by the Senate of Benue State University and with relevant experience shall also be considered for admission.

iii) In addition to (i) and (ii) above, a candidate seeking admission into any of the M.Sc. Programmes of the Department MUST have O' level credit passes in English and Mathematics.

iv) Candidates can only be admitted to master degree, their transcripts for certificates are received at Postgraduate School at the time of consideration of application for admission.

Remedial Courses

Candidates who have deficiencies at their degree level or who wish to pursue M.Sc in area other than those they did their degree would be made to make up such deficiencies along with the M.Sc course

Residency/Duration of Programme

Candidates admitted to pursue M.Sc. Programmes of the Department on full-time basis shall spend a minimum of three semesters and a maximum of four semesters. Candidates on part-time shall spend a minimum of five semesters and a maximum of eight semesters. An extension of two semesters shall be granted where the need arises.

Mode of Examination

i. Any 400 level course(s) specified on entry to remedy apparent deficiencies.
ii. A minimum of 42 credit units as follows: 22 units of core courses, 8 units of elective courses, 2 units of Seminar and 10 units of Dissertation.
iii. The scoring system is 30% C.A. and 70% final examination.

Graduation Requirements

To qualify for the M.Sc. degree in any of the areas of specialization in chemistry, a candidate must have registered for a minimum of 42 credit units and passed not less than 36 units including core courses, seminar and dissertation. The minimum pass mark for each course is "C" or 50 percent.

Probation/ Withdrawal

A student whose CGPA is below 3.00 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.00 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 2.50 shall be withdrawn

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 -69	4.00
C	50 – 59	3.00
F	0 – 49	0

Course Code and Course Titles

M.Sc. ANALYTICAL CHEMISTRY

First Semester

Core Courses

S/No.	Course Code	Course Title	Units
1.	CHM 801	Statistical and Research Methods	2
2	SCI 801	Management and Entrepreneurship	2
2.	CHM 803	Advanced Kinetics and Catalysis	3
3.	CHM 831	Spectrochemical Methods of Analysis	3
4.	CHM 833	Classical Methods of Analysis	3
5.	CHM 847	Analytical Laboratory Techniques	3
6.	CHM 851	Seminar	*2*
		Total	***18***

Elective courses: A minimum of 2 units to be taken

7.	CHM 809:	Thermal and Photochemical Processes	2
8.	CHM 835:	Clinical and Biochemical Methods	2
9.	CHM 837:	Nuclear and Radiochemical Methods	2
10.	CHM 839:	Environmental Chemistry	2
		Total	**8**

Second Semester

Core Courses

S/No.	Course Code	Course Title	Units
1.	CHM 800	Separation Methods	2
2.	CHM 820	Applied Spectroscopy	3
3.	CHM 830	Advanced Electroanalytical Techniques	2
4.	CHM 832	Instrumentation in Chemical Analysis	3
5.	CHM 834	Quality Assurance /Quality Control	2
6.	CHM 850	Advanced Toxicology	2
		Total	**14**

Elective courses: A minimum of 2 units to be taken

7.	CHM 804	Advanced Electrochemistry and Corrosion	2
8.	CHM 814	Industrial Inorganic Chemistry	3
9.	CHM 836	Drugs, Food and Pharmaceutical Analysis	2
		Total	**7**
10.	CHM 852	Dissertation	10

M.SC. ORGANIC CHEMISTRY

First Semester

Core Courses

S/No.	Course Code	Course Title	Units
1.	CHM 801	Statistical and Research Methods	2
2	SCI 801	Management and Entrepreneurship I	2
3.	CHM 821	Advanced Organic Synthesis and Reaction Mechanisms	3
4.	CHM 823	Advanced Natural Products Chemistry	3
5.	CHM 825	Advanced Heterocyclic Chemistry I	2
6.	CHM 845	Experimental Organic Chemistry I	2
7.	CHM 851	Seminar	2
		Total	**13**

Elective courses: A minimum of 2 units to be taken

8.	CHM 809	Thermal and Photochemical Processes	2
9.	CHM 827	Petroleum Chemistry	2
10.	CHM 829	Selected Topics in Organic Chemistry	2
11.	CHM 831	Spectrochemical Methods of Analysis	3
		Total	**9**

Second Semester

Core Courses

S/No.	**Course Code**	**Course Title**	**Units**
1.	CHM 800	Separation Methods	3
2.	CHM 812	Advanced Organometallic Chemistry	2
3.	CHM 820	Applied Spectroscopy	3
4.	CHM 846	Experimental Organic Chemistry II	2
		Total	**20**

Elective courses: A minimum of 2 units to be taken

5.	CHM 822	Polymer Chemistry	2
6.	CHM 824	Industrial Organic Chemistry	2
7.	CHM 834	Quality Assurance/Quality Control	2
8.	CHM 836	Drugs, Food and Pharmaceutical Analysis	2
		Total	**8**
9.	CHM 891	Dissertation	10

Course Synopese

CHM 800: Separation Methods (3 Credit units)

General introduction to separation techniques.Distillation and solvent extraction. Chromatography: paper chromatography, thin layer chromatography, column chromatography, ion-exchange chromatrography, Gel-filtration chromatography, Gas chromatography, super-critical fluid chromatography. HPLC and its modern innovations (GC-MS, LC-MS etc), Medium pressure liquid chromatography (MPLC,).

CHM 801: Statistical and Research Methods (2 Credit units)
Treatment of analytical data.Sampling and specifications.Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables. Report writing.

CHM 802: Colloid and Surface Chemistry (2 Credit units)
Adsorption isotherms. Modified adsorption isotherms – modified Freundlich and Langmuir adsorption isotherms. Comparative adsorption modeling, properties of colloids. Surfactants, cloud point, micelles and interfacial phenomena. Winsor type microemulsions. Water in oil, oil in water emulsion. Synergistic interactions of surfactants. Hydrotropy and wetting agents. Peptization, light scattering, donnan equilibrium. Industrial/Analytical applications of colloids.

CHM 803: Advanced Chemical Kinetics and Catalysis (3 Credit units)
Methods of determining the order of reactions.Complex reactions, mechanisms and rate constants. Fast reactions, flash photolysis and pulse radiolysis. Photochemical reactions.Quenching/Relaxation techniques.Temperature, pressure and electrical jump techniques. Molecular dynamics and energy transfer. Theories of reaction rates.Principles of heterogenous catalysis, rate and kinetics of catalytic reactions. Trends in catalyst manufacture, quality and efficiency. Salt effect in the kinetics of reactions.

CHM 804: Advanced Electrochemistry and Corrosion (3 Credit units)

Conductance in molten state and in solution.Dissociation constant measurements.Determination of activity and activity coefficients and reduction potentials of cells.Ionic distribution function, ionic atmosphere potential and Debye-Huckel theory.Electrical mobility and double layer.Electrode kinetics Bulter-Volmer equation and the Tafel plots.Mechanism and rate of reactions at the electrode surface.Thermodynamics and kinetics of corrosion.Inhibition.Sacrificial anode and cathodic protection. Economic waste of corrosion.Electroanalytical techniques.

CHM 805: Advanced Thermodynamics (3 Credit units)

Review of first, second and third laws of thermodynamics.Fugacity, fugacity coefficient and its determination.Chemical potential.Evaluation of partial molar quantities, Gibbs-Duhem equation.Thermodynamics of mixtures and solutions.Raoult's and Henry's laws.Pressure and temperature variation of solubility.Thermodynamics of phase changes. Colligative effects:- derivations and applications.

CHM 806: Quantum Chemistry (3 Credit units)

Review of basic principles and approximate methods of solution of Schrodinger's equation. (Approximate methods as applied to atomic and molecular structures). Wave functions of many electron atoms and molecules. Linear Combination of Atomic Orbitals (LCAO).Molecular orbital theory and its applications in chemical problems including interpretation of absorption and emission spectra and reactivity.

CHM 807: Group Theory and Spectroscopy (2 Credit units)

Theorems of group theory.Application of Symmetry and Group Theory to Chemical Bonding and Spectroscopic Selection Rules.The Use of

Character Tables.Electronic and Vibrational Spectroscopy. Symmetry related to wave function, dipole moment and optical activity.

CHM808: Statistical Thermodynamics (2 Credit units)
Statistical interpretation of entropy. Thermodynamic probability. Sterling's formula. Maximum distribution – maximum and minimum terms. Ensemble. Assembly of Harmonic oscillators. Partition functions, separation into translational, rotational, vibrational and electronic partition functions. Seckur Tetrode equation. Equilibrium partition function and stationary separated atoms. Statistical thermodynamics of solids and liquids – cell and Eyring hole theories. Use of computer in statistical mechanics. Base-Einstein and Fermi-Dirac statistics.

CHM 809:Thermal and Photochemical Processes (2 Credit units)
Band theory and defects in solids. Rate of defects formation in thermal and photo-decomposition of solids. Thermal methods of analysis – DTA or DSC and TGA. Absorption and emission-fluorescence, chemilumininescence, bioluiminescence and phosphorescence. Frank-Condon principle. Jablonski diagram, flash photolysis and laser, photosensitization, photoionization and photochemical cross-linking. Mechanisms of photo-decomposition of molecules.Vision and photography.

CHM 810: Advanced Coordination Chemistry (3 Credit units)
Bonding, structure (including stereochemistry) and properties of transition metal complexes. Synthetic pathways. Electronic states and spectra. The Russell-Saunders coupling scheme. Transition metal coordination compounds in biological systems. Optical activity and circular dichroism.

CHM 811: Inorganic Reaction Mechanisms (3 Credit units)
Survey of the Mechanisms of Inorganic and Organometallic Reactions. Techniques used in the study of Mechanisms of Inorganic Reactions. Substitution reactions in Square – planar and Octahedral complexes.Electron Transfer Reactions.Inorganic Photochemistry.

CHM 812: Advanced Organometallic Chemistry (3 Credit units)
Synthesis, Structure and Reactivity of Organometallic Compounds.Bonding in Transition metal Organometallic Compounds. Metal carbonyls, Arenes, Aryls, Alkyls and Cyclic π-donors. Characterization of Organometallic Compounds by IR, NMR, X-ray and Neutron Diffraction and Mass Spectrometry Techniques.Applications of Organometallic Compounds in Organic Synthesis and in Catalysis.Substitution, Elimination and Rearrangement reactions of Organometallic Compounds.

CHM 814: Industrial Inorganic Chemistry (3 Credit units)
Industrial Thermodynamics and Electrochemistry. Energy Requirement for the Chemical Industry. The Technologies of Cement, Glass, Ceramics and Fertilizer Production. The Chlor-AlKali Process and Iron and Steel Production.

CHM 816: Bioinorganic Chemistry (3 Credit units)
Survey of Biologically Important Elements.Elements in Naturally Occurring Compounds such as Haemoglobin, Cytochrome, Metal Porphyrins, Chlorophylls.Biosensors, Transport Proteins, Electron Transfer Agents, Fe-S Compounds.Bioinorganic Nanomaterials.

CHM 820: Applied Spectroscopy (3 Credit units)
Applications of spectroscopic techniques, especially in the use of combined UV-VIS, IR, 1HNMR, 13CNMR and MS in structural determination of organic, inorganic and organometallic compounds

CHM 821: Advanced Organic Synthesis and Reaction Mechanisms (3 Credit units)

Principal reactions leading to carbon-carbon bond formation and functional group transformations. Strategic applications of named reactions in organic synthesis. Importance of retro-synthetic approach to organic synthesis. Relevant mechanistic details of named reactions.Modern applications of metallation reactions in organic synthesis.

CHM 822 Polymer Chemistry (2 Credit units)

Biosynthesis of natural polymers. Catalysis in polymer synthesis.Cosses mechanism of Ziegler-Nattaa polymerization. Reaction probability models for copolymerizatin. Bernoullion, first order and second order Markovian statistical models. Spectroscopic elucidation of polymer structures.Computational techniques in the study of polymer structures and properties. Molecular dynamics of polymer chains.Phyelogy of polymers.Elastics properties of polymers.

CHM 823: Advanced Natural Product Chemistry (3 Credit units)

More complex examples of natural products than were studied at the undergraduate level: Advanced treatment of terpenoids, steroids, alkaloids and their biogenetic path-ways. Some detailed examples of recent literatures on the structural elucidations using modern spectroscopic techniques. Total synthesis of some natural products and their derivatives. Methods of isolation of natural products including bio-assay directed isolation methodology. Natural polymers (natural rubber) and their biogenesis.

CHM 824: Industrial Organic Chemistry (2 Credit units)

Green Chemistry in the industrial production of chemicals, renewable and non-renewable sources of raw materials for the chemical industry. Process optimization and unit operation in industrial

processes.Pharmaceutical industries, plastics, paper and pulp industries, leather products, chemicals in food industries, soap and Detergents industries, etc. stressing the economics of individual production.

CHM 825: Advanced Heterocyclic Chemistry (3 Credit units)
1,3-Cycloaddition in the construction of heterocylic rings (chemistry of nitrilimines). Selected heterocycles with two or more heteroatoms not already covered at undergraduate level (emphasis will be laid on recent literature on the subject). Heterocylic compounds of biological/pharmaceutical interests (indoles, benzopyrillium salts, coumarins, chromones, porphyrins, vitamins and purines).

CHM 827: Petroleum Chemistry (2 Credit units)
Crude oil and its origin, diagenesis, catagenesis. Occurrence and place of crude oil in the contemporary energy scene. Classification and composition of crude oils (petroleum) and petroleum refining techniques for further processing of petroleum fractions: Purification of refinery gases and liquid petroleum fractions, hydrodesulphurization, hydrodenitrogenation, deoxygenation and dehydrohalogenation. Processes for increasing the yield of gasoline. Processes for increasing the octane number of gasoline. Some aspects of petrochemicals.

CHM 829: Selected Topics in Organic Chemistry (2 Credit units)
Structural and stereochemical principles in organic chemistry.Pericyclic reactions, photochemistry. Aspects of green chemistry in organic synthesis, isotope effects in organic chemistry. Reactive intermediates in organic chemistry. Organic chemistry of P, S, Si, B etc.Structure of protein. Chemistry and heredity. Colour chemistry, medicinal chemistry and agro-chemistry.

CHM 830: Advanced Electroanalytical Methods (3 Credit units)
General introduction and classification of electro-analytical methods. Potentiometry and potentiometrictitrations. Polarography. Amperometry. Coulometry. Chromopotentiometry. Stripping .Analysis.

CHM 831: Spectrochemical Methods of Analysis (3 Credit units)
General introduction to applications of spectroscopy in analytical chemistry. Flame photometry, Atomic Absorption spectrophotometry, Atomic fluorescence, UV fluorescence, X-ray fluorescence, X-ray diffraction, UV-visible spectrophotometry (colorimetry), Emission spectroscopy. The use of Arc and spark.

CHM 832: Instrumentation in Chemical Analysis (3 Credit units)
Automation in electrochemical analysis, polarography, amperometry, coulometry, automated counting in radiometric and X-rays methods of analysis. Automated analytical chromatography including gas, thin-layer, ion-exchange. Automated florescence methods. Continuous discrete flow. Application of computers in analytical chemistry including digital electronics, readout devices, noise, microprocessor. Analytical instruments, components and circuits. Sensitivity and detection limits of instruments.Chemometrics. Amplifiers, power supplies and regulators.

CHM 833: Classical Methods of Analyses (3 Credit units)
Introduction to qualitative and quantitative analysis.Group separation of ions (use of H2S and other reagents).Titrimetric methods.Acid-base strengths, Acid-base titration, complexometric, precipitation and redox titrations.Titration in non-aqueous solvents/media.Indicators in chemical analysis.Gravimetric analysis.Precipitates, their nature of formation, separation, purification and conversion to a weighing form.Common organic and inorganic precipitants and their

applications.Application of classical methods in the characterization of foods.

CHM 834: Quality Assurance/Quality Control (3 Credit units)
Quality and quality control; life cycle quality (to include-stated quality, Real quality, Advertised quality, Experienced quality) of products; Basic statistics for quality assurance (To include combinations and Permutations, frequency distribution, The Normal (Gaussian) distribution; Binomial distribution, Poisson distribution, central measures and measures of dispersion; statistical process control (to include control process, variations and control charts, control charts for variables; control charts for attributes, managerial considerations concerning control charts, test models, process capability and operations strategy); Reliability and maintainability assurance (To include Reliability levels, maintainability and types of maintenance); organization and management for product assurance (To include the position of inspection and quality control functions in an organization. Role of government agencies in maintaining quality standards (To include Standards Organization of Nigeria (SON), and National Agency for Food and Drug Administration and Control, NAFDAC).

CHM 835: Clinical and Biochemical Methods (2 Credit units)
Biologically important molecules, their separation and analysis. Sugars, amino acids, peptides, proteins, lipids, nucleic acids. Clinical analysis including enzyme assays. Immunological methods. Trace metal determination in blood, serum and urine.

CHM 836: Drugs, Foods and Pharmaceutical Analysis (2 Credit units)
Preservatives and Additives. Food and Drug Act, Biopharmaceutics, Determination of drugs by chromatography and

spectropharmacopedia.Food analysis.Health safety. Good laboratory practice. Good manufacturing practice (GMP).

CHM 837: Nuclear and Radiochemical Methods (2 Credit units)
Radioactive decay and elementary particles.Nuclear binding energy and stability.Production of radionuclides, electrical and magnetic properties of nuclides.Two nucleon system, the square-well potential.Neutron and proton scattering.Absorption of nuclear radiation and its effects on matter.Radiation detection and measurement.Statistics of counting. Analytical applications of radioisotopes (Neutron Activation methods, Isotopic dilution methods, Radiometric methods). Hazards, laboratory design and organization, radioactive waste disposal.

CHM 839: Environmental Chemistry (2 Credit units)
Sources and causes of pollution in the hydrosphere, the atmosphere, and soil/land. Application of various analytical techniques in the analysis of environmental samples, e.g. water, air, industrial effluents, soil, sediments, geochemical materials, for trace and major constituents, e.g. heavy metals, organics, inorganics, pesticides, hydrocarbons, detergents. Environmental Impact Assessment (EIA) and Environmental Impact Statements (EIS) for selected chemical industries, mining, waterworks, etc.

CHM 841: Experimental Physical Chemistry I (2 Credit units)
Two experiments on measurement of heat of reaction, solubility product, equilibrium constant via spectroscopic method or rate constant.

CHM 842: Experimental Physical Chemistry II (2 Credit units)
Experiments on calorimetry, e.m.f. measurement, conductance of weak electrolytes for dissociation constant measurements or heat of reactions and combustion.

CHM 843: Inorganic Chemistry Laboratory I (2 Credit units)
Experiments in classical analysis including complexometric titrations and gravimetry. Investigations of rates and mechanisms of inorganic reactions.

CHM 844: Inorganic Chemistry Laboratory II (2 Credit units)
Experiments covering the preparations and study of coordination and organometallic compounds of main group and transition metals.

CHM 845: Experimental Organic Chemistry I (2 Credit units)
Isolation and purification of natural products of plants or animal origin: solvent extraction and chromatographic methods of separation of organic mixtures. Determination of purity of organic compounds and spectroscopic methods of structural elucidation of natural products

CHM 846: Experimental Organic Chemistry II (2 Credit units)
Principles of organic synthesis: planning for a synthesis, determination of physical data for organic compounds, determination of yields. Synthesis of some simple/complex organic compounds and practical spectroscopic analysis of synthesized products.

CHM 847: Analytical Laboratory Techniques I (2 Credit units)
Qualitative and quantitative analysis. Experiments in spectroscopic techniques, analysis of air, soil, water and plant samples.

CHM 848: Analytical Laboratory Techniques II (2 Credit units)
Experiments in chromatographic and other separation techniques, instrumental and classical methods of food and drug analysis.

CHM 850 Advanced Toxicology (2 Credit units)
Specific types of toxicant (poisons, pesticides, solvents, oils, estrogen, estrogen mimics, triclosan, carcinogens, teratogens, natural toxins and pollutants), adsorption, distribution, metabolism, biological elimination,

sequestration, and remediation.Mammalian systems with emphasis on target organs, detoxification and adverse effects. Different methods of extracting toxicants from soil, water, air, and plant materials. Pesticide toxicity and organ effects will be demonstrated in invertebrate systems focusing on routes of entry, solubility, sequestration, elimination, and detoxification.

CHM 851: Seminar (2 Credit units)
Students will be required present supervised seminar papers in their areas of specialization. The papers will be graded by a panel of examiners.

CHM 891 Dissertation (10 Credit units)
Each student is expected to carry out original research work culminating to a report or dissertation on which he or she will be examined by a panel of examiners.

SCI 801: Management and Entrepreneurship I (2 Credit units)
The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

Staff list

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc-Manchester-2004 Ph.D –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel

2	John Obaji Igoli	B.Sc - Nsukka - 1985 M.Sc - Nsukka 1990 Ph.D- Nsukka 2003	Visiting	Professor	Organic Chemistry
3	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
4	Simon Terver Ubwa	B.Sc -Calabar - 1991 M.Sc- Ibadan - 1997 PhD- Nsukka- 2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
	Godwin Oche Obochi	B. Sc. –UAM- 2002 M.Sc. –Calabar- 2007 Ph.D Calabar- 2014	Tenure	Associate Professor	Biochemistry
5	Lami Angela Nnamonu	B.Sc- Jos-1984 M.Sc- Nsukka- 2009 PhD- UAM-2011	Part-Time	Senior Lecturer	Agricultural Technology
6	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics

7	Vitus Eze Agbazue	B.Sc - Nsukka 1978 M.Sc Nsukka-1990 Ph.D Nsukka 2005	Sabatical	Senior Lecturer	Pure and Industrial Chemistry
8	Benjamin Asen Anhwange	B.Sc- Zaria-1992 M.Sc- Zaria-2005 PhD- Zaria-2014	Tenure	Senior Lecturer	Analytical Chemistry
9	Sylvester Obaike Adejoh	B.Sc- Jos-1980 M.Sc –Jos-1995 PhD- Jos-2015	Tenure	Senior Lecturer	Physical Chemistry
10	Isaac Gbaa Agbidye	B.Sc. Zaria 1981 M.Sc. Ibadan 1988	Tenure	Lecturer I	Organic (Synthetic/Natural Products) Chemistry
11	Barnabas Aloo Kyenge	B.Sc-BSU 1997 M.Sc.-Nsukka 2007 Ph.D-Bauchi-2017	Tenure	Senior Lecturer	Polymer Chemistry
12	Ngozi Uchukwuka Igoli	B. Sc. –Nsukka-1983 M.Sc. Nsukka-1989 Ph.D Nsukka 2009	Part-Time	Lecturer II	Food Chemistry

DOCTOR OF PHILOSOPHY DEGREE (PhD) PROGRAMME IN FOOD PROCESSING TECHNOLOGY

Philosophy

The doctorate degree in Food Processing Technology is designed to prepare students to become specialists in the technology of food processing. The programme will deepen the theoretical and practical knowledge of the students so as to enrich research effort in the Food Processing Technology. In addition, it will enhance development of scholarly competence for teaching, research and for placement in the Food industries. Furthermore, in keeping pace with the present trend in research, the programme will emphasize interdisciplinary and collaborative work.

Rationale

The PhD Food Processing Technology is targeted at strengthening the training of graduate Chemists and related discipline in specialized food technologies and to cater for research and human capital developmental needs in curbing post harvest loses in the immediate environment as well as the wider society. Graduates of this programme can create self employment and job opportunity for others as well as serve as manpower for emerging food industries.

Objectives

The PhD programme is designed to:

(i) Broaden the understanding of the subject by the students, with emphasis on the applied aspects especially as it relates to the environment, food and allied products and the chemical nature of materials encountered in the control of post – harvest losses of food.

(ii) Produce well-equipped Food Scientists required at the universities and other institutions of higher learning.
(iii) Meet the man-power needs of research institutes, industries and government ministries and parastatal
(iv) To equip graduates for careers in food processing research.
(v) To explore local methods of processing food with a view to prevent post harvest losses
(vi) To focus on research in food processing that has direct impact on the socio-economic well being of Nigerians and the wider society
(vii) To encourage interdisciplinary and collaborative research with other scientists at local and global levels.

Admission Requirements

i. Admission shall be opened to candidates who have a minimum of an M. Sc Degree in Food Processing Technology and in any relevant area of Food chemistry/Food Science and Technology/ Chemistry or its equivalent with a minimum CGPA of 3.50 on a 5-point scale from Benue State University or any other institution recognized by the Senate of Benue State University.
ii. A minimum qualification of second class (honours) lower division with a CGPA of not less than 3.0 0n a 5 - point scale. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in Food Science and Processing Technology, Chemistry/related disciplines shall be eligible for admission.
iii. In addition to (i) and (ii) above, a candidate seeking admission into the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry, Biology and Physics.
iv. Candidates can only be admitted for doctorate degree, if their transcripts for certificates are received at Postgraduate school at the time of consideration of application for admission.

v. Dissertation score of not less than 60%
vi. Intellectually sound.

Remedial Courses

Candidates who have deficiencies at their Master's level or who wish to pursue PhD in areas other than those they did their Master's would be made to make up such deficiencies along with the doctoral courses.

Duration of Study

(i) Full-Time
- Minimum duration: Three (3) academic sessions.
- Maximum duration: Five (5) academic sessions.

(ii) Part-Time
- Minimum duration: Five (5) academic sessions.
- Maximum duration: Seven (7) academic sessions.

Graduation Requirements

To qualify for the award of PhD Degree in Food Processing Technology, a candidate shall meet the following requirements:

(i) Must have duly registered for each session and paid the prescribed fees.

(ii) Must have passed all the courses as prescribed in the course work module of the programme at a grade of C (CGPA=3.0) or above. A candidate who fails to meet this minimum CGPA at the end of the academic session shall be advised to withdraw.

(iii) Must have accumulated a minimum of 24 credit units of course work and must have submitted a supervised research work embodied in a Thesis.

(iv) The Thesis must have been examined by a board of examiners which shall include an external examiner.

Probation/ Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn

Course Work Grading

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0.00

Course Code and Course Title

First Semester

Core Courses

Course Code	Course Title	Credit Unit(s)
CHM 901	Statistical and Research Methods II	2
SCI 901	Management and Entrepreneurship II2	
FST 903	Advanced Food Freezing and Cold Storage	3
FPT 905	Beverage Technology	2
FPM 909	Advanced Food Products Development	3
FPT 903	Pilot Plant Demonstration	3
FPT 991	Seminar	2
	Total	**17**

Elective Courses: At least 4 units to be taken

FST 901	New Concepts in Food Processing	2
FST 905	Advanced Food Toxicology	2
FST 907	Chemistry of Plant Food Products	2
FPT 907	Advanced Milk and Dairy Processing Technology	*2*
	Total	**8**

Second Semester
Core Course

Course Code	**Course Title**	**Credit Unit(s)**
FPT 902	Aquatic Foods Processing Technology	3
FPT 904	Advanced Poultry Processing Technology	3
FPT 906	Advanced Meat Processing Technology	3
	Total	**9**
Elective Courses		
FPT 908	Soybean Processing Technology	3
FPT 910	Food Enzymology	2
	Total	**5**
FPT 999	Thesis	30

Courses Synopses
CHM 901: Statistical and Research Methods II (2 Credit units)

Research design, data collection and treatment of analytical data.Sampling and specifications.Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables.Report writing.

FPM 909: Advanced Food Products Development (3 Credit units)
Basis of new product development: idea generation,, development stage, shelf life studies, sensory evaluation, packaging, consumer sampling, market testing, final commercialization, Nutritional and age considerations in food product development.

FPT 902: Aquatic Foods Processing Technology (3 Credit units)
Handling of landed fresh fish and shell fish – marine and fresh water, fish processing equipment, modern methods of fish curing, dehydration, canning and frying oils, savoury, granted fish products, fish irradiation, industrial development and fish quality, pesticide residues in fish, legislation relating to fish processing.

FPT 903: Pilot Plant Demonstration (3 Credit units)
Conventional milling processes. Baking, Fruit juice extraction and production of soft drinks. Preparation of tomato puree Manufacture of malt drinks, lager beer, stout drinks. Conventional and unconventional methods of vegetable oil extraction. Demonstration of can seaming techniques.Smoking techniques of some food commodities. Industrial visits to food industries to complement the pilot work and to serve as a means of highlighting the problems of food plant location, layout, design and plant sanitation.

FPT 904: Advanced Poultry Processing Technology (3 Credit units)
Design and layout of poultry slaughter plants, grading of poultry meat, freezing curing, smoking, and frying of poultry products, problems associated with poultry meat processing, egg and egg quality identification, modern techniques of egg dehydration and processing.

FPT 905: Beverage Technology (2 Credit units)
Production of carbonated and non-carbonated beverages (e.g. coffee, tea, coca-chocolate and related products, wine, distilled liquors etc).

FPT 906: Advanced Meat Processing Technology (3 Credit units)
Modern methods of meat preservation and processing, enzyme treatment of meat, flavour constituents in meat and their evaluation, meat by-products, Microbial interaction with meat and meat stability, role of meat fats in nutrition, methods of analysis of processed meat. Legislation relating to meat and meat products.

FPT 907: Advanced Milk and Diary Processing Technology (2 Credit units)
Milk production and handling in the farm. Factors affecting milk yield land composition. Preservation, pasteurization and sterilization. Manufacture of dairy products, yoghurt, cheese, ice cream, butter, powder milk, evaporated milk, etc. imitation dairy products. Packaging and packaging materials for dairy products. Physical chemical, microbiological and nutritional aspects of milk and milk products.

FPT 910: Food Enzymology (2 Credit units)
Enzymes and their general characteristics. Properties of enzymes important in food processing. The production and purification of enzymes for food processing. Comprehensive discussion of parameters which affect enzyme activity. The technological application of enzymes in foods.

FPT 991: Seminar (2 Credit units)
Presentation and discussion of research problems and findings in the area of Food Science and Technology

FPT 999: PhD Thesis (30 Credit units)
Each student is expected to carry out original research work culminating to a thesis on which he or she will be examined by a panel of examiners

FST 901: New Concepts in Food Processing (2 Credit units)

Concepts of and requirements for processing systems and continuous processes. Use of computers in food processing.Microwave heating of foods, radiation preservation of foods and related processing methods. Economic consideration of processing systems.Effects of different processing methods on physical and chemical components of foods.

FST 903: Food Freezing and Cold Storage (3 Credit units)

Overview of the refrigeration and air-conditioning industry; Refrigerants and their thermodynamic properties. Design and operation of cold storage requirement. Refrigeration in dairy, abattoirs and brewery.

FST 905: Advanced Food Toxicology (2 Credit units)

Origin, occurrence and potential health hazard of toxic substances in foods; microbial toxins, chemical residues of materials used in food production or toxic components of food stuffs.Effects of carcinogenesis on nucleic acid metabolism.Basic concepts and techniques of food safety evaluation and interpretation of biological data.

FST 907: Chemistry of Plant Food Products (2 Credit units)

Chemistry and biochemistry of plant pigments, tannins, toxins and proteins. Nutritional significance of the plant pigments and effects of processing methods on their physico-chemical properties nutritional value.

SCI 901: Management and Entrepreneurship II (2 Credit units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc-Manchester-2004 PhD –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Dick Iorwuese Gernah	B.Sc. – Ibadan-1978 M.Sc- Edinburgh-1982 PhD- UAM-2009	Part-Time	Professor	Food Prod/Develop.
3	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
4	Joseph Shian Alakali	B.Sc. –Jos-1987 M.Sc-Nsukka-1990 PhD- UAM-2004	Part-Time	Professor	Food Engineering
5	Charle Chukuma Ariahu	B.Sc.-Zaria-1979 M.Sc-Ife-1983 PhD –Ife-1990	Part-Time	Professor	Food Engineering
6	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan-1994	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and

		Ph.D –Ibadan 2012			Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Ahemen Samuel Aondoaver	B.Eng UAM 1990 M.Sc. Ibandan 2008 PhD Ibadan 2015	Part-Time	Senior Lecturer	Processing and Storage
10	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
11	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
12	Grace Mwuese Gberikon	B. Sc. –Zaria-1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
13	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD-Loughborough,	Tenure	Senior Lecturer	Environmental Chemistry

		UK-2014			
14	Dinnah Ahure	B. Sc. 1995-UAM M.Sc. 2004-UAM Ph.D 2015-UAM	Part-Time	Lecturer I	Food Processing
15	Mike Ojotu Eke	B.Sc- UMA - 1992 M.Sc- UMA-2009 PhD –UAM – 2015	Part-Time	Lecturer I	Meat Technology

DOCTOR OF PHILOSOPHY DEGREE (PhD) PROGRAMME IN FOOD SCIENCE AND TECHNOLOGY

Philosophy

The doctorate degree programme in Food Science and Technology is designed to prepare candidates to become specialists, Food Scientist and Technologists. The programme will deepen the theoretical knowledge of the candidates so as to enhance research efforts in curbing post harvest losses. In addition, it will enhance development of scholarly competence for teaching, research and for placement in the Food industries. Furthermore, in keeping pace with the present trend in research, the programme will emphasize interdisciplinary and collaborative work.

Rationale

The PhD in Food Science and Technology is anchored on training research scientists capable of researching and working effectively in the food industry, food research institutes, universities and other government establishments to address challenges related to food production; particularly in reducing food spoilage at postharvest periods. In addition, graduates of this programme can create self

employment and job opportunities for others as well as serve as manpower for emerging food industries.

Objectives

The programme is designed to:

(i) Broaden the understanding of the subject by the students, with emphasis on the applied aspects especially as it relates to the environment, food and allied products and the factors encountered in the control of post – harvest losses of food.

(ii) Produce high level manpower needed in food policy formulation for government and non governmentalestablishments.

(iii) Meet the man-power needs of Universityand other institutions of higher learning, research institutes, industries and government ministries and parastatals.

(iv) To equip graduates for careers in food science and technology research.

(v) To focus on research in food science and technology that has direct impact on the socio-economic well being of Nigerians and the international commununity.

(vi) To encourage interdisciplinary and collaborative research with other scientists at local and global levels.

(vii) Candidates considered from other disciplinesother than Food Science and Technology shall be required to take complementary courses in their areas of deficiency.

Admission Requirements

i. Admission shall be open to candidates who have a minimum of an M.Sc Degree in Food Science and Technology and in other relevant discipline or its equivalent with a minimum CGPA of 3.50 on a 5-point scale from Benue State University or any other institution recognized by the Senate of Benue State University.

ii. A minimum qualification of second class (honours) lower division with a CGPA of not less than 3.0 0n a 5 - point scale. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in Food Science and Processing Technology, Chemistry/related disciplines shall be eligible for admission.

iii. In addition to (i) and (ii) above, a candidate seeking admission into the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry, Biology and Physics.

iv. Candidates can only be admitted for doctorate degree, if their transcripts for certificates are received at Postgraduate school at the time of consideration of application for admission.

v. Dissertation score of not less than 60%

vi. Intellectually sound.

Remedial Courses

Candidates who have deficiencies at their Master's level or who wish to pursue PhD in areas other than those they did their Master's would be made to make up such deficiencies along with the doctoral courses.

Duration of Study

(i) Full-Time
- Minimum duration: Three (3) academic sessions.
- Maximum duration: Five (5) academic sessions.

(ii) Part-Time
- Minimum duration: Five (5) academic sessions.
- Maximum duration: Seven (7) academic sessions.

Graduation Requirements

To qualify for the award of PhD Degree in Food Science and Technology, a candidate shall meet the following requirements:

(i) Must have duly registered for each session and paid the prescribed fees.

(ii) Must have passed all the courses as prescribed in the course work module of the programme at a grade of C (CGPA=3.0) or above. A candidate who fails to meet this minimum CGPA at the end of the academic session shall be advised to withdraw.

(iii) Must have accumulated a minimum of 24 credit units of course work and must have submitted a supervised research work embodied in a Thesis.

(iv) The Thesis must have been examined by a board of examiners which shall include an external examiner.

Probation/ Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn

Course Work Grading

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0

Course Code and Course Titles

First Semester

Core Course

Course Code	Course Title	Credit Unit(s)
CHM 901	Statistical and Research Methods	2
SCI 901	Management and Entrepreneurship II	2
FPT 905	Beverage Technology	2
FST 901	New Concepts in Food Processing	2
FST 903	Food Freezing and Cold Storage	3
FST 905	Food Toxicology	2
FST 991	Seminar	2
	Total	**15**

Elective Courses: at least one course to be taken

FST 907	Chemistry of Plant Food Products	2
FST 911	Food and Nutrition Policy	2
	Total	**4**

Second Semester

Core Courses

Course Code	Course Title	Credit Unit(s)
FST 904	Flavour and Sensory Testing	2
FST 906	Fats and Oils Technology II	2
FST 908	Food Packaging Technology II	3
FST 910	Food Biochemistry	2
FPT 910	Food Enzymology	2
	Total	**11**

Electives Courses: at least one course to be taken

FPM 906	Food Business Management	2
FPT 908	Soybean Processing Technology	3
	TOTAL	**5**

FST 999 Thesis **30**

Course Synopsis

CHM 901: Statistical and Research Methods (2 Credit units)

Research design, data collection and treatment of analytical data.Sampling and specifications. Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables. Report writing.

FPT 905: Beverage Technology (2 Credit units)

Production of carbonated and non-carbonated beverages (e.g. coffee, tea, coca-chocolate and related products, wine, distilled liquors etc).

FPM 906: Food Business Management – (2 Credit units)

The food business environment; the Nigerian food chain systems characteristics of Nigerian food processors and retailers. Marketing in food business management, food operations management human resources management, finance and accounting for food firms.

FST 901: New Concepts in Food Processing (2 Credit units)

Concepts of and requirements for processing systems and continuous processes.Use of computers in food processing.Microwave heating of foods, radiation preservation of foods and related processing methods.Economic consideration of processing systems.Effects of different processing methods on physical and chemical components of foods.

FST 903: Food Freezing and Cold Storage (2 Credit units)

Overview of the refrigeration and air-conditioning industry. Refrigerants and their thermodynamics properties. Design and operation of cold storage requirement. Refrigeration in dairy, abattoirs and brewery.

FST 911: Food and Nutrition policy (2 Credit units)
International nutrition – FAQ, WHO and UNO food policies and programmes, World Hunger Project, refugee problems as they relate to nutrition.National nutritional policy and programmes. Place of industries in nutritional planning and implementation. National development planning.

FST 903: Food Freezing and Cold Storage (3 Credit units)
Overview of the refrigeration and air-conditioning industry. Refrigerants and their thermodynamics properties. Design and operation of cold storage requirement.Refrigeration in dairy, abattoirs and brewery.

FST 904: Flavour and Sensory Testing (2 Credit units)
Chemistry of foods with particular reference to the compounds responsible for flavour and odour. Physical and chemical techniques for the separation, purification and identification of these compounds: consideration of the behavioural science with respect to evaluation of food acceptability

FST 905: Food Toxicology (2 Credit units)
Origin, occurrence and potential health hazard of toxic substances in foods; microbial toxins, chemical residues of materials used in food production or toxic components of food stuffs.Effects of carcinogenesis on nucleic acid metabolism.Basic concepts and techniques of food safety evaluation and interpretation of biological data.

FPT 908: Soybean Processing Technology (3 Credit units)
Chemistry and technology of soybean and soy products (soy flour, oil, concentrates, isolates etc). Application of soy products in foods.Nutritional and economic significance of soy products.

FST 906: Fats and Oils Technology II (2 Credit units)

Sources of edible fats and oils, methods of extraction and chemical constituents of oils. Processing, storage, spoilage, uses physical and chemical quality indices of fats and oils. Manufacturing of margarine, cooking fats and oils.

FST 907: Chemistry of Plant Food Products (2 Credit units)

Chemistry and biochemistry of plant pigments, tannins, toxins and proteins. Nutritional significance of the plant pigments and effects of processing methods on their physico-chemical properties nutritional value.

FPT 910: Food Enzymology (2 Credit units)

Enzymes and their general characteristics. Properties of enzymes important in food processing. The production and purification of enzymes for food processing. Comprehensive discussion of parameters which affect enzyme activity. The technological application of enzymes in foods.

FST 910: Food Biochemistry (2 Credit units)

Protein, lipid, carbohydrate chemistry and biochemistry in natural and processed foods and their changes during storage.The fundamental roles of pectin, vitamins, pigments and minerals.Texture, flavour and colour as affected by chemical/biochemical interaction of food macromolecules.Enzymes and enzymic reactions and their effects.

FST 991: Seminar (2 Credit units)

Presentation and discussion of research problems and findings in area of food science and technology

FST 999: PhD Thesis (30 Credit units)

Each student is expected to carry out original research work culminating to a thesis on which he or she will be examined by a panel of examiners.

SCI 901: Management and Entrepreneurship II (2 Credit units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1993 M.Sc-Manchester-2004 PhD –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Dick Iorwuese Gernah	B.Sc. Ibadan-1978 M.Sc- Edinburgh-1982 PhD- UAM-2009	Part-Time	Professor	Food Prod/Develop.
3	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing
4	Joseph Shian Alakali	B.Sc. –Jos-1987 M.Sc-Nsukka-1990 PhD- UAM-2004	Part-Time	Professor	Food Engineering

5	Charle Chukuma Ariahu	B.Sc.-Zaria-1979 M.Sc-Ife-1983 PhD –Ife-1990	Part-Time	Professor	Food Engineering
6	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan-1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Ahemen Samuel Aondoaver	B.Eng UAM 1990 M.Sc. Ibandan 2008 PhD Ibadan 2015	Part-Time	Senior Lecturer	Processing and Storage
10	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Senior Lecturer	Food Biotechnology
11	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
12	Grace	B. Sc. –Zaria-	Par-	Senior	Microbiology

	Mwuese Gberikon	1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Time	Lecturer	
13	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD- Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
14	Dinnah Ahure	B. Sc. 1995-UAM M.Sc. 2004-UAM Ph.D 2015-UAM	Part-Time	Lecturer I	Food Processing
15	Mike Ojotu Eke	B.Sc- UMA -1992 M.Sc- UMA-2009 PhD –UAM – 2015	Part-Time	Lecturer I	Meat Technology

DOCTOR OF PHILOSOPHY DEGREE (PhD) PROGRAMME IN FOOD CHEMISTRY

Philosophy

The doctorate degree in chemistry is designed to prepare students to become specialists Food Chemistry.Theprogramme will deepen the theoretical knowledge of the students so as to enrich research effort in the Food Chemistry. In addition, it will enhance development of scholarly competence for teaching, research and for placement in the Food industries. Furthermore, in keeping pace with the present trend in research, the programme will emphasize interdisciplinary and collaborative work.

Rationale

The need to address challenges related to food production; particularly in reducing food spoilage at postharvest periods necessitates the training of middle and senior level scientists capable of working effectively in the food industry, food commodity research institutes, universities and other establishments. Graduates of this progamme can be self-employed and create job opportunities as well as manpower for emerging food industries.

Objectives

(i) To train high calibre graduates to work in industries, universities and other institutions of learning.

(ii) To equip graduates for careers in food research.

(iii) To explore Nigeria's natural resources with a view to prevent post harvest losses

(iv) To focus on research that has direct impact on the socio-economic well being of Nigerians and the wider society

(v) To encourage interdisciplinary and collaborative research with other scientists at local and global levels.

(vi) Develop an understanding of how individual food components contribute to the overall quality of foods.

(vii) Achieve an understanding of the chemical changes that take place with food components during processing and storage.

(viii) Recognize reactions and mechanisms important in food chemistry.

(ix) Be capable of designing and conducting experiments and interpreting data to understand important food chemistry principles.

Admission Requirements

(a) Admission shall be opened to candidates who have a minimum of an M.Sc Degree in Food Chemistry andinany relevant area of chemistry or its equivalent with a minimum CGPA of 3.50 on a 5-

point scale from Benue State University or any other institutionrecognized by the Senate of Benue State University.

The Department may admit candidates with a CGPA of less than 3.5 if there is satisfactory evidence of quality academic research Dissertation (a score of 60% and above) at M.Sc level

Remedial Courses

Candidates who have deficiencies at their Master's level or who wish to pursue PhD in areas other than those they did their Master's would be made to make up such deficiencies along with the doctoral courses.

Transcripts

Candidates can only be admitted for doctorate degree, if their transcripts for certificates are received at Postgraduate school at the time of consideration of application for admission.

Duration of Study

(i) Full-Time
- Minimum duration: Three (3) academic sessions.
- Maximum duration: Five (5) academic sessions.

(ii) Part-Time
- Minimum duration: Five (5) academic sessions.
- Maximum duration: Seven (7) academic sessions.

Graduation Requirements

To qualify for the award of PhD Degree in Food Chemistry, a candidate shall meet the following requirements:

(i) Must have duly registered for each session and paid the prescribed fees.

(ii) Must have passed all the courses as prescribed inthe course work module of the programme at a grade of C (CGPA = 3.0) or above.

A candidate who fails to meet this minimum CGPA at the end of the academic session shall be advised to withdraw.

(iii) Must have accumulated a minimum of 24 credit units of course work and must have submitted a supervised research work embodied in a Thesis.

(iv) The Thesis must have been examined by a board of examiners which shall include an external examiner.

Probation/ Withdrawal

A student whose CGPA is below 3.00 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.00 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 2.50 shall be withdrawn

Grading System

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0.00

Course Code and Courss Titles

First Semester

Core Courses

S/No	Course Code	Course Title	Credit Units
1	CHM 901	Statistical and Research Methods	2
2	SCI 901	Management and Entrepreneurship II	*2*

3	CHM 903	Advances in Radiochemical Techniques of Analysis	2
4	CHM 919	Advances inOrganic Chemistry	2
5	CHM 921	Food Chemistry and Toxicology	2
6	CHM 923	Food Analysis and Instrumental Techniques	2
7	CHM 925	Food Biotechnology	2
8	CHM 961	Electronics and Automation in Chemical Analysis	2
9	CHM 992	Seminar	2
Elective Course		**(at least 2 units to be taken)**	
10	CHM 927	Food, Drugs and Pharmaceutical Analysis	2
11	CHM 947	Carbohydrates and Nucleic Acids	2
		Total	**22**

Second semester

Core Courses

S/No.	**Course Code**	**Course Title**	**Credit Units**
1	CHM 914	Advances in Classical Methods of Analysis	*2*
2	CHM 918	Minerals and Vitamins	3
3	CHM 920	Food Processing, Preservation and Packaging.	2
4	CHM 922	Recent Advances in Applied Spectroscopy	2
Elective Course		**(at least 2 units to be taken)**	
6	CHM 910	Environmental Law and Policy	2
7	CHM 904	Experimental Design and Data Analysis	2

	Total	**12**
CHM 991	Thesis	30

Course Synopses

CHM 901: Statistical and Research Methods (2 Credit units)
Research design, data collection and treatment of analytical data.Sampling and specifications. Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables. Report writing.

SCI 901: Management and Entrepreneurship II (2 Credit units)
The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

CHM 903: Advances in Radiochemical Techniques of Analysis (2 Credit Units)
New directions in application of radiochemical techniques.Radiation detection and measurement.Statistics of counting.Analytical application of radioisotopes, Hazards, Laboratory design and organisation - purity, storage and stability of labelled compounds.

CHM 904: Experimental Design and Data Analysis(2 CreditUnits)
Design of Research experiment, Sampling and specifications. Treatment of analytical data; Nature of errors: Quality control charts; Statistical inference based on significance tests and confidence limits; Analysis of variance; Regression analysis between variables.

CHM 906: Seminar (1 Credit Unit)

Thought-provoking discourse on topical research issues of relevance to scientific, national and international interest selected from an area outside that of the student's thesis research must be formulated and defended in the semester following end of course work.

CHM 910: Environmental Law and Policy (2 Credit Units)

Aspect of national policy and guidelines on the environment, pollution control and environmental equity and health; A survey of environmental laws and policy; the NESERA Act; World Health Organisation and other international environmental standards; Scientific basis of environmental standards. Managing the environment for sustainable development. Energy and agricultural policy and environmental quality.

CHM 914: Advances in Classical Methods of Analysis (2 Credit Units)

State-of-the-art developments in qualitative and titrimetric techniques of analysis and how they have been applied in various facets of science for rapid determinations.

CHM 918: Minerals and Vitamins (3 Credit Units)

The role of inorganic elements in living systems.Metabolism of individual inorganic elements.Metalloproteinase and other metallocompounds in living systems Interaction of inorganic elements.Inorganic elements deficiency symptoms and diagnostic and therapeutic importance of inorganic elements. Recent advances in the studies of metabolism of inorganic elements and future trends. The Chemistry and functions of vitamins, the co-enzyme role of some vitamins, synthetic vitamins.The mechanism of action of vitamins as co-enzymes.Bioavailability of vitamins. Toxicity of vitamins,

therapeutic uses of vitamins. Recent advances in vitamin research and future trends

CHM 919: Advances in Organic Chemistry (2 Credit Units)
Advances in C-C bond, C-Heteroatom bond formation, Retrosynthetic analysis and selected total synthesis, Biomolecules and biological activity determination. Linear free energy relationship, Kinetic and non-kinetic methods of determining reaction mechanisms.

CHM 920: Food Processing, Preservation and Packaging (2 Credit Units)
Broad review of food processing and preservation techniques – dehydration, canning, freezing, fermentation, irradiation, Modified Atmosphere Storage (MAS), conventional drying, special drying techniques (freeze – drying, foam mat drying, osmotic dehydration).Use of high and low temperatures, fermentation, use of food additives.Functions and types of packaging materials, Packaging requirements for raw and processed foods.

CHM 921: Food Chemistry and Toxicology (2 Credit Units)
Food composition (nutrients and non – nutrients constituents), overview of the chemical, physical and biological properties of food components (protein, carbohydrate, fat, water, minerals, vitamins and pigments). Theoretical and applied concepts of the effects of handling, processing and storage on food components and nutrients. Evaluation of methods used to determine safety of economically important chemicals used in food preservation. Nature and occurrence of toxins in food. Detoxification of foods. Foodcolour, flavour and texture.

CHM 922: Recent Advances in Applied Spectroscopy (2Credit Units)

Introduction and applications of techniques such as COSY, HSQC, HMBC, NOESY, ROSEY, LCMS, HRMS, TGA, SEM, XRF, XRD, TEM in separation and structural elucidation problems shall be treated.

CHM 923: Food Analysis and Instrumental Techniques (2 Credit Units)

Sampling and sample preparation; physical, chemical and biological techniques in food analysis: Proximate analysis, densimetry, spectroscopy, rheometry, microscopy, refractometry, polarimetry, chromatography, NMR, enzymatic and immunological assay and sensory evaluation methods.

CHM 925: Food Biotechnology (2 Credit Units)

Fermented foods of tropical and temperate countries, oriental fermented foods. Production of: vitamins, amino acids, lactic acid, polysaccharides, polyhydroxyl alcohols, vinegar, beer and wine by fermentation. Diagnostic biotechnology and food safety.Microbial protein enrichment of carbohydrate foods.

CHM 927: Food, Drugs andPharmaceutical Analysis (2Credit Units)

Food and drugs Act. Food analysis: Chemical, Physical, Microbiological, Separation techniques. Preservatives and additives; Determination of drugs by chromatography and spectroscopic methods; Pharmaceutical analysis: Monographs and pharmacopoeia techniques; Good laboratory (GLP) and good manufacturing (GMP) practices.

CHM 947: Carbohydrates and Nucleic Acids (2 Credit Units)

Monosaccharides and disaccharides; Structure, reactions and biosynthesis.uses of Deoxysugars, oxosugar, amino-sugars, sugar

epoxides and antibiotics having these sugar moieties.Polysaccharides, starch (glycogen) and cellulose and their biosynthesis.Structure and synthesis of nucleosides, nucleotides and oligonucleotides.Biosynthesis of nucleic acids andProteins.Concept of genes and genetic engineering.

CHM 952: Thesis (30 Credit Units)

Each student is expected to carry out original research work culminating to a report or thesis on which he or she will be examined by a panel of examiners.

CHM 961: Electronics and Automation in Chemical Analysis (2 Credit Units)

Components and circuits; Amplifiers; Non-linear circuits; Recorders, applications in analytical instrumentation; Microprocessors and their applications; Online and Laboratory systems; Continuous flow, discrete and centrifugal analysers; Computer control of instruments.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1998 M.Sc- Manchester-2004 Ph.D –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Ukpabi Joseph Ukpabi	B. Sc. 1979 Zaria M.Sc. 1983 Zaria Ph.D 2003 Zaria	Part-Time	Professor	Plant, Food and Nutritional Biochemistry, Food Science and Technology
3	Bibiana Dooshima Igbahul	B.Sc. – UAM-1994 M.Sc-UMA-2001 PhD- UAM-2007	Part-Time	Professor	Food Processing

4	John Obaji Igoli	B.Sc - Nsukka - 1985- M.Sc - Nsukka 1990 Ph.D- Nsukka 2003	Visiting	Professor	Organic Chemistry
5	Simon Terver Ubwa	B.Sc -Calabar - 1991 M.Sc- Ibadan -1997 PhD- Nsukka-2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
6	Godwin Oche Obochi	B. Sc. –UAM-2002 M.Sc. –Calabar-2007 Ph.D Calabar-2014	Tenure	Associate Professor	Biochemistry
7	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
8	Yusufu Mohammed Ikagu	HND (Idah) 1996 PGD (UAM) 2002 M.SC (UAM) 2005 PhD (UAM) 2011	Part Time	Senior Lecturer	Food Science and Tech.
9	Joseph Kwaghar Ikya	B.Sc. – Yola-1998 M.Sc- UAM-2004 PhD- UAM-2010	Part-Time	Associate Professor	Food Biotechnology
10	Abraham Tartenger Girgih	B.Sc. –UAM 1992 M.Sc-UAM 2001 PhD- Manitoba 2013	Part-Time	Senior Lecturer	Human Nutrition
11	Benjamin Asen Anhwange	B.Sc- Zaria-1992 M.Sc- Zaria- 2005 PhD- Zaria-2014	Tenure	Senior Lecturer	Analytical Chemistry
12	Grace Mwuese Gberikon	B. Sc. –Zaria- 1999 M.Sc. –Zaria 2007 Ph.D – Zaria 1999	Par-Time	Senior Lecturer	Microbiology
13	Itodo	B. Sc. Sokoto 2002	Part-Time	Senior	Analytical

	Udoji Adams	M.Sc. Sokoto 2006 Ph.D Zaria 2011		Lecturer	Chemistry
14	Peter Agorye Adie	B.Sc- Calabar-1991 M.Sc- Calabar - 2004 PhD –Calabar-2010	Tenure	Senior Lecturer	Analytical/Environmental Chemistry
15	Ogo Ogo	B.Sc. Jos 2003 M.Sc. Jos 2008 Ph.D UK 2015	Tenure	Lecturer I	Clinical Biochemistry
16	Moses Ukeyima	B.Tech (Yola) 2002 M.Sc (IIe-Ife) 2008 PhD (Reading, UK) 2016	Part-Time	Lecturer I	Food and Nutritional Science
17	Ngozi Chukwuka Igoli	B.Sc. Nsukka 1983 B.Sc. Nsukka 1989 Ph.D Nsukka 2009	Part-Time	Lecturer II	Food Chemistry

PhD PROGRAMME IN ANALYTICAL/ENVIRONMENTAL, NATURAL PRODUCTS AND ORGANIC CHEMISTRY

Philosophy

The doctorate degree in chemistry is designed to prepare students to become specialists in one of the following sub-disciplines in chemistry; Analytical/Environmental Chemistry, Inorganic Chemistry, Physical Chemistry Natural Products Chemistry and Organic Chemistry.

The programme will deepen the theoretical knowledge of the students in their areas of specialization so as to enrich research effort in the selected area. In addition, it will enhance development of scholarly competence for teaching, research and for placement in chemical/allied industries. Furthermore, in keeping pace with the present trend in research, the programme will emphasize interdisciplinary and collaborative work.

Rationale

The current level of Technological achievements and the potential for continuous advancement in the future, there is obvious need to strengthen the training of graduate Chemists in tertiary Institutions; Chemical/Biochemical; Pharmaceutical and Petrochemical industries where their leadership will be required.

The Department of Chemistry has therefore, designed a doctorate degree programme to cater for research and human capital developmental needs in these areas, and the immediate environment as well as the wider society.

Objectives

(i) To train high calibre graduates to work in chemical industries, universities and other institutions of learning.

(ii) To equip graduates for careers in research in their chosen areas of specializations

(iii) To explore Nigeria's natural resources with a view to accumulating and utilizing relevant chemical data.

(iv) To focus on research that has direct impact on the socio-economic well being of Nigerians and the wider society

(v) To encourage interdisciplinary and collaborative research with other scientists at local and global levels

Areas of Specialization

(i) Analytical/Environmental Chemistry

(ii) Inorganic Chemistry

(iii) Organic Chemistry/Natural Products Chemistry

(iv) Physical Chemistry

Admission Requirements

Candidates for PhD admission in Chemistry must satisfy the following conditions:

i. Admission shall be opened to candidates who have a minimum of an M.Sc Degree in Food Science and Technology and in any relevant area of chemistry or its equivalent with a minimum CGPA of 3.50 on a 5-point scale from Benue State University or any other institution recognized by the Senate of Benue State University.

ii. A minimum qualification of second class (honours) lower division with a CGPA of not less than 3.0 0n a 5 - point scale. Holders of the Benue State University degree or a degree from any other university recognized by the Senate of the Benue State University in Food Science and Processing Technology, Chemistry/related disciplines shall be eligible for admission.

iii. In addition to (i) and (ii) above, a candidate seeking admission into the Programme MUST have O' level credit passes in English Language, Mathematics, Chemistry, Biology and Physics.

iv. Candidates can only be admitted for doctorate degree, if their transcripts for certificates are received at Postgraduate school at the time of consideration of application for admission.

v. Dissertation score of not less than 60%

vi. Intellectually sound.

Remedial Courses

Candidates who have deficiencies at their Master's level or who wish to pursue PhD in areas other than those they did their Master's would be made to make up such deficiencies along with the doctoral courses.

Duration of Study

(i) Full-Time

(a) Minimum duration: Three (3) academic sessions.

(b) Maximum duration: Five (5) academic sessions.

(ii) Part-Time

(a) Minimum duration: Five (5) academic sessions.

(b) Maximum duration: Seven (7) academic sessions.

Graduation Requirements

To qualify for the award of PhD Degree in the above stated areas of Chemistry, a candidate shall meet the following requirements:

(i) Must have been duly registered for each session and paid the prescribed fees.

(ii) Must have passed all the courses as prescribed in the course work module of the programme at a grade of C (CGPA=3.0) or above. A candidate who fails to meet this minimum CGPA at the end of the academic session shall be advised to withdraw.

(iii) Must have accumulated a minimum of 24 credit units of course work and must have submitted a supervised research work embodied in a Thesis.

(iv) The Thesis must have been examined by a board of examiners which shall include an external examiner.

Probation/ Withdrawal

A student whose CGPA is below 3.0 at the end of a semester of study earns a probation status. To avoid withdrawal the student must have a CGPA of 3.0 at the end of the next semester of study. If at the end of the next semester of study he/she could not make up a CGPA of 3.0 shall be withdrawn

Course Work Grading

This shall be done on the following scale:

Letter Grade	Mark	Grade Point
A	70 and above	5.00
B	60 – 69	4.00
C	50 – 59	3.00
F	0 – 49	0

Course Outline

PhD ANALYTICAL/ENVIRONMENTAL CHEMISTRY

First Semester

Core Courses

S/N	Course Code	Course Title	Credit Units
1.	CHM 901	Statistical and Research Methods	2
2	SCI 901	Management and Entrepreneurship II	2
3.	CHM 903	Advances in Radiochemical Techniques of Analysis	2
4.	CHM 905	Aquatic and Atmospheric Chemistry	2
5.	CHM 907	Techniques in Environmental Chemistry	3
6.	CHM 909	Advances in Electro analytical Techniques	2
7.	CHM 961	Electronics/Automation in Chemical Analysis	2
10	CHM 991	Seminar	1

Elective Courses

6.	CHM911	Advances in Analytical Separation Techniques	2
7.	CHM 913	Environmental Pollution and Toxicology	2
8.	CHM 915	Environmental Modeling	2

9.	CHM 917	Environmental Inorganic Chemistry	2

Second Semester

Core Courses

10	CHM 902	Advances in Thermal Methods of Analysis	2
11	CHM 904	Experimental Design and Data Analysis	2
12	CHM 908	Advances in Analytical Spectroscopy	2
13	CHM 910	Environmental Law and Policy	2

Elective Courses

14	CHM 912	Development of Analytical Methods	2
15	CHM 914	Advances in Classical Methods of Analysis	2
16	CHM 916	Chemical Fate and Transport in the Environment	2
17	CHM 928	Bio-Inorganic Chemistry	2
18	CHM 999	Thesis	30

PhD ORGANIC CHEMISTRY/NATURAL PRODUCTS CHEMISTRY

First Semester

Core Courses

S/No.	Course Code	Course Title	Credit Units
1.	CHM 901	Statistical and Research Methods	2
2	SCI 901	Management and Entrepreneurship II	2
3.	CHM 907	Techniques in Environmental Chemistry	3
4	CHM 919	Advances in Organic Chemistry	2
5.	CHM 931	Advanced Chemical Kinetics	2
6.	CHM 941	Reaction mechanism and Stereochemistry	2
7.	CHM 943	Natural Products Chemistry	2
8	CHM 991	Seminar	1

Elective Courses

8.	CHM 945	Organic Photochemistry	2

9.	CHM 947	Carbohydrates and Nucleic acids	2

Second Semester

Core Courses

S/No.	Course Code	Course Title	Credit Units
1.	CHM 904	Experimental Design and Data Analysis	2
2	CHM 914	Advances in Classical Methods of Analysis	2
3.	CHM 922	Recent Advances in Applied Spectroscopy	2
4.	CHM 930	Heterocyclic Chemistry	2

Elective Course

5	CHM 916	Chemical Fate and Transport in the Environment	2
6.	CHM 932	Industrial Organic Chemistry	2
7.	CHM 999	Thesis	30

Course Synopsis

CHM 901: Statistical and Research Methods (2 Credit units)

Research design, data collection and treatment of analytical data. Sampling and specifications.Random and systematic errors of directly measured quantities. Statistical inference based on significance tests and confidence limits. Quality control charts. Analysis of variance. Linear relationships between two variables. Report writing.

SCI 901: Management and Entrepreneurship II (2 Credit units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving.

CHM 902: Advances in Thermal Methods of Analysis (2 Credit Units)

Recent developments in thermochemistry in the areas of Thermogravimetric analysis, differential thermal analysis, Differential scanning calorimetric analysis and Enthalpimetry

CHM 903: Advances in Radiochemical Techniques of Analysis (2 Credit Units)

New directions in application of radiochemical techniques.Radiation detection and measurement.Statistics of counting.Analytical application of radioisotopes, Hazards, Laboratory design and 175quilibrium175 – purity, storage and stability of 175quilib compounds.

CHM 904: Experimental Design and Data Analysis (2 Credit Units)

Design of Research experiment, Sampling and specifications. Treatment of analytical data; Nature of errors: Quality control charts; Statistical inference based on significance tests and confidence limits; Analysis of variance; Regression analysis between variables.

CHM 905: Aquatic and Atmospheric Chemistry (2 Credit Units)

Hydrospheric chemistry; physical and chemical properties of (ground andsurface) water. Distribution of species in aquatic system (single-variable andtwo-variable diagrams). Organic matter inwater.Biomethylation in aquaticsystems, Metal complexes with ligands of anthropogenic origin (in water andsediment).The earth's atmosphere: regions and chemical composition of theatmosphere, stratospheric and Tropospheric chemistry; classical and photochemical smog and their origin. Chemistry of global climatechanges; Greenhouse gases and ozone layer depletion.

CHM 907: Techniques in Environmental Chemistry (3 Credit Units)
Environmental quality assessment techniques; residue analysis, bio-indicators of chemical pollution etc.; Practical methods for environmental analysis: sampling for environmental analysis, methods of assessing the labilities of toxic chemicals in soil, assessing contaminant recovery in environmental samples, extractions from aqueous solutions (Liquid-liquid extraction (LLE), Solid phase extractions (SPE), Supercritical fluid extraction (SFE) etc.); Contaminant screening techniques; Spot tests in environmental analysis; GC-MS techniques; HPLC and AAS techniques; UV-visible spectrometry. Ion-selective electrodes in environmental analysis.

CHM 908: Advances in Analytical Spectroscopy (2 Credit Units)
A look at recent developments hi Flame Photometry, AAS, Atomic fluorescence, X-ray Fluorescence and Diffraction; Arc, spark and plasma

CHM 909: Advances in Electroanalytical Techniques (2 Credit Units)
Discussion shall include modern trends in polarography, coulometry,amperometry, ion-selective electrodes, Electrochemical biosensors, etc

CHM 910: Environmental Law and Policy (2 Credit Units)
Aspect of national policy and guidelines on the environment, pollution control and environmental equity and health; A survey of environmental laws and policy; the NESERA Act; World Health Organisation and other international environmental standards; Scientific basis of environmental standards. Managing the environment for sustainable development. Energy and agricultural policy and environmental quality.

CHM 911: Advances in Analytical Separation Techniques (2 Credit Units)

Topics shall include recent developments in state-of-the-art techniques in analytical separations and spectroscopy. New trends in chromatography, HPLC and GC-MS techniques. Supercritical fluid extraction and current uses of electrophoresis in clinical and other areas

CHM 912: Development of Analytical Methods (2 Credit Units)

Role of analytical chemistry in research and development and industry; Survey of analytical methods; Hierarchy of Analytical Methodology; Technique, Method and Procedure; Method's sensitivity, selectivity and detection limits; Criteria for the selection of an analytical technique or method; Analytical methods evaluation and validation.

CHM 913:Environmental Pollution and Toxicology(3 Credit Units)

The concept of environmental contamination/pollution; classification of pollution.Types and sources of pollutants; Eco-toxicity of pollutants; Bioconcentration, biomagnifications, ecological consequences of Manifestations of toxicity: 177quilibrium177, 177quilibrium177on177 teratogenicity; Toxicity testing: LD_{50}, LC50, ED_{50}, etc.; Acceptable Daily Intake and Acceptable Daily Exposure (ADI/ADE); Toxicity of organic pollutants: Chlorinated hydrocarbons, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), pesticides, trihalomethanes (THMs).

CHM 914: Advancesin Classical Methods of Analysis (2 Credit Units)

State-of-the-art developments in qualitative and titrimetric techniques of analysis and how they have been applied in various facets of science for rapid determinations.

CHM 915: Environmental Modeling(2 Credit Units)

Modeling to predict the pathways of contaminant, transport and dissipation in environmental media; Risk assessment models; Modeling rates of soil chemical processes; Validation of existing models in the Nigerian environment, with a view to modifying them, where necessary.

CHM 916: Chemical Fate and Transport in the Environment (2 Credit Units)

Survey of Xenochemicals and their spatial distribution **in** the environment; Physico-chemical properties of environmental contaminants; Dynamics of contaminants in air, soil and water including inter-media transfer and multiphase splitting, volatilization, sorption, ion exchange, leaching, bioaccumulation, abiotic and biotransformation; bioavailability; speciation etc.; Factors responsible for persistence of xenochemicals in environmental media; (Photo)oxidation and reduction, hydrolysis and microbial degradation of contaminants in soil, water and sediment; Mass balance and Kinetics of contaminant persistence and dissipation processes.

CHM 917: Environmental Inorganic Chemistry (2 Credit Units)

Organometallics in the environment (e.g. Biomethylation of mercury, tin and lead; alkyl- and aryl tin and lead etc.).Environmental fate of organometallic compounds.Metal complexation with organic contaminants in soil and water in situ; Organic contaminants-aided lability of inorganic (metallic ions) contaminants, etc.; Atmospheric water complexes, etc.

CHM 918: Advanced Mineral Metabolism (2 Credit Units)

The role of inorganic elements in living systems.Metabolism of individual inorganic elements.Metalloproteinase and other metallocompounds in living systems Interaction of inorganic

elements.Inorganic elements deficiency symptoms and diagnostic and therapeutic importance of inorganic elements. Recent advances in the studies of metabolism of inorganic elements and future trends.

CHM 919: Advances in Organic Chemistry (2 Credit Units)
Advances in C-C bond, C-Heteroatom bond formation, Retrosynthetic analysis and selected total synthesis, Biomolecules and biological activity determination. Linear free energy relationship, Kinetic and non-kinetic methods of determining reaction mechanisms.

CHM 920: Food Processing, Preservation and Packaging (2 Credit Units)
Broad review of food processing and preservation techniques – dehydration, canning, freezing, fermentation, irradiation, Modified Atmosphere Storage (MAS), conventional drying, special drying techniques (freeze – drying, foam mat drying, osmotic dehydration).Use of high and low temperatures, fermentation, use of food additives.Functions and types of packaging materials, Packaging requirements for raw and processed foods.

CHM 921: Food Chemistry and Toxicology (2 Credit Units)
Food composition (nutrients and non – nutrients constituents), overview of the chemical, physical and biological properties of food components (protein, carbohydrate, fat, water, minerals, vitamins and pigments). Theoretical and applied concepts of the effects of handling, processing and storage on food components and nutrients. Evaluation of methods used to determine safety of economically important chemicals used in food preservation. Nature and occurrence of toxins in food.Detoxification of foods.Food colour, 179quili and texture.

CHM 922: Recent Advances in Applied Spectroscopy (2 Credit Units)

Introduction and applications of techniques such as COSY, HSQC, HMBC, NOESY, ROSEY, LCMS, HRMS, TGA, SEM, XRF, XRD, TEM in separation and structural elucidation problems shall be treated.

CHM 923: Food Analysis and Instrumental Techniques (2 Credit Units)

Sampling and sample preparation; physical, chemical and biological techniques in food analysis: Proximate analysis, densimetry, spectroscopy, rheometry, microscopy, refractometry, polarimetry, chromatography, NMR, enzymatic and immunological assay and sensory evaluation methods.

CHM 924: Selected Topics in Inorganic Chemistry (2 Credit Units)

Cluster compounds; boranes, metalloboranes, carboboranes. Compound with metal-metal multiple bonds, chemistry of silicates, metalloligands, sandwich compounds, scaffolds.

CHM 925: Food Biotechnology (2 Credit Units)

Fermented foods of tropical and temperate countries, oriental fermented foods. Production of: vitamins, amino acids, lactic acid, polysaccharides, polyhydroxyl alcohols, vinegar, beer and wine by fermentation. Diagnostic biotechnology and food safety.Microbial protein enrichment of carbohydrate foods.

CHM 926: Advanced Nuclear Chemistry (2 Credit Units)

Basic properties of nuclei; Nuclear constituents; Stable nuclei; Nuclear binding energies; Nuclear size; Saturation of nuclear forces; Electrical and magnetic properties of the nuclei; The two nucleon system; The square well potential; Neutron-proton scattering; The liquid drop and nuclear shell models for the structure of the nuclei; Radio-active decay and nuclear reaction; Applicability of 1^{st} order law to radio-decay

reactions; Elementary nuclear particles and their interactions; Invariance principles and conservation laws.

CHM 927: Food, Drugs and Pharmaceutical Analysis (2 Credit Units)

Food and drugs Act. Food analysis: Chemical, Physical, Microbiological, Separation techniques. Preservatives and additives; Determination of drugs by chromatography and spectroscopic methods; Pharmaceutical analysis: Monographs and pharmacopoeia techniques; Good laboratory (GLP) and good manufacturing (GMP) practices.

CHM 928: Bio-Inorganic Chemistry (2 Credit Units)

Enzymes: Chemical and physical properties; catalysis and kinetics. Essential trace elements in biological systems; Metal chelates and their importance in biology; Oxygen carriers and transfer of phosphates in biological systems; Electron transfer agents in the respiratory system; Iron-sulphur protein; Recent studies in bio-inorganic chemistry.

HM 929: Advances in Inorganic Chemistry (2 Credit Units)

Chirality in transition metal Chemistry, Bio-organometallic Chemistry, Synthesis, Processing and characterization of new catalytic agents Inorganic polymers, Structure and thermodynamics of halides and oxides.

CHM 930: Heterocyclic Chemistry (2 Credit Units)

Structure, reactivity and synthesis of the following heterocyclics; furacin, Porphyrin, Biotin, tryptophan, Pyridine and derivatives (e.g nicotinic acid) benzopyrrole, benzofuran and benzothiophene rings, fused ring systems involving purines, pteridines, (folic acid, vitamin B_2), quinolines, Isoquinolines and isoindoles. Heterocyclic compounds of pharmaceutical interest: Morphine, Acridine, Reserpine, Triazines.

CHM 931: Advanced Chemical Kinetics (2 Credit Units)
The mechanism and rates of elementary processes in the gas-phase and in solution. Reactions at interfaces and fast reactions; Heterogeneous catalysis and surface reactions; Molecular dynamics and other theories of reaction rates outside the equilibrium hypothesis: survey of experimental results and other topics of current interest.

CHM 932: Industrial Organic Chemistry (2 Credit Units)
Basic organic reactions of industrial interest: Petrochemicals; Agricultural chemicals; (pesticides, herbicides, fertilizers, Nitrogen Fixation). Polymer Products (Synthetic fibres, nylon; polyesters, foams; pyrotechnics and explosives). Process development and design; Pilot plants design. Patents of raw materials; Flavourings and other food additives; Surfactants. Economics of production.

CHM 933: Advances in Coordination Chemistry (2 Credit Units)
A review of group theory and applications in atomic and molecular structure, molecular vibrations, spectroscopic selection rules and chemical reactivity.Ligand field theory (LFT), MOT, VBT.Chemical rearrangement of complexes having coordination number up to 9.Applications of these concepts to contemporary problems in Inorganic Chemistry.

CHM 934: Atomic and Molecular Spectroscopy (3 Credit Units)
Time – dependent states: time-dependent perturbation theory, absorption and emission of radiation, selection rules, line shapes and widths, band contours, lasers. Vibration and rotation of molecules; harmonicity, vibration-rotation, interaction and centrifugal distortion, potential energy functions, nuclear spins and Pauli Principle; the Raman effect; degenerate and near-degenerate levels; cryscopy. Advanced study of the following topics: Molecular symmetry and group theory, Photoelectron spectroscopy; Electronic absorption spectroscopy;

Vibrations and rotational spectroscopy; Nuclear magnetic resonance spectroscopy; Mass spectroscopy.

CHM 935: Spectroscopic Techniques in Inorganic Chemistry (3 Credit Units)

Molecular and Group Theory; Advanced study of the following topics: Photoelectron Spectroscopy, Electron Absorption Spectroscopy, Vibrational and Rotational Spectroscopy, Electron Paramagnetic Resonance Spectroscopy, Nuclear Quadruple Resonance Spectroscopy, Mossbauer Spectroscopy, Raman Spectroscopy, Mass Spectroscopy; Theory of molecular crystal, x-ray and crystal structure, solid states, semi-empirical orbital calculations.

CHM 936: Statistical Thermodynamics (2 Credit Units)

Definition of partition functions, translational, rotational, vibrational and electronic partition functions and their calculations and applications to thermodynamics problems, application of spectroscopic measurements to thermodynamic properties of matter.

CHM 937: Inorganic Reaction Mechanism (2 Credit Units)

Mechanism of electron transfer reactions and synthesis of coordination compounds; Substitution reactions for octahedral and square – planar coordination compounds; Molecular rearrangements; Photo-chemical reactions with special emphasis on metal complexes; Reactions at groups attached to central atom through co-ionic bonds; Synthesis of coordination ligands and Macrocyclic ligands; Theories and experimental techniques, role of solvent and catalyst, reactions involving solids, gas-phase reactions, isotopic exchange reactions.

CHM 938: Polymer Processing (2 Credit Units)

Introduction to polymer processing, chronological development of polymer technology, additives in polymers, compounding – virgin resins, thermoplastics and thermosetting.Extrusion, extruders, classes of

extruder, extruder screws, characteristics of a screw, barrel heaters, injection moulding, types of injection moulding, advantages and disadvantages of each type. Blow moulding-historical development, types of processes used for blow moulding – reciprocating screw injection blow moulding and extrusion blow mounding, articles produced from each process. Compression moulding – historical development, rotational moulding, film casting, calendaring, thermoforming, foaming, reinforcing, reinforcing techniques – the hand lay-up technique, the filament winding technique and the sporay-up technique and other techniques. Coating, spinning – melt, dry and wet spinning.

CHM 939: Process Metallurgy (2 Credit Units)

Principles of extraction metallurgy; Extraction methods; Treatment of ores; particle Crushing, grinding, classification and concentration; Pyrohydrometallurgy and electrometallurgy as applied to iron, steel, zinc, tin, copper, aluminium and uranium

CHM 940: Polymer Degradation and Stabilization (3 Credit Units)

Brief review of the classes of polymers, bonding in polymers, structure-property relationships in polymers.Factors that affect polymer stabilities.Degradation influences:- Mechanisms of mechanical, physical/thermal/flame, photolysis or UV, high energy radiations such as α, β, γand (X-ray), chemical viz. oxidation/reduction, hydrolysis, aminolysis, acidolysis., alcoholysis, biochemical or enzymic. Polymer stabilization – mechanisms of the actions of fillers, plasticizers,UV-filters, free radical scavengers (hindered alcohols), flame-retardancy preparation of special polymers – Novolacs, Resols,Aramids, FR –polymers, etc.

CHM 941: Reaction Mechanism and Stereochemistry
(2 Credit Units)

Advanced Stereochemistry and Asymmetric synthesis, a survey of representative groups of widely used synthetic reactions; emphasis on scope, limitations, and stereochemical consequences, Reactive intermediates and Rearrangement reactions.

CHM 942: Advanced Vitaminology (2 Credit Units)

The Chemistry and functions of vitamins, the co-enzyme role of some vitamins, synthetic vitamins.The mechanism of action of vitamins as co-enzymes. Bioavailability of vitamins. Toxicity of vitamins, therapeutic uses of vitamins. Recent advances in vitamin research and future trends

CHM 943: Natural Products Chemistry (2 Credit Units)

Review of methods of trends in isolation and structural determination of major groups of secondary metabolites of natural origin i.e terpenes, steroids, alkaloids, flavonoids and phenolic compounds. Macromolecules i.e protein, peptides, fats, carbohydrates and Nucleic acids. Biosynthesis and elucidation of biosynthetic pathways of the above natural products; Modern trends in Medicinal and industrial applications of natural products.

CHM 945: Organic Photochemistry (2 Credit Units)

Energy and electromagnetic radiation; Electronic vibrational and rotational energy of molecules; Molecular orbitals; Adsorption spectroscopy selection rules; Franck Gordon principles; Fluorescence; Phosphorescence; Joblonski diagram; Lasers and Masins; Photo-chemical energy conversions; Laws of Photochemistry of alkenes, aldehydes and ketones; Di-methane rearrangements; Woodward Hofmann Rules; Molecular rearrangements; Sensitization and quenching of photochemical systems' Industrial and biological photo-chemical processes.

CHM 947: Carbohydrates and Nucleic Acids (2 Credit Units)
Monosaccharides and disaccharides; Structure, reactions and biosynthesis.uses of Deoxysugars, oxosugar, amino-sugars, sugar epoxides and antibiotics having these sugar moieties.Polysaccharides, starch (glycogen) and cellulose and their biosynthesis.Structure and synthesis of nucleosides, nucleotides and oligonucleotides.Biosynthesis of nucleic acids and Proteins.Concept of genes and genetic engineering.

CHM 949: Advanced Chemical Thermodynamic (2 Credit Units)
Advanced discussion of the development of thermodynamic function (based on the 3 main laws) which describe chemical systems in equilibrium; Irreversible processes near equilibrium; Non-isothermal systems and steady states (examples will be taken from recent literature); Definition of partition functions; Transitional, rotational, vibrational and electronic partition problems; application of spectroscopic measurements to thermodynamic properties of matter.

CHM 951: Advanced Quantum Chemistry (2 Credit Units)
Fundamentals of quantum mechanics; Approximate methods of solution of Schrodinger's equation; Valency theory; Molecular orbital methods; Semi-empirical molecular orbital calculations; Valence bond methods; Group theory and its applications to chemical problem; Quantum theory of angular momentum; Advanced molecular quantum mechanics; The horontz transformation; The Klein-Gordon equation; The Dirac equation; Quantum electro-dynamics.
Prediction of molecular structure, molecular spectra and molecular reaction mechanisms using ab initio and semi-empirical methods.

CHM 953: Colloids and Surface Chemistry (2 Credit Units)
Dispersion system; Aerosols, lyosols (Lyophillic and hyophobic Sols); Optical and electrical properties of sols; Emulsions; Surface chemistry

(absorption); Inorganic and Organic macro-molecules; Thermoplastic; thermoset and their mechanical properties;Naturally occurring polymers and biological systems; Catalytic 187quilibrium187on and configuration; practical importance of colloids and Nanoparticle technology

CHM 955: The Chemistry and Technology of Fibre, Textiles and Leather (2 Credit Units)

Fibres:-Classification of fibres into natural, synthetic and artificial-cellulosic fibers, e.g. cotton, jute, ramie, hemp, sisal, kapok, kenerf, flax, etc and their special characteristics. Protein fibres (e.g. silk, wools, angora, mohair, etc) and their characteristics, Inorganic fibers, viz, glass asbestos, and their characteristics. Synthetic tibres, viz nylons, pps, carbon fibers carbon fibers etc. Fibre-structure-property relationships, artificial fibres such as rayons, cuprammon, dicell, soya/groundnut milk fibres. The chemical synthesis of artificial fibres and preparation of artificial fibres.

Textiles: Methods of converting fibres to yarns and to fabrics – classes of fabrics, spinning operation, textiles finishing – physical (e.g. calendaring, singeing, beetling shneidering ironing etc), chemical (eg. Scouring bleaching, mercerizalion, sanforization**,** dyeing, optical whitening, crease-resist treatment, flame – retardancy antistatic, artimildew etc).The textile industry.

Leather; Brief Protein Chemistry, the animal skin pre-tannage processes of flaying, curing (drying, salting, brining) dehairing, soaking, pickling/pulping /bating paraffin degreasing,skinning. Tannage processes – tanning materials viz vegetable, chrome, zircon, alum, syntan, oil etc. Tannins bearing plants – world wide distribution, extraction of tannins, brief account.The Chemistry of the tannins. Vegetable tanning processes, inorganic tanning processes, post tannage

processes. The leather industry in Nigeria.International commerce in hides and skins and leather goods.

CHM 957: Polymerization Methods and Structural Characterization (3 Credit Units)

Synthesis and structure of Polymers-Biosynthesis of natural polymers, Cossee-Arlman mechanism of Ziegler-Nalta vinyl Polymerization, plasma Polymerization, template Polymerization, Computational techniques in polymer structures and properties, Bernoullion first and second order and Markovian statistical model in polymer tacticities, molecular dynamics of Polymer chains

Kinetics and mechanism of polymerization processes- condensation and ring opening Polymerization reactions, cationic, anionic and co-ordination Polymerization.

Physical Chemistry of Polymers – Structures and properties of bulk polymers, solution properties of Polymers, rheology of polymers.

Analytical Chemistry of Polymers – Thermal analysis of Polymers, light scattering, NMR, X-ray, gel permeation chromatography, FTIR etc.

CHM 959: Polysaccharides Gums, Polypeptides andProteins (2 Credit Units)

General introduction to macromolecules, Interaction between polymers and solvent; structures and technology of dairy products; Milk – hydrocolloid interaction; gel formation: Theory of visco-elasticity; Classification, synthesis, general properties and structure of polypeptides and proteins.

CHM 960: Thesis (30 Credit Units)

Candidates are required to carry out a detailed and original research in their areas of specialization under their supervisors, and to present analysis of their results and research data embodied in a thesis. As part of their preparation for the thesis, candidates shall be required to give three seminars comprising of proposal, progress and results based seminars.

CHM 961: Electronics and Automation in Chemical Analysis (2 Credit Units)

Components and circuits; Amplifiers; Non-linear circuits; Recorders, applications in analytical instrumentation; Microprocessors and their applications; Online and Laboratory systems; Continuous flow, discrete and centrifugal analysers; Computer control of instruments.

CHM 991: Seminar (1 Credit Unit)

Thought-provoking discourse on topical research issues of relevance to scientific, national and international interest selected from an area outside that of the student's thesis research must be formulated and defended in the semester following end of course work.

List of Staff

S/N	Name	Qualification	Status	Rank	Area of Specialization
1	Ogbene Gillian Igbum	B.Sc- BSU-1998 M.Sc- Manchester-2004 Ph.D –Nsukka-2013	Tenure	Associate Professor & HOD	Polymer Chemistry/Bio-fuel
2	Patrice Anthony Okoye	B.Ed.- Benin-1982 M.Sc-Benin-1987 Ph.D -Nnamdi Azikiwe- 2000	Visiting	Professor	Analytical/Environmental Chemistry

3	Casmir Emmanuel Gimba	B.Sc,- Zaria – 1983 M.Sc,- Zaria - 1988 PhD – Zaria - 2001	Visiting	Professor	Analytical Inorganic
4	Raymond Ahulle Wuana	B.Sc,- BSU – 1998 M.Sc,- Benin - 2004 PhD – Benin - 2010	Visiting	Professor	Analytical/Environmental Chemistry
5	Simon Terver Ubwa	B.Sc -Calabar -1991 M.Sc- Ibadan -1997 PhD- Nsukka-2011	Tenure	Associate Professor	Food and Environmental Organic Chemistry
6	Godwin Oche Obochi	B. Sc. –UAM- 2002 M.Sc. –Calabar- 2007 Ph.D Calabar- 2014	Tenure	Associate Professor	Biochemistry
7	Sule Philips Ivoms Ogah	B. Sc. Maiduguri -1992 M.Sc. Maiduguri-1998 Ph.D Maiduguri- 2013	Part Time	Senior Lecturer	Analytical Chemistry
8	Michael Imande	B.Sc –Jos -1987 M.Sc-Ibadan- 1994 Ph.D –Ibadan 2012	Tenure	Associate Professor	Multilevel Modeling, Mixed Models and Econometrics
9	Itodo Udoji Adams	B. Sc. Sokoto 2002 M.Sc. Sokoto 2006 Ph.D Zaria 2011	Part-Time	Senior Lecturer	Analytical Chemistry
10	Sylvester Obaike Adejoh	B.Sc- Jos-1980 M.Sc –Jos-1995 PhD- Jos-2015	Tenure	Senior Lecturer	Physical Chemistry
11	Benjamin Asen Anhwange	B.Sc- Zaria-1992 M.Sc- Zaria- 2005 PhD- Zaria-2014	Tenure	Senior Lecturer	Analytical Chemistry
12	Samuel Peter Malu	B. Sc. 1993- Zaria M.Sc. 2007 –Zaria Ph.D 2015-Zaria	Part-Time	Senior Lecturer	Analytical/Industrial Chemistry/Environmental Chemistry and Toxicology

13	Vitus Eze Agbazue	B.Sc -1978- Nsukka M.Sc Nsukka-1990 Ph.D Nsukka-2005-	Sabatical	Senior Lecturer	Pure and Industrial Chemistry
14	Peter Agorye Adie	B.Sc- Calabar-1991 M.Sc- Calabar -2004 PhD –Calabar-2010	Tenure	Senior Lecturer	Analytical/Environmental Chemistry
15	Rose Erdoo Ikyereve	B.Sc- (BSU)-2000 M.Sc- Wolver Hampton, UK-2007 PhD- Loughborough, UK-2014	Tenure	Senior Lecturer	Environmental Chemistry
16	Leke Luter	B.Sc- Jos-2002 M.Sc- Ibadan-2006 PhD -Aberdeen, UK-2015	Tenure	Senior Lecturer	Industrial Chemistry

CHAPTER THREE
DEPARTMENT OF ECONOMICS

MASTER OF SCIENCE (M.SC) PROGRAMME IN FOOD ECONOMICS

INTRODUCTION

The Department of Economics is one of the pioneer departments of the University. For many years it has graduated very high quality B.Sc, MSc and PhD students. In line with its desire to continually contribute to the academic development of the university, the department is mounting a Master of Science (MSc) in Food Economics to be hosted by the Centre for Food Technology and Research (CEFTER), African Centre of Excellence (ACE) for Control of Post-Harvest Losses.

PHILOSOPHY

The philosophy underlying the Master of Science (M.Sc) Food Economics programme at the Benue State University is to produce a steady flow of graduates who are well-grounded in food economics, economic theories and the methodology needed to analyse and proffer solutions to problems relating to agriculture and post-harvest losses at the local, national and global levels. Students will be equipped with the specialized knowledge of food economics so that they can contribute meaningfully to the Nigerian, African and World economy.

OBJECTIVES

The objectives of the course are to:

1) give graduates of M.Sc Food Economics advanced treatment and grasp of the economics of food production and selected applied areas of food economics to enhance their ability to make more efficient policy decisions related to control of post-harvest losses.
2) provide intellectual motivation for the academically-minded to pursue further studies in food economics;

3) contribute, through (1) and (2) above to the development of high-level manpower for Nigeria; and
4) contribute to the supply of trained food economists for the faculties of other universities in Nigeria.

ADMISSION REQUIREMENTS

1) Candidates must have the requisite matriculation requirements of 5 O' Level credits which must include English Language, Mathematics and Economics.
2) Candidates should hold at least a second class honours degree in Economics or Agricultural economics, from any approved university whose Programmes are accredited by the National Universities Commission and any other university recognised by the Senate of Benue State University; and
3) Candidates must have obtained a minimum of a second class lower degree and a CGPA of 3.00 on a five-point scale or 2.5 on a four-point scale.

DURATION

The minimum and maximum duration of the MSc programme is four (4) semesters and six (6) semesters respectively.

REQUIREMENTS FOR GRADUATION

The M. Sc. programme is by course work and examination but also includes a dissertation. To be awarded a Master of Science degree in Food Economics, a candidate must obtain a minimum of 41 credit units made up as follows:

i) Core courses of twenty seven (27) credit units
ii) Elective courses of at least four (4) credit units
iii) Dissertation of ten (10) credit units

EXAMINATION

a) The minimum pass mark shall be 50%. Continuous assessment shall constitute 40% of the examination of each course.

b) Any student who fails in any core course shall repeat the course only once.
c) Any student whose CGPA falls below 2.50 at the end of two consecutive semesters shall be advised to withdraw from the programme.

COURSES

First Semester

Core Courses		**Credit Units**
FEC 801	Advanced Microeconomic Theory	3
FEC 803	Research Methodology	3
FEC 805	Issues in Entrepreneurship	3
PHM 803	Post-harvest Handling of Crops	2
FPM 805	Food Preservation and Storage	3

Elective Courses (Candidates to take a minimum of two credit units)

FPM 803	Food Hygiene and Safety	2
FEC 809	Consumer Food Psychology	2
FEC 807	Economics of Food Production and Marketing	3
FEC 813	Global Trade in Food Products	2
PHP 809	Introduction to Losses Assessment	2

Second Semester

Core Courses		**Credit Units**
FEC 802	Advanced Macroeconomic Theory	3
FEC 804	Econometrics	3
FEC 806	Project Analysis and Evaluation	3
FEC 808	Food supply Chain Management	3
FEC 820	Seminar	1
FEC 822	Dissertation	10

Elective Courses (Candidates to take a minimum of two credit units)

FEC 810	Economics of Food Regulation and Legislation	2
FEC 812	Historical Perspectives of Food Supply	2

FEC 814	Development Economics	2
FPM 808	Food Packaging	2

Course Synopsis

FEC 801: Advanced Microeconomic Theory

Consumption and production choice theoretic structure; theory of the firm; linear programming and applications; theory of distribution; social welfare function; cost-benefit analysis; externalities; demand for and supply of factors of production; capital theory.

FEC 802: Advanced Macroeconomic Theory

Concepts of income and output; macroeconomic aggregates; consumption and investment functions; critical analysis of Keynesian, monetarist and post-Keynesian theories; the demand for and supply of money and their impact on the effectiveness of monetary and fiscal policies; inflation; growth theory; new dimensions of macroeconomic research to suit Nigerian conditions.

FEC 803: Research Methodology

Overview of economics methodology; economics or political economy; the meaning of and reason for methodology; the scientific status of Economics; positive and normative economics; the question of method; the positive economics method; the political economy method; the history of economics methodology; verificationism, falsificationism, etc, schools of thoughts and methods; economic theory and reality; the language of economic theorizing; the structure and testing of economic theory; methodological appraisal of economic theories; applied economics: the Job of the applied economist; the economist as adviser; research methods in applied economics; non-parametric statistical analysis; accuracy and error in applied economics; the crisis of modern economics: the crisis, explaining the crisis, towards resolving the crisis.

FEC 804: Econometrics

Philosophy and methodology of Economics; the role of econometrics in analysis; limits of econometrics as a tool of analysis; types of econometric models; economic data and analysis; types of econometric model;, types of economic data; time series plot, scatter diagram and

basic analysis of association between variables in a model; bivariate probability distributions and conventional models; the two-variable linear regression model; estimators, estimates and Inferential analysis; the Gauss-Markov Theorem; inferential analysis and hypothesis testing; predictions; other aspects of two-variable relationships, univariate time series analysis; concepts and uses of univariates; time series modeling; ARMA modeling, and ARMA processes and properties; testing for stationarity; the generalized linear equation model; matrix formulation and estimation; tests of significance and specification errors; multiple equation model, vector auto regressions; simultaneous equation models; panel data; sources and types of identification and estimations; pooled estimators; dynamic OLS; fully modified OLS; Logit/Probit/Tobit regression models; co-integration; Granger causality; computer applications of statistical packages – SPSS, E-Views, stata, and micro-fit.

FEC 805 Issues in Entrepreneurship

Meaning of and rationale for entrepreneurship; personal entrepreneurial characteristics; the business environment: classification, challenges and opportunities; the Nigerian entrepreneur: challenges, risks and opportunities; vocational skills development; starting a business project: concept, design, planning and implementation; conversion of ideas into business; validation of ideas; concept of market analysis; basic resources needed for business; raising finance for small businesses; management of working capital.

FEC 806: Project Analysis and Evaluation

Definition of a project; the project cycle; projects and economic development; outline of a feasibility report; national income accounting; project market analysis; conventional project market analysis; marketable and non-marketable goods; technical aspects of a project; environmental soundness; financial and commercial viability; objectives of projects; accounting conventions and financial statement, cash flow statement, financial ratios; appraisal of a project: economic and social; cost-benefit analysis; the valuation problem; the importance of proper project management and control; work stoppages; production

management and control; marketing policy and production control; risk, uncertainty and sensitivity analysis; institutional considerations.

FEC 807: Economics of Food Production and Marketing
The micro and macro determinants of food supply and demand; the interrelationship among food, income, population and public sector decision making. The role of agriculture in poverty alleviation, economic development and environmental outcomes. The role of marketing institutions in the modern agro-system; environmental and internal trends influencing agricultural marketing channels. The concept of Cooperative firms as an agricultural marketing institution. Other marketing institutions: Marketing boards, commodity boards, producer groups, auctions, futures markets, vertical marketing systems.

FEC 808: Food Supply Chain Management
Focus on the qualitative and quantitative analysis of food supply and effective management; analysis of micro and macro determinants of the supply chain; with further emphasis on efficiency and effectiveness of food supply chain. Organizing storage of goods. Warehousing, Logistics and supply chain management. Safety and security of the food supply chain.

FEC 809: Consumer Food Psychology
This course explores the principles of consumer psychology as they are applied to food; the social, ethical and moral values that influence our individual decision making with respect to food and explore the interrelationship between consumer food psychology and new product development and innovation. The course draws on a range of psychological theories most prevalent in consumer food psychology. Perceptions and attitudes, personality, learning, motivation and environmental influences; family and peer influences; cultural influences. Consumer decision process and food advertising.

FEC 810: Economics of Food Regulation and Legislation
Introduction to some basic legal concepts; the historical development of food law. Food safety and food information. Food safety at national and international level. Food labelling; general regulations, nutritional and

health claims. Quality, certifications and regulations for Genetically Modified Foods and organic Foods respectively. Geographical indications, trademarks and patents; standards and certifications.

FEC 812: Historical Perspectives of Food

Emphasis is laid on the historical trends and developments in Food and Food Supply for advanced and developing nations. Historical perspectives of technical change and innovation in the production of food. Historical review of policy interventions in food production and supply; market instruments, tariff and non- tariff barriers, measures of protection/ support.

FEC 813: Global Trade in Food Products

Price development and price context on food markets, international food marketing, grain markets, meat markets, markets for renewable resources. Evaluation of the determinants of global food trade. Constraints and available opportunities for developing countries. Preparing and presenting results of research on current issues of international food markets.

FEC 814: Development Economics

Historical, political and ideological context of contemporary discussions in economic development; emergence of modern development theory; review of theories of development, emphasizing the relevance of the various perspectives to LDC context: the classical, neo-classical, structuralist, Marxist/Dependency theory of underdevelopment; new political economy or *New Institutionalism*; issues in problems and policies of development; population and employment; science, engineering and technology (SET) and development; planning and financing development; the environment and development; economic and non-economic indicators of development; meaning, causes, effects and measure of the relative and absolute development gap between the rich and poor nations; the cultural and gender dimensions of development; globalization: meaning, causes and implications.

FEC 820: M. Sc. Seminar
Candidates will be required to present one seminar paper on a topic of their choice. Candidates will only be allowed to present seminar papers after having passed all prescribed courses.

FEC 822: M. Sc. Dissertation
Candidates will be required to prepare a dissertation on a topic of their choice, which must be related to food packaging, storage, preservation or post-harvest loss issues. The dissertation shall be subjected to oral examination by an External Examiner.

FPM 803: Food Hygiene and Safety
Identification of vulnerabilities to contamination along the food supply chain; Types of food contamination; food poisoning; food borne diseases; regulatory Toxicology; Chemical hazards in food.

FPM 805: Food Preservation and Storage
Aim of food preservation. Classification of food on the basis of perishability; factors that affect spoilage; principles of food preservation, compromise between food preservation techniques and nutrient retention. Methods of food preservation- Blanding, Pasteurization (HTST), Canning, food additions, control of water activity (solute preservation, drying); Low temperature preservation (freezing); Huda technology, Irradiation, Non-thermal food processing technologies, Shelf Life studies.

FPM 808: Food Packaging materials and Packaging Design
Types of packaging materials, Design of packaging materials to conform to desired functions of package. Factors to consider I the design of packages for various foods. Basic principles in Mass and Heat transfer in packages. Some recent innovations in the field of packaging-development of active and passive packaging' intelligent packaging' interactive packaging. Food packaging and product shelf life. Mathematical methods to predict shelf life of packed food via the use of chemical kinetics involving zero and first order reactions.

PHM 803: Post-Harvest Handling of Crops

Advanced Post Harvest technology. Causes of Post- harvest losses. Post -Harvest treatments to minimize Produce Contamination and Maximize quality. Crop processing. Post –Harvest storage pests and disease control measures.

PHP 809: Introduction to Losses Assessment

Definition of Post –Harvest physiology and Post –Harvest loss. The importance of the study of Post –Harvest physiology in food science. Estimates of Post –Harvest losses in developing nations.

Staff List

S/No	Name	Qualifications	Status	Present Rank	Area Of Specialization
1	P.T. Abachi	B.Sc., M.Sc., Ph.D. (ABU Zaria)	Full Time	Assoc. Prof.	Economic Theory
2	S.O. Ajegi	B.Sc. (ABU), M.Sc. (UNijos) Ph.D.BSU	Full Time	Assoc. Prof.	Development Economics
3	A. Ngutsav	B.Sc. (ABU), M.Sc. (Unijos), Ph.D.(BSU)	Full Time	Assoc. Prof.	Development Economics
4	I.J. Okpe	B.Sc. (BUK), M.Sc (ABU)., Ph.D.(BUK)	Full Time	Assoc. Prof.	Economic Theory
5	C.O. Obute	B.Sc., (Ibadan) PhD (Edingburgh)		Senior Lecturer	Monetary Economics
6	N.O. Doki	B.Sc., M.Sc., Ph.D. (BSU)	Full Time	Senior Lecturer	Development Economics/ Research Methods
7	J.Andohol	B.Sc. (UNN) M.Sc., Ph.D.BSU	Full Time	Senior Lecturer	Development Economics
8	G. Anjande	B.Sc. , M.Sc (Odessa,Ukraine	Full Time	Lecturer I	Mathematical Economics

		), Ph.D. (UNN)			
9	S.E. Akiri	B.Sc. , M.Sc. (Ife) , Ph.D.(UNN)	Full Time	Lecturer I	Development Economics
10	T.S. Asom	B.Sc. (ABU), MBA, PhD (BSU)	Full Time	Lecturer I	Finance
11	S.O. Ominyi	B.Sc. (Sokoto) M.Sc., Ph.D. (BSU)	Full Time	Lecturer I	Development Economics
12	D T Akighir	B.Sc., M.Sc., Ph.D.(BSU)	Full Time	Lecturer I	Quantitative Methods
13	D T Nomor	B.Sc., M.Sc., Ph.D.(BSU)	Full Time	Lecturer I	Development Economics
14	M. Ahemen	B.Sc., M.Sc., Ph.D.(BSU)	Full Time	Lecturer I	Rural Economics
15	O.G Igbum	B.Sc (BSU) MSc (Manchester) PhD (UNN)	Full Time	Assoc. prof	Polymer Chemistry/ Bio-fuel
16	S.T Ubwa	B.Sc (Calabar) MSc (Ibadan) PhD (UNN)	Full Time	Assoc. Prof	Food and Environmental Organic Chemistry
17	S.O Adejo	BSc, MSc PhD (Unijos)	Full Time	Senior Lecturer	Physical Chemistry
18	L. Luter	B.Sc (Unijos) MSc (Ibadan) PhD (Aberdeen)	Full Time	Lecturer I	Industrial Chemistry
19	B.A Atu	B.Sc.(Benin) M.Sc., PhD (ABU)	Full Time	Assoc. Prof	Environmental / Public Health/ Microbiology

DOCTOR OF PHILOSOPHY (PHD) PROGRAMME IN FOOD ECONOMICS

INTRODUCTION

The Department of Economics is one of the pioneer departments of the University. For many years it has graduated very high quality B.Sc, MSc and PhD students. In line with its desire to continually contribute to the academic development of the university, the department is mounting a Doctor of Philosophy (P.hD) Food Economics to be hosted by the Centre for Food Technology and Research (CEFTER), African Centre of Excellence (ACE) for Control of Post-Harvest Losses.

PHILOSOPHY

The philosophy underlying the Doctor of Philosophy (P.hD) Food Economics programme at the Benue State University is to produce a steady flow of graduates who are well-grounded in food economics, economic theories and the methodology needed to analyse and proffer solutions to problems relating to agriculture and post-harvest losses at the local, national and global. Students will be equipped with the specialized knowledge of food economics so that they can contribute meaningfully to the Nigerian, African and World economy.

OBJECTIVES

The objectives of the course are to:

1. give graduates of PhD Food Economics advanced treatments and grasp of the economics of food production and selected applied areas of food economics to enhance their ability to make more efficient policy decisions related to control of post-harvest losses.
2. provide intellectual motivation for the academically-minded to pursue further research and applications in food economics;
3. contribute, through (1) and (2) above to the development of high-level manpower for Nigeria; and
4. contribute to the supply of trained food economists for the faculties of other universities in Nigeria.

ADMISSION REQUIREMENTS

1. Candidates must have the requisite matriculation requirements of 5 O' Level credits which must include English Language, Mathematics and Economics.
2. Candidates should hold either a second class honours degree in Economics or Agricultural economics from any approved university whose Programmes are accredited by the National Universities Commission and any other university recognised by the Senate of Benue State University; and
3. Candidates must have obtained a minimum of a second class lower degree and a CGPA of 3.00 on a five-point scale or 2.5 on a four-point scale.
4. Candidates must have obtained an M.Sc. degree in Food Economics, or Agricultural Economics with a CGPA not less than 3.5
5. Submit a brief satisfactory statement of intended area of research.

DURATION

1) The minimum and maximum duration of the PhD programme is six (6) semesters and ten (10) semesters respectively
2) For an extension beyond the maximum period, permission of the Postgraduate School shall be required.

REQUIREMENTS FOR GRADUATION

The PhD programme is by course work and examination but also includes a thesis. To be awarded a Doctor of Philosophy degree in Food Economics, a candidate must pass a minimum of 61 credit units made up as follows:

1. Core courses of twenty seven (27) credit units
2. Elective courses of at least four (4) credit units
3. Thesis of thirty (30) credit units

EXAMINATION

a. The minimum pass mark shall be 50%. Continuous assessment shall constitute 40% of the examination of each course.
b. Any student who fails in any core course shall repeat the course only once.

c. Any student whose CGPA falls below 2.50 at the end of two consecutive semesters shall be advised to withdraw from the programme.

COURSES

First Semester

Core Courses		**Credit Units**
FEC 901	Advanced Microeconomic Theory	3
FEC 903	Research Methodology	3
FEC 905	Issues in Entrepreneurship	3
PHM 903	Post-harvest Handling of Crops	2
FPM 905	Food Preservation and Storage	3

Elective Courses (Candidates to take a minimum of two credit units)

FPM 903	Food Hygiene and Safety	2
FEC 909	Consumer Food Psychology	2
FEC 907	Economics of Food Production and Marketing	3
FEC 913	Global Trade in Food Products	2
PHP 909	Introduction to Losses Assessment	2

Second Semester

Core Courses		**Credit Units**
FEC 902	Advanced Macroeconomic Theory	3
FEC 904	Econometrics	3
FEC 906	Project Analysis and Evaluation	3
FEC 908	Food supply Chain Management	3
FEC 920	Seminar	1
FEC 922	Thesis	30

Elective Courses (Candidates to take a minimum of two credit units)

FEC 910	Economics of Food Regulation and Legislation	2
FEC 912	Historical Perspectives of Food Supply	2
FEC 914	Development Economics	2
FPM 908	Food Packaging	2

Course Synopsis

FEC 901: Advanced Microeconomic Theory
Game theory and economics of information; non-competitive models; employment and pricing of inputs; wages, rent, interest and profit; input market analysis; general equilibrium analysis and social optimality; public goods and externalities; welfare economics; the economics of private units under conditions of spatial, gender and class diversity.

FEC 902: Advanced Macroeconomic Theory
The demand for money: Fisher's transaction demand, Cambridge approach, Keynes' liquidity preference, neo-Keynesian analysis (e.g., Tobin's inventory theoretic and Baumol's liquidity preference as behaviour towards risk); estimating the demand for money; open economy macroeconomics: foreign exchange market, exchange rate regimes, balance of payments; macroeconomic policy in various contexts; macroeconomic themes: classical, Keynesian, neo-classical, neo-Keynesian, monetarist revolution and new classical economics/rational expectations; representative agent models, overlapping generation theory, search theory, and real business cycle models.

FEC 903: Research Methodology
Overview of economics methodology; economics or political economy; the meaning of and reason for methodology; the scientific status of Economics; positive and normative economics; the question of method; the positive economics method; the political economy method; the history of economics methodology; verificationism, falsificationism, etc, schools of thoughts and methods; economic theory and reality; the language of economic theorizing; the structure and testing of economic theory; methodological appraisal of economic theories; applied economics: the Job of the applied economist; the economist as adviser; research methods in applied economics; non-parametric statistical analysis; accuracy and error in applied economics; the crisis of modern economics: the crisis, explaining the crisis, towards resolving the crisis.

FEC 904: Econometrics

Philosophy and methodology of Economics; the role of econometrics in analysis; limits of econometrics as a tool of analysis; types of econometric models; economic data and analysis; types of econometric model;, types of economic data; time series plot, scatter diagram and basic analysis of association between variables in a model; bivariate probability distributions and conventional models; the two-variable linear regression model; estimators, estimates and Inferential analysis; the Gauss-Markov Theorem; inferential analysis and hypothesis testing; predictions; other aspects of two-variable relationships, univariate time series analysis; concepts and uses of univariates; time series modeling; ARMA modeling, and ARMA processes and properties; testing for stationarity; the generalized linear equation model; matrix formulation and estimation; tests of significance and specification errors; multiple equation model, vector auto regressions; simultaneous equation models; panel data; sources and types of identification and estimations; pooled estimators; dynamic OLS; fully modified OLS; Logit/Probit/Tobit regression models; co-integration; Granger causality; computer applications of statistical packages – SPSS, E-Views, stata, and micro-fit.

FEC 905 Issues in Entrepreneurship

Meaning of and rationale for entrepreneurship; personal entrepreneurial characteristics; the business environment: classification, challenges and opportunities; the Nigerian entrepreneur: challenges, risks and opportunities; vocational skills development; starting a business project: concept, design, planning and implementation; conversion of ideas into business; validation of ideas; concept of market analysis; basic resources needed for business; raising finance for small businesses; management of working capital.

FEC 906: Project Analysis and Evaluation

Definition of a project; the project cycle; projects and economic development; outline of a feasibility report; national income accounting; project market analysis; conventional project market analysis; marketable and non-marketable goods; technical aspects of a

project; environmental soundness; financial and commercial viability; objectives of projects; accounting conventions and financial statement, cash flow statement, financial ratios; appraisal of a project: economic and social; cost-benefit analysis; the valuation problem; the importance of proper project management and control; work stoppages; production management and control; marketing policy and production control; risk, uncertainty and sensitivity analysis; institutional considerations.

FEC 907: Economics of Food Production and Marketing

The micro and macro determinants of food supply and demand; the interrelationship among food, income, population and public sector decision making. The role of agriculture in poverty alleviation, economic development and environmental outcomes. The role of marketing institutions in the modern agro-system; environmental and internal trends influencing agricultural marketing channels. The concept of Cooperative firms as an agricultural marketing institution. Other marketing institutions: Marketing boards, commodity boards, producer groups, auctions, futures markets, vertical marketing systems.

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Focus on the qualitative and quantitative analysis of food supply and effective management; analysis of micro and macro determinants of the supply chain; with further emphasis on efficiency and effectiveness of food supply chain. Organizing storage of goods. Warehousing, Logistics and supply chain management. Safety and security of the food supply chain.

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Introduction to some basic legal concepts; the historical development of food law. Food safety and food information. Food safety at national and international level. Food labelling; general regulations, nutritional and health claims. Quality, certifications and regulations for Genetically Modified Foods and organic Foods respectively. Geographical indications, trademarks and patents; standards and certifications.

FEC 912: Historical Perspectives of Food
Emphasis is laid on the historical trends and developments in Food and Food Supply for advanced and developing nations. Historical perspectives of technical change and innovation in the production of food. Historical review of policy interventions in food production and supply; market instruments, tariff and non- tariff barriers, measures of protection/ support.

FEC 913: Global Trade in Food Products
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FEC 914: Development Economics
Historical, political and ideological context of contemporary discussions in economic development; emergence of modern development theory; review of theories of development, emphasizing the relevance of the various perspectives to LDC context: the classical, neo-classical, structuralist, Marxist/Dependency theory of underdevelopment; new political economy or *New Institutionalism*; issues in problems and policies of development; population and employment; science, engineering and technology (SET) and development; planning and financing development; the environment and development; economic and non-economic indicators of development; meaning, causes, effects and measure of the relative and

absolute development gap between the rich and poor nations; the cultural and gender dimensions of development; globalization: meaning, causes and implications.

FEC 920: PhD Seminar
Candidates will be required to present two seminar papers on a topic of their choice related to the control of post-harvest losses. Candidates will only be allowed to present seminar papers after having passed all prescribed courses.

FEC 922: PhD Thesis
Each candidate shall submit five bound copies of a supervised thesis as the final requirement for the award of the PhD degree. The supervised thesis must be based on original research which must be successfully defended before an appropriate panel of examiners. The theme of the thesis must be related to food packaging, processing and control of post-harvest losses. The thesis must represent a specific original contribution to economic knowledge. Prior to submission, each PhD student must give at least two seminars.

FPM 903: Food Hygiene and Safety
Identification of vulnerabilities to contamination along the food supply chain; Types of food contamination; food poisoning; food borne diseases; regulatory Toxicology; Chemical hazards in food.

FPM 905: Food Preservation and Storage
Aim of food preservation. Classification of food on the basis of perishability; factors that affect spoilage; principles of food preservation, compromise between food preservation techniques and nutrient retention. Methods of food preservation- Blanding, Pasteurization (HTST), Canning, food additions, control of water activity (solute preservation, drying); Low temperature preservation (freezing); Huda technology, Irradiation, Non-thermal food processing technologies, Shelf Life studies.

FPM 908: Food Packaging materials and Packaging Design
Types of packaging materials, Design of packaging materials to conform to desired functions of package. Factors to consider I the

design of packages for various foods. Basic principles in Mass and Heat transfer in packages. Some recent innovations in the field of packaging-development of active and passive packaging' intelligent packaging' interactive packaging. Food packaging and product shelf life. Mathematical methods to predict shelf life of packed food via the use of chemical kinetics involving zero and first order reactions.

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S/No	Name	Qualifications	Status	Present Rank	Area Of Specialization
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2	S.O. Ajegi	B.Sc. (ABU), M.Sc. (UNijos) Ph.D.BSU	Full Time	Assoc. Prof.	Development Economics
3	A. Ngutsav	B.Sc. (ABU), M.Sc. (Unijos), Ph.D.(BSU)	Full Time	Assoc. Prof.	Development Economics
4	I.J. Okpe	B.Sc. (BUK), M.Sc (ABU)., Ph.D.(BUK)	Full Time	Assoc. Prof.	Economic Theory
5	C.O. Obute	B.Sc., (Ibadan) PhD (Edingburgh)	Full Time	Senior Lecturer	Monetary Economics
6	N.O. Doki	B.Sc., M.Sc., Ph.D. (BSU)	Full Time	Senior Lecturer	Development Economics/ Research

					Methods
7	J.Andohol	B.Sc. (UNN) M.Sc., Ph.D.BSU	Full Time	Senior Lecturer	Development Economics
8	G. Anjande	B.Sc. , M.Sc (Odessa,Ukraine) , Ph.D. (UNN)	Full Time	Lecturer I	Mathematical Economics
9	S.E. Akiri	B.Sc. , M.Sc. (Ife) , Ph.D.(UNN)	Full Time	Lecturer I	Development Economics
10	T.S. Asom	B.Sc. (ABU), MBA, PhD (BSU)	Full Time	Lecturer I	Finance
11	S.O. Ominyi	B.Sc. (Sokoto) M.Sc., Ph.D. (BSU)	Full Time	Lecturer I	Development Economics
12	D T Akighir	B.Sc., M.Sc., Ph.D.(BSU)	Full Time	Lecturer I	Quantitative Methods
13	D T Nomor	B.Sc., M.Sc., Ph.D.(BSU)	Full Time	Lecturer I	Development Economics
14	M. Ahemen	B.Sc., M.Sc., Ph.D.(BSU)	Full Time	Lecturer I	Rural Economics
15	O.G Igbum	B.Sc (BSU) MSc (Manchester) PhD (UNN)	Full Time	Assoc. prof	Polymer Chemistry/ Bio-fuel
16	S.T Ubwa	B.Sc (Calabar) MSc (Ibadan) PhD (UNN)	Full Time	Assoc. Prof	Food and Environmental Organic Chemistry
17	S.O Adejo	BSc, MSc PhD (Unijos)	Full Time	Senior Lecturer	Physical Chemistry
18	L. Luter	B.Sc (Unijos) MSc (Ibadan) PhD (Aberdeen)	Full Time	Lecturer I	Industrial Chemistry
19	B.A Atu	B.Sc.(Benin) M.Sc., PhD (ABU)	Full Time	Assoc. Prof	Environmental / Public Health/ Microbiology

CHAPTER FOUR
DPARTMENT OF MATHEMATICS AND COMPUTER

M.SC BIOSTATISTICS PROGRAMME FOR THE CONTROL OF POST-HARVEST LOSSES

PHILOSOPHY

The M.Sc Biostatistics programme aims at producing graduates with advanced knowledge and skills in statistical theory and methodology that makes them proficient in data management, data analysis, quality control and assurance techniques. It is also to enable efficient deployment of appropriate statistical computing skills that are, particularly, relevant for Research Institutes, Pharmaceutical industries, Health, Chemical, Manufacturing, food processing, food preservation and other Agricultural industries.

RATIONALE

The M.Sc Biostatistics programme for the control of Post-harvest losses is anchored on imparting specialized statistical skills that are not just theoretically sound but particularly tailored to be applied in the most appropriate manner towards appraising the efficacy of the deployed technologies that would be employed to control post-harvest losses. Techniques of quality assurance, time series analysis and econometric modeling (among others) as applied to quantitative and qualitative data emanating from pre-planting, planting, harvest and distribution of the various agricultural products. These will instill the appropriate skills and expertise needed to assist all stakeholders associated with production, consumption and distribution of all food and agricultural products of prime global economic interest particularly as commonly found in west and central African sub-regions.

OBJECTIVES

The objectives of M.Sc. Biostatistics programme are:

(i) To provide sound statistical knowledge and skills that will enthuse competence in the recognition, collection, analysis and interpretation of agricultural or food-based data.

(ii) To produce statisticians that are highly knowledgeable and proficient in deploying efficient services for the analysis and interpretation of data associated with food processing, food preservation and food storage based on statistical quality control/assurance techniques.

(iii) To broaden understanding and enhance skill in application of statistical methodologies to address challenges in Epidemiology, Agriculture, Pharmacy, Biology, Chemistry and product quality control/assurance

(iv) To produce well-equipped food quality control professionals required at the universities and other institutions of higher learning

(v) To prepare students for a Doctoral programme in Statistics and related fields

(vi) To prepare students for teaching statistics in colleges and institutions of higher learning as well as take up jobs related to statistics in industry, government and organizations/companies at national and international levels.

ADMISSION REQUIREMENTS

(i) Admission shall be opened to holders of B.Sc.(Hons) degree in Mathematics or Statistics and Health or Biological/Agricultural

Science from Benue State University or any other recognized University with a minimum of second class lower division. However preference shall be given to those candidates that have a second class upper division, and above.

(ii) Holders of Post Graduate Diploma in Statistics or Mathematics with a minimum CGPA of 3.00 will also be eligible for admission.

(iii) In addition to (i) and (ii) a candidate seeking admission into the programme must have O'level credit passes in Mathematics, English language and any other three science (or social science) subjects.

RESIDENCY/DURATION OF PROGRAMME

Candidates admitted to pursue the programme on a full-time basis shall spend a minimum of three semesters and a maximum of six from the date of registration. The first two semesters will be devoted to course work whilst the remaining semesters for the research work, dissertation writing, seminar presentation and oral defence. An extension up to a maximum of two semesters shall be granted where the need arises.

GRADUATION REQUIREMENTS

To qualify for the award of the M.Sc. degree in Biostatistics, the candidate must have fulfilled the following requirements:

(i) Candidates must have duly registered for each semester and paid all the prescribed fees.

(ii) Candidates must have registered for a minimum of 52 credit units and passed all the prescribed core courses and earned a minimum of 46 credit units including core courses, seminar and

dissertation before graduation. Candidates shall be required to achieve a minimum grade of "C" in each course unit in order to pass the course work.

(iii) Candidates must obtain a cumulative grade point average (CGPA) of 3.0 or above in order to graduate

(iv) Candidates must have submitted a dissertation not exceeding 30,000 words in length. Candidates must successfully defend the dissertation at an oral examination. The topic of the dissertation must be in the area of Statistics and must be chosen in consultation with the candidates' supervisors.

(v) Candidates must have attended 75% of all lectures and must be present at all departmental workshops and seminars.

(vi) The award of the M.Sc. degree in Biostatistics shall further be governed by regulations guiding similar programmes prescribed from time to time by the University Postgraduate School.

GRADING SYSTEM

The grading system at the Postgraduate level shall be as reflected in the table below:

LETTER GRADE	**MARKS**	**GRADE POINT**	**REMARKS**
A	70 & above	5	Pass
B	60 - 69	4	Pass
C	50 - 59	3	Pass
D	40 - 49	2	Fail
E	30 - 39	1	Fail
F	0 - 29	0	Fail

Continuous assessment shall constitute 30% minimum and 50% maximum of total marks for any given course and the end of examination shall carry between 50% and 70% of total marks.

There shall be NO Resit Examination

COURSE STRUCTURE FOR M.SC. BIOSTATISTICS

FIRST YEAR

FIRST SEMESTER CORE COURSES

S/No	Course Code	Course Title	Credit Units
1	BST801	Probability and Distribution Theory	3
2	BST803	Design and Analysis of Experiments	3
3	BST805	Statistical Genetics and Ecology	3
4	BST807	Statistical Quality Control I	3
5	BST809	Management and Entrepreneurship	2
6	BST811	Statistical Data Analysis Using Microsoft Excel and BASE SAS	3
		Total	**17**

FIRST SEMESTER ELECTIVE COURSES

S/No	Course Code	Course Title	Credit Units
1	BST827	Sample Survey Methods	3
2	BST851	Computer Programming in C++ and SAS	3
3	BST875	Bayesian Theory and Decision Methods	3
4	BST887	Demography and Health Data Management	3
		Total	**12**

Students must register all core courses and a minimum of 3 credit units of the elective courses

SECOND SEMESTER CORE COURSES

S/No	Course Code	Course Title	Credit Units
1	BST802	Statistical Estimation: Theory and Practice	3
2	BST814	Basic Epidemiology and Vital Statistics	3
3	BST826	Statistical Testing of Hypotheses	3
4	BST838	Statistical Data Analysis using SPSS, R and ADVANCED SAS	3
5	BST842	Statistical Quality Control II	3
6	BST864	**ICT and Research Methodology**	**3**
		Total	**18**

SECOND SEMESTER ELECTIVE COURSES

S/No	Course Code	Course Title	Credit Units
1	BST844	Applied Multivariate Analysis and Time Series Analysis	3
2	BST854	Controlled Clinical Trials and Operations Research	3
3	BST868	Biometric Methods	3
4	BST870	Stochastic Modelling	3
		Total	**12**

Students must register all core courses and a minimum of 3 credit units of the elective courses listed above.

Second Year

First Semester

S/No	Course Code	Course Title	Credit Units
1	BST861	**Seminar**	2

Second Semester

S/No	Course Code	Course Title	Credit Units
1	**BST890**	Dissertation	10

The Dissertation, **BST890** (10 credit units) shall be registered only after a successful completion of the first session by a candidate with a CGPA of not less than 2.50

Course Synopsis

BST801: Probability and Distribution Theory (3 Credit Units)

Sets and classes of events, Random variables, Definition of probability, Simple properties, Sample space and events, Discrete probability space, General probability space, Distribution function of a random variable, Definition of Expectation, Properties of Expectation. Inequalities: (Chebychev's, Markov's, Holder's, Jenison's and Minkowski inequalities). Convergence in probability, Almost sure Convergence, Convergence in distribution. Moment generating function, Characteristic function, Definition and properties. Inversion formula, Convergence of distribution function and characteristic function. Independence, Multiplication properties, Central limit theorem for independently and identically distributed random variables (statement only).Review of univariate distributions with special reference to

biostatistics; Binomial, Poisson, Geometric, negative binomial, Hypergeometric, Normal, Logistic, Lognormal, Exponential, $\chi 2$, t , F ,gamma and beta distributions. Their properties and applications, transformation and change of variables techniques.

BST802: Statistical Estimation: Theory and Practice (3 Credit Units)

Basic concepts and properties of estimators: Parametric models, parameters, random sample and its likelihood, statistic and its sampling distribution, problem of inference, estimator and estimate, mean square error (MSE), properties of estimators ,unbiasedness, consistency, efficiency, sufficiency, Cramer-Rao lower bound, Minimum variance unbiased estimator, relative efficiency of an estimator. Methods of estimation: Fisher information, complete and sufficient statistic, Rao-Blackwell theorem, UMVUE. Methods of Estimation: Method of moments, method of MLE, properties of MLE (statements only), method of minimum chi-square, linkage estimation (Examples from Genetics). Interval estimation: concepts of confidence interval, confidence coefficient, confidence interval for the parameters of univariate normal, proportion, mean , difference of means. Small sample and large sample confidence intervals. Large sample confidence intervals for binomial and Poisson parameters, bootstrap methods.

BST803: Design and Analysis of Experiments (3 Credit Units)

Introduction to design of experiments: estimable linear parametric functions and their estimation, Gauss-Markov Theorem (meaning and statement only), testing of linear hypotheses, Basic principles of experimental design, uniformity trails, analysis of variance, CRD, RBD, LSD (equal and unequal number of observations, missing observations). Incomplete block designs, Balanced incomplete block designs (BIBD), group testing, PBIBD, hierarchical and nested designs.

Split plot experiments, Analysis of Covariance. General factorial experiments, factorial effects, 2n and 3n factorial experiments in randomized block, Yate's method, complete and partial confounding, Design, Replication, Randomization, Assignable cause, Chance causes, Analysis of CRD, RBD and LSD. Missing values in RBD, CRD and LSD. Design of clinical trials, Single and double blind trials. Type of control, Design of studies with matched controls.

BST805: Statistical Genetics and Ecology (3 Credit Units)

Basic biological concepts in genetics, Mendel's law, Hardy Weinberg equilibrium, estimation of allele frequency (dominant/co-dominant cases), Approach to equilibrium for X-linked gene. The law of natural selection, mutation, genetic drift. Non-random mating , inbreeding, phenotypic assortative mating. I T,O matrices, identity by descent. Family data-estimation of segregation ratio under ascertainment bias pedigree data : Elston - Stewart algorithm for calculation of likelihoods. Linkage, estimation of re-combination fraction, inheritance of quantitative traits. Introduction to ecology and evolution, population dynamics: single species- Exponential, Logistic and Gompertz models, Leslie matrix model for age and stage Structured population, survivorship curves Constant, monotone and bath tub shaped hazard rates. Two species: Lotka- Volterra equations, isoclines. Abundance estimation: Capture –recapture, Nearest Neighbour, line transect sampling, indirect methods. Ecological Diversity: Species abundance curve, indices of diversity (Simpson's index, Shannon- Wiener index). Game theory in ecology - Evolutionarily stable strategy, its , properties, simple games such as Hawk-Dove game, Prisoner's dilemma, etc. Preservation of ecology and biodiversity.

BST807: Statistical Quality Control I (3 credit Units)

The Meaning of Quality and Quality Improvement; Brief History of Quality control Methodology; Statistical Methods for Quality Control

and Improvement; Total Quality Management (quality philosophy, links between quality and productivity, quality costs legal aspects of quality implementing quality improvement).Frequency distribution and histogram, numerical and graphical descriptive statistics, some important discrete and continuous probability models; some useful approximations. Sampling distributions, estimation and confidence interval for process parameter(s), hypothesis testing on process parameter(s) and power analysis. Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, ARL, sensitizing rules for control charts); Deming's Magnificent Seven Implementing SPC; An Application of SPC; Nonmanufacturing application of SPC. Control Charts for $\bar{X}$ and R (statistical basis, development and use, estimating process capability; interpretation, the effect of non normality on the chart, the OC function, average run length); Control Charts for $\bar{X}$ and S; Control Chart for Individual Measurements; Applications of Variables Control Charts.

BST809: Management and Entrepreneurship (2 Credit Units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem-solving

BST 811: Statistical Data Analysis Using Microsoft Excel and BASE SAS (3 Credit Units)

This is a practical-oriented course that uses data from Bio statistical contexts based on BST 803 and BST805 . Data Analysis using Microsoft Excel & SAS is expected.

BST814: Basic Epidemiology and Vital Statistics (3 Credit Units)

Basic concepts & Measures of exposure and outcome: What is epidemiology?

History of Epidemiology, Emergence of modern epidemiology, Measures of Exposures, Types of exposures, Sources of exposures, Measures of outcome, disease registries, Classification of diseases. Measures of disease frequency: Prevalence, Incidence, Risk, Odds of disease, Incidence time, Incidence rate, Relationship between prevalence , rate and risk, Routine data to measure disease occurrence, age standardization, direct method of Standardization, indirect method of standardization, cumulative rate, cumulative risk, proportional incidence. Overview of study designs: Type of study design, Intervention studies, Cohort studies, case-control studies, cross-sectional studies, ecological studies, Measures of exposure effect, relative and absolute measures of effect, Confidence intervals and significance tests for measures of occurrence and effect. Validity and reliability of measures of exposure and outcome: Sensitivity, Specificity, predictive value method for selecting a positivity criterion, receiver Operator characteristic (ROC) curve, Intra and Inter-observer reliability, Kappa measure of agreement. Coverage and content errors in demographic data, use of balancing equations and Chandrasekharan-Deming formula to check completeness of registration data, adjustment of age data- use of Whipple, Meyer and UN indices. Population composition, dependency ratio. Stable and quasi-stable populations: Population-stable, stationary, 5 stages, inter census, post census; population projection, migration; factors affecting population-internal and international; age pyramid, age structure intrinsic growth rate. Models for population growth and their fitting to population data. Stochastic models for population growth.

BST826: Statistical Testing of Hypotheses (3 Credit Units)

Testing of hypothesis: Basic concepts, simple and composite hypotheses, two types of errors, critical region, significance level, size and power of the test, p- value and its interpretation. Neymann-Pearson

Lemma (Statement only) and its application in testing of hypothesis. Testing Composite Hypotheses, Uniformly most powerful test, Likelihood ratio test, Test for mean, variance, equality of means, equality of variances, large sample and small sample tests. Basics of sequential testing, Wald's SPRT with illustrations, OC and ASN functions for tests regarding binomial and normal populations. Linkage estimation and testing. Partitioning of Chi-square. Non parametric tests: Sign test, Quantile Test, Wilcoxon signed rank, Mann Whitney U test, runs test, median test Chi-square test for independence of attributes, homogeneity, goodness of fit, Kolmogorov-Smirnov one sample and two sample tests, Freidman's test, Kruskal Wallis test.

BST827: Sample Survey Methods (3 Credit Units)

Concepts of population and sample, need for sampling, census and sample surveys, sampling and non-sampling errors, sample size determination, finite population sampling techniques-SRSWR, SRSWOR, estimation of mean or total in each case and their variances. Systematic sampling, stratified sampling, allocation problems in stratified sampling, estimation of mean or total in each case and their variances. Examples from health sciences. Ratio and regression estimators based on SRSWOR method of sampling, Auxiliary information in sample surveys; Randomized response technique Warner's model-related and unrelated questionnaire methods. Cluster and Multistage Sampling: double sampling, two stage and multi-stage sampling, cluster sampling. : Examples based on bio statistical experiments. Unequal probability sampling and Non-probability sampling: PPS WR/WOR methods and related estimators of a finite population mean, Horvitz –Thompson estimator of a finite population total/mean and expressions for variance and its unbiased estimator, convenient sampling, non-random sampling.

BST838: Statistical Data Analysis using SPSS, R and ADVANCED SAS (3 Credit Units)

This is a practical-oriented course that uses data from Bio statistical contexts based on BST802, BST814, BST826 and Data Analysis using SAS, R and SPSS is expected.

BST842: Statistical Quality Control II (3 Credits)

Control Chart for Fraction Nonconforming (OC curve of the control chart, variable sample size, nonmanufacturing application, the OC function and ARL calculation); Control Charts for Nonconformities or Defects; Choices between tribute and variable Control Charts, Guideline for Implementing Control charts. PCA analysis using a histogram or a probability plot, process capability ratios, confidence interval for process-capability ratio, PCA using a control chart, estimating natural tolerance limits of a process CUSUM Control Chart (basic principles of the chart for monitoring the process mean, tabular or algorithmic CUSUM, recommendation for CUSUM design, the standardized CUSUM, rational subgroups, improving the responsiveness of the CUSUM for large shifts, designing a V-Mask, designing CUSUM based on ARL, one sided CUSUM); EWMA control chart (EWMA control chart for monitoring process mean, design of an EWMA control chart, rational subgroups); The moving Average Control Chart. The accepting sampling problem, single sampling plan for attributes, Double, Multiple, and sequential sampling, Military Standard 105E, the Dodge-Roming sampling plans (AOQL and LTPD plans).

BST844: Applied Multivariate Analysis and Time Series Analysis (3 Credit Units)

Multivariate data, multivariate normal distribution, random sampling from a multivariate normal distribution. Maximum likelihood estimators of parameters. Distribution of sample mean vector.

Hotelling's T2 and Mahalanobis D2 statistics, applications in tests on mean vector for one and more multivariate normal populations and also on equality of the components of a mean vector in a multivariate normal population. Wishart distribution and applications. Likelihood ratio test criterion. Multivariate Analysis of Variance [MANOVA]of one-and two-way classified data. Dimension reduction, Principal components– estimation and computation, canonical correlations and applications. Classification and discrimination procedures for discrimination between two multivariate normal populations – sample discriminant function, tests associated with discriminant functions, classification into more than two multivariate normal populations, Cluster analysis, Hierarchical and agglomerative methods Application of time series analysis in epidemiology- Simple descriptive techniques for detecting seasonal, cyclical, secular and random variations- Transformations-Trend analysis-Auto correlation-Forecasting spectral analysis. Box Jenkins Models, Moving average processes, auto regressive processes, ARIMA models, Auto correlation function and correlogram, diagnostic checks, modelling and prediction, non-Gaussian models, vector autoregression, cointegration and causality, applications in bio statistical contexts.

BSTA 851: Computer Programming in C++ and SAS (3 Credit Units)

Fundamentals, Operating Systems- Windows, Linux, Internet, algorithms, Flowcharts, data types and variables, Operators, Input Output statements, Control statements:-if, if-else, nested if-else, goto and switch statements. Loops: for, while, do…while loops. Break, continue, exit), Library functions. One dimensional, two-dimensional and multi-dimensional arrays. Functions, definition and declaration, Illustrative examples from statistics. Pointers and references. Introduction to SAS: SAS variables, Libraries ,Windows, Parts of a SAS program, Data sets-Creation, Reading data from an external file,

Data step statements like CARDS, DATA, Assignment, Do-loops, DROP, KEEP, INPUT, OUTPUT, SET, STOP,IF-THEN-ELSE, SAS Operators , Functions , Arrays. Procedures in SAS, Proc statements, CLASS, BY, DROP, FREQ, KEEP, OUTPUT, LABEL etc. Procedures-PRINT, FREQ, MEANS, UNIVARIATE, SORT, CONTENTS, CORR, PLOT, REG, ANOVA, LOGISTIC, IMPORT, TABULATE.

BST854: Controlled Clinical Trials and Operations Research (3 Credit Units)

Introduction to clinical trials: the need and ethics of clinical trials, Drug Development Process, ICH GCP, Relevant FDA and EMEA guidelines (Industry, TA-, phase-specific), data management, objectives and end points of clinical trials, bias and random errors in clinical studies, conduct of clinical trials, overview of phase I-IV trials, multi-center trials. Design of clinical trials: parallel vs cross-over designs, cross - sectional vs: longitudinal designs. Design and analysis of Phase - I, Phase -II and Phase- III trials. Statistical Methods (Industry-, TA-, phase-specific),Defining objectives and end-points, Various study designs, Analysis of data sets, Handling missing data, Handling multiplicity , Baseline and covariates , Sub-group analysis, Modelling treatment effects , Design of bio-equivalence trials, Understanding Protocol, Sample Size Determination, Inputs to Data Management Documents, Understanding Clinical Study Report Randomization Methods, Statistical Analysis Plan, TLG Shells Analysis methods / models for continuous, categorical, binary, survival data, Non-parametric methods, Repeated measures analysis, Quality of life data analysis, Interim analysis, Data Comprehension , Data Interpretation, Adaptive Trials, Meta Analysis, SAS Programming –Efficacy reporting, Validation Plans, Blind Data Review, Data Visualizations Methods, Sensitivity Analysis, Unblinding, DSMB Reviews Introduction to

Operations Research, linear programming problems (LPP),framing an LPP problem, graphical solution, feasible, basic feasible and optimal basic feasible solutions to an LPP, simplex method, dual of linear programming, transportation problems, assignment problems, simple numerical problems as illustration.

BST861: Seminar (2 credit units)
A topic of choice to be taken by the student in consultation with his/her supervisor(s) and in-depth research carried out on it. An appropriate number of copies(soft or spiral binding) of the report are to be submitted to the department before the oral presentation of the report.

BST864: ICT and Research Methodology (3 Credit Units)
Principles and approaches of scientific research, research scope and experiment. Choosing research topics and developing research proposals. Concepts of hypothesis formulation and testing. Literature review methodology, research documentation and communication. Time management, research regulations and ethics. Research thesis writing and organization. Research tools and ICT, internet technology, oral presentation.

BST868: Biometric Methods (3 Credit Units)
Advanced topics selected from genetics and statistics. Bioassay techniques and designs and analysis of biological investigations.

BST870: Stochastic Modelling (3 Credit Units)
Introduction to stochastic processes (sp's); classification of sp's according to state space and time domain. Countable state Markov chains (MC's), Chapman-Kolmogorov equations; calculation of n-step transition probability and its limit. Stationary distribution, classification of states; first –passage time problems. Stationary process; weakly stationary and strongly stationary processes; Discrete state space

continuous time MC: Kolmogorov differential equations; Poisson processes and properties, birth and death process, Yule process. Renewal theory: Elementary renewal theorem and applications. Statement and uses of key renewal theorem; Branching process: Galton –Watson branching process, pgf relations, probability of ultimate extinction, distribution of population size.

BST875: Bayesian Theory and Decision Methods (3 Credit Units)
Philosophical principles underlying Bayesian and non-Bayesian statistics. Decision theoretic foundations of Bayesian statistics including loss functions, minimaxity, and admissibility. Construction of conjugate prior distributions and non-informative prior distributions. Bayesian point estimation, hypothesis tests and credible sets. Computational tools for Bayesian problems including Markov chain Monte Carlo (MCMC) and other methods for approximating posterior distributions with some emphasis on implementation via a programming language or statistical computing software. The normal linear model, non-normal models, hierarchical models, Bayesian model averaging.

BST887: Demography and Health Data Management (3 Credit Units)
Introduction to demographic data: Census, vital events, registration, survey, extent of under registration. Chandrasekhar Deming index. Mortality measurements: crude and specific rates, direct and indirect methods of standardization, Life tables –construction and uses, Abridged Life table – construction and uses, concept of model life table Determination of mortality. Population growth, Composition and Distribution: Population pyramid, Aging of population, Rejuvenation of population, Age ratios and Sex ratio, effect of fertility, mortality and migration on age structure. Introduction to MS Excel, creating a data file, data manipulations, simple statistical analysis using Excel, making graphs and charts. Statistical package for Social Sciences (SPSS

Version 16.0) :Data view and variable view, importing a file, Data transformations (compute, recode, count, If, yrmoda). Sort cases, merging and appending data, Frequencies, descriptive statistics, cross tabulations. Statistical analysis: independent samples't' test, paired 't' test, ANOVA, chi square, Fisher's exact test, McNemar chisquaretest, correlation and regression. Non-parametric methods: Mann WhitneyU test, Wilcoxon Signed rank test, Spearman's correlation.

BST890: Dissertation (10 Credit Units)

An approved topic for dissertation is chosen(typically in the applied areas of Statistics, Biology, Chemistry, Agriculture, Food Processing, Food Preservation, Post-Harvest Preservation Analysis issues and the Pharmaceutical industry) under the guidance of his/her supervisor(s)

List of Staff

S/N	Name of Staff	Qualification(S)	Status	Specialization	Rank
1	Dr. Musa Egahi	B.Sc.(Jos);1996 M.Sc.(Jos);2004 Ph.D(Jos);2015	Full-Time	Complex Analysis	Senior Lecturer and Ag HOD
2	Prof. Msugh Kembe	B.Sc.(Jos);1984 M.Sc.(UNN);1992 Ph.D. (UAM) ;2009	Full-Time	Operations Research	Professor
3	Prof. Moses Chiawa	B.Sc.(Sokoto);1986 M.Sc.(Ibadan);1991 Ph.D.(Sokoto);2009	Full-Time	Applied Time Series and Econometrics	Professor
4	Prof. Moses Ikape Ogbaji	B.Agric.(UNN);1985 M.Sc. Agric.(UNN);1989 Ph.D.(UNN) ;1995	Part-Time	Plant Science and Genetics/Biostatistics	Professor
5	Prof. Vange Terkimbi	B.Agric.(UAM);1991 M.Sc. Agric.(UAM);1997 Ph.D.(UNN) ;2008	Part-Time	Plant Breeding and Biometics	Professor

6	Dr. Michael Imande	B.Sc.(Jos):1987 M.Sc.(Ibadan);1994 PGDM (BSU); 2000 Ph.D. (Ibadan); 2012	Full-Time	Econometrics, Multilevel Modeling, Design and Analysis of Experiments.	Associate Professor
7	Dr Priscilla Mwuese Utoo	MBBCh;1998, FMCPH;2007	Full-Time	Public Health	Senior Lecturer
8	Dr Patience Onuche Agada	B.Sc. Ed(Jos); 1998 PGD(ATBU); 2001 M.Sc.(ATBU); 2006 Ph.D.(UAM); 2014	Part-Time	Operations Research, Stochastic Processes and Simulation	Senior Lecturer
9	Dr Jonathan Ikughur	HND(Bida); 1995 PGDCS(Minna);1999 M.Sc.(Ibadan);2005 Ph.D.(Ibadan);2011	Part-Time	Statistics	Senior Lecturer
10	Dr. Patrick Obilikwu	B.Sc.(Benin):1993 M.Sc.(Benin): 1997 P.hD. (Benin) ; 2017	Full- Time	Software Engineering	Lecturer 1
11	Dr. Innocent Ogwuche	B.Tech.(Minna);1998 M.Tech.(Minna);2005 Ph.D.(Yola);2015	Full-Time	Computational Mathematics	Lecturer I
12	Dr. Adeyelu Adekunle	B.Sc.(Ife);1997 M.Sc.(Ife);2008 Ph.D.(Ife);2014	Full-Time	Data Communication and Hardware Systems Design	Lecturer I

CHAPTER FIVE

BENUE STATE UNIVERSITY, MAKURDI
DEPARTMENT OF PHYSICS

M.SC.PROGRAMME IN RADIATION AND MEDICAL PHYSICS.

PHILOSOPHY

Manpower development in Nigeria, a third country, should take into consideration the overall improvement of the quality of life of its citizens. The training of Physicists and indeed other scientists and professionals should involve the broad strategy of human resources development with the aim of achieving broader goals of economic emancipation, political and social modernization. The Programmes are aimed at encompassing not only educational but also cultural, social and political development. This strategy would enhance reasonable contributions (by products of the training) to nation-building, national identity and integrity. Physics is the centre-point discipline in science and technology. The training of Physicists-thus needs to be thorough and broad based and should produce personalities that have self-confidence. This would ensure this self-reliance, graduate employment opportunities, creativity, innovation and less dependence on government.

Beneficiaries of the postgraduate programme should be creative, innovative and well equipped to seek self-employment and as a result create job opportunities for others. Through such training, individuals would achieve social relevance and acceptability and be strategically equipped to render service to mankind.

OBJECTIVES

The graduate programmes are designed to train those with first and Master Degrees in Physics and other related areas leading to production of specialists with knowledge and skills relevant to the needs of Benue

State, Nigeria and world over. The courses are designed to be of sufficiently high standards to make them profitable to both the trainee and society.

Programmes are also designed to produce an opportunity to students to study Theoretical Physics, Radiation and Medical Physics, Environmental and space Physics and Electronics and Communication respectively in depth, to stimulate thought and to create new knowledge. It is expected that such students well-grounded in these advanced areas of Physics will be able to use the knowledge gained in Academics and offering solutions to the varied problems of the society.

In particular, the Ph.D Programmes seek to create opportunities and challenges for talented candidates to attain the highest level of their potentials in academic pursuit in these areas of Physics. The Ph.D rather than emphasize a mere accumulation of knowledge through course credits, focuses on the development of scholarly competence. By implication, the course work content is limited only to that which is capable of deepening the theoretical knowledge base of the enrollees in these core areas of Physics thereby heightening the research competence in these chosen fields of the advanced level and a comprehensive research culminating in a Dissertation/Thesis which is orally defended.

DEGREES OFFERED

i. Master of Science (M.Sc.) Radiation and Medical Physics
ii. Ph.D. Radiation and Medical Physics

ENTRY REQUIREMENT FOR M.SC PROGRAMME: A minimum of 2nd Class honours (B.Sc.) Degree in physics from Benue State University or any other University, recognized by the senate of Benue State University or its equivalent.

NATURE OF ADMISSION: Full time of part time.

DURATION OF STUDY FOR M.SC PROGRAMME:

i. A minimum of three semesters and a maximum of four for full time students.
ii. A minimum of four semesters and a maximum of six semesters for part time students.

GRADUATION REQUIREMENTS FOR M.SC PROGRAMME:

A candidate must pass a minimum of 24 credits units of course work and maximum of 41 credits. 19 credit units from the general core courses and the remaining credit chosen from the area of specialization. In addition to the above, the candidate must satisfy the following Departmental requirements: -

i. Present two seminar papers to the Departmental Board.
ii. Submit M.Sc. dissertation for oral defense.
iii. In addition, a candidate must have fully and duly registered for each session and paid the prescribed fees
iv. A candidate must have passed all the core courses as prescribed in the course work module of the programme at grade of 'C' (with a CGPAOF 3.00) or above. Course work grading shall be on the following scale:

Letter Point	Mark	Grade
A	70 or above	5.00
B	60-69	4.00
C	50-59	3.00
F	0-49	0.00

The M.Sc. Dissertation is the original research work carried out by the student, which contains his/her original contributions to the chosen area of specialty. The Dissertation will be examined by a panel of examiner(s) approved by both the Postgraduate school and the Senate.

For the purpose of award of Degree, the Dissertation is examined as part of the course work.

COMPUTATION OF MARKS

A student is assumed to have passed a course if he/she has obtained a total of 50% and above in the course examined. The marks for a given course shall be divided into continuous assessment and written Examination with continuous Assessment taking 30% and written Examination taking 70% respectively.

M.SC. CORE COURSES

First Semester

Course Code	Course Title	Credits
PHY 801	Mathematical Methods in Physics	3
PHY 803	Thermal and Statistical Physics	3
	Total	**6**

Second Semester

Course Code	Course Title	Credits
PHY 802	Electromagnetic Theory	3
PHY 804	Dissertation	10
	Total	**13**

M .Sc. Radiation and Medical Physics

First Semester Elective Courses (or specialized areas):

Course Code	Course Title	Credits
PHY 821	Physics of Radiation Therapy	3
PHY 823	Nuclear Medicine	3
PHY 825	Medical Biophysics	3
	Total	**9**

Second Semester Elective Courses (or specialized areas):

Course Code	Course Title	Credits
PHY 822	Radiation Dosimetry and Protection	3
PHY 824	Biomedical Biophysics	3
	Total	**6**

M.SC. CORE COURSES: DESCRIPTION/SYNOPSIS

PHY 801: Mathematical Methods in Physics (3 credits) Tensor and vector analysis, complex variable techniques, special functions of mathematical physics.

Eigenvalue problems, boundary value problems for ordinary differential equations. Partial differential equations, solutions to partial differential equations. Fourier series and the Fourier Transform; Laplace Transform. Integral equations, Monte Carlo method; group theory, use of symbolic computation packages for selected problems in Physics.

PHY 802: Electromagnetic Theory (3 credits)

Boundary value problems in electrostatics and magnetostatics, multiple fields: Advanced applications of Maxwell's equations; Electrodynamics of surfaces and interfaces; Waveguides; radiating systems; Scattering theory.

PHY 803: Thermal and Statistical Physics (3 credits)

Heat and mass transfer; steady state conduction, transient conduction; Free convection; forced convection; radiative transfer; Review of distribution functions for bosons and fermions; Boltzmann transport equation and its applications; theory of fluctuations dissipation theorem; Linear response theory, Phase transitions; Scaling theories.

PHY 804: Dissertation (10 credits)

Each M.Sc. candidate after successful M.Sc. seminars shall orally defend his/her completed dissertation before a panel of examiners. The dissertation, which shall be an in-depth and original investigation into a

well-defended theoretical or practical problem in physics, must satisfy the panel of examiners that it has indeed made a significant contribution to the existing pool of knowledge in physics.

M.Sc. Radiation and Medical Physics: Elective Courses (or specialized areas):

PHY 821: Radiation Physics (3 credits)

Ionizing Radiations: Atomic and Nuclear Structure: Radioactivity, physical and biological half-life, cumulated activity, secular and transient equilibrium Interaction of photons and particles units with matter, Interaction cross-sections and interaction mechanisms.

Radiodiagnosis: X-ray production, design of x-ray tubes. Beam collimation, interaction of x-photons with patients, radiographic contract film construction role of intensifying screens. Film contrast, scatter reduction x-ray fluoroscopy and computed Tomography.

Radiotherapy: General introduction to radiobiology (interaction of ionizing radiation with biological systems at chemical, cellular and whole-body level) and radiotherapy tissue susceptibility and other parameters, treatment planning and branchytherapy.

Non-Ionizing Radiations: Interaction of non-ionizing radiation with Biological matter. Complex permittivity of tissues specific absorption rate (SAR) photochemical reactions and action spectra Electromagnetic radiational in medicine. Applications of Radiofrequency fields Lasers and UV radiation in medicine, Ultrasound in medicine: Radiation pressure and Acoustic intensity, Propagation of ultrasound I matter, physical effects of ultrasound, attenuation of ultrasound in tissues, the basic physics of NMR and magnetic resonance imaging.

Excursion: all M.Sc. Radiation and Medical Physics students will undergo excursion to examine the radiation emitting machines. It shall

form part of their continuous assessment test of 30% after submitting a comprehensive report of their excursion trip.

PHY 822: Radiation Dosimetry and Protection (3 credits)

Dosimetry: Units of radiation dose and exposure, Kerma. Fluence rate, energy fluence, Bragg-Garay cavity theory and others cavity theories, measurement of radiation dose, Gas detectors, scintillation detectors, solid and liquid types. Semiconductor detectors. Neutron detectors Particle radiation Dosimetry. Radiation Protection: Radiation hazards and methods of control Basic safety standards (BSS). Maximum permissible does and **ALARA** principles Epidemiological data, radiation protection legislation: IRR, POPUMENT, RSAFRPS and Nigerian regulatory agency, personnel close monitoring. Radiation protection in x-ray Departments, nuclear medicine, radiotherapy, industries and radio-pharmaceutical laboratories. Hazards and safety aspects of R.F. lasers and UV radiations.

PHY 823: Nuclear Medicine (3 credits)

The physical principles of Nuclear Medicine: Problem of isotope distribution in the body, cumulated activity, Fractional distribution function and residence time for a 2-compartment Biophysical model, the gamma camera, specification of camera performance, data processing, mode of action of radio-pharmaceuticals and the interpretation of clinical studies, MIRD formalism, in-vitro studies position emission tomography (PET).

PHY 824: Biomedical Instrumentation (3 credits)

Electronic noise and its reduction I Biomedical equipment. Transducers, active and passive transducers. Temperature, force ultrasonic transducers. Bioelectric potentials, Nernst equation Biopotential electrodes. Physiological measurements. Amplifies for physiological signals, operational amplifiers, clinical applications of electronics e.g. equipment, pacemakers.

PHY 825: Medical Biophysics (3 credits)

Hemodynamics and Biomechanics: Rheological concepts for solids, solutions and suspensions. Circulatory systems. Pressure and flow waves in arterial system. Arterial elasticity and compliance. Static and dynamic stresses in bone and muscles. Transport across membranes and Dialysis physical techniques for studying proteins and other macromolecules.

DOCTOR OF PHILOSOPHY, (Ph.D) RADIATION AND MEDICAL PHYSICS

Admission Requirement

Admission shall be opened to candidates who have a minimum of an M.Sc. Degree in the chosen area of specialization or its equivalent with a minimum of 3.5 grade point on a 5-point scale from Benue State University or any other University recognized by the senate of the Benue State University.

Duration of Study

i. A minimum of six semesters (or three academic years) and a maximum of ten semesters (or five academic years) for a full-time student
ii. A minimum 12 semesters (or six academic years) for part time students

Graduation Requirement:

To qualify for the award of Ph.D Degree in Physics, a candidate shall meet the following requirements:

i. Must have fully and duly registered for each session and paid the prescribed fees.
ii. Must have passed all the core courses as prescribed in the course work module of the programme at a grade of 'C' (with a CGPA of 3.00) or above. A candidate who fails to meet this minimum

CGPA at the end of the academic session shall be asked to withdraw. Course work grading shall be on the following scale:

Letter Point:	Mark:	Grade:
A	70 or above	5.0
B	60-69	4.00
C	50-59	3.00
F	0-49	0.00

iii. Must pass a minimum of 24 credit units of course work.

iv. Must have presented three seminar papers to the Departmental Board

v. Must have submitted and defended a Ph.D Thesis at Oral Examination

COMPUTATION OF MARKS

A student is assumed to have passed a course if he/she obtained a total of 50% and above in the course examined. The marks for a given course shall be divided into continuous assessment and written examination with continuous assessment taking 30% and written examination taking 70% respectively.

Ph.D CORE COURSES

First Semester Courses

Course Code:	Course Title:	Credits
PHY 901	Research Method of Physics	3
PHY 905	Thesis	35
	Total	**38**

Second Semester Courses

Course Code:	Course Title:	Credits
PHY 902	Advanced Numerical and Computational Techniques	3
	Total	**3**

Ph.D RADIATION AND MEDICAL PHYSICS: ELECTIVE (OR SPECIALIZED) COURSES

First Semester Courses

Course Code:	Course Title:	Credits
PHY 917	Seminar in Ultrasonic & Nuclear Medicine	3
PHY 919	Physics of Radiology	3
PHY 910	Clinical Physics Practicals	3
	Total	**9**

Second Semester Courses

Course Code:	Course Title:	Credits
PHY 916	Seminar in Radiation Dosimetry Protection	3
PHY 918	Advanced Radiation Physics	3
PHY 920	Physics of Medical Imaging	3
	Total	**9**

Ph.D COURSES: DESCRIPTION/SYNOPSIS

Core Courses

PHY 901: Research Methods in Physics (3 credits)

The nature and structure of Physics Research. The scientific basis of Physics Research. Theoretical and applied research in physics the structure and components of a research proposal. A case study on research proposal. The structure and components of a Journal article in Physics. A case study on a Journal in Physics referencing.

PHY 902: Advanced Numerical and Computational Techniques (3 credits)

This course deals with advanced topic needed by students for Advanced Numerical and Computational Techniques. Topics include:- solving the

equation f (x)=0 using eg. Newton-Raphson method; solution of ordinary equatins using e.g. rung-Kuta alogarithum; numerical integration using e.g. Gausina quadrature method, numerical differentiation; the method of least squans, system of linear equations, Monte Carlo methods and simulation. Computer applications using e.g. FORTRAN, symbolic computing etc.

PHY 905 Thesis (35 Credits)

Each doctoral candidate after a successful doctoral seminal shall orally defend his/her completed thesis before a panel 0f examiners. The thesis, which shall be an in-depth and original investigation into a well-defend theoretical or practical problem in physics, the existing pool of knowledge in Physics.

Ph.D RADIATION AND MEDICAL PHYSICS: ELECTIVE (OR SPECIALIZED) COURSES

PHY 916: Seminar in Radiation Dosimetry and Protection (3 credits)

Students are expected, with the guidance of their Lecturer(s) to critically analyze and discuss the major current issues in Radiation Dosimetry and Protection in a seminar environment, attended by both lecturer(s) and Post-graduate students. The sources of information/data required for the seminar is mainly from current Journals, Books and Internal. There shall be at least two seminars in PHY 916.

PHY 917: Seminar Ultrasonic and Nuclear Medicine (3 credits)

Students are expected, with the guidance of their Lecturer(s) to critically analyze and discuss the major curre3nt issues in Ultrasonic and Nuclear Medicine in a seminar Environment, attended by both Lecturer(s) and Post-graduate students. The main source of data/information required for the seminar is mainly from current journals, Books and Internal. There shall be at least seminars in PHY 917.

PHY 918: Advanced Radiation Physics (3 credits)

Interactions between Photons and Charged Particles with Matter. Photoelectric effect, Thomason scattering, Rayleigh scattering, Compton effect, Energy-Angel relations I Compton process, Energy of Compton electrons, effect of Binding energy on Compton scattering, pair and triplet production. Energy distribution of electrons and positions in pair production. Multiple processes and Monte Carlo calculations with a case study.

Interaction of Heavy Charged Particles with Matter: interaction of electrons with matter, Ionizational losses and Bremsstrahlung, range of electrons and Bremsstrahlung yield. Energy spectrum of electrons in a medium, mean stopping powers, restricted stopping powers and linear energy transfer.

PHY 919: Physics of Radiator Therapy (3 credits)

Interaction of x-rays with scattering medium*:* Phantoms, functions used in Dose calculations, tissues-Air radio, backscatter factor, percentages depth dose, tissue-phantom ratios and equivalent square/circles for rectangular and irregular fields patient dose calculations. Tabular data, Iso curves and calculation of dose at any point.

Treatment planning with single and combined Beams, Director Patient: Dose calculation, alteration of isodose curve by contour shape, Bolus and filters, exist surface dose, Dose for in homogenous tissue, energy absorption in tissues-bone, lungs. Integral dose and whole body irradiation, opposing and combinations of opposing pairs of beams. Angle fields ad wedged pairs. Three-field technique, beam direction and special fields. Use of CT in treatment planning, Rotation therapy, general consideration in treatment planning.

Brachytherapy: Radium and its series, exposure rate and from radium and radon sources, exposure rate and dose rate from never sources. Construction and care of Brachytherapy treatments. Isodose curves and linear sources, and seed, plamar, seed and volume implants. Clinical brachytherapy calculation, special Brachytherapy techniques.

PHY 920: Physics of Medical Imaging (3 credits)

Computed Tomography, basic principles, generation of CT scanners, Detectors and Arrays, Tomographic reconstructions, digital display dose measurements Image quality and artifacts.

Magnetic Resonance Imaging: Nuclear magnetic characteristics of elements, resonance signals, T, and T_2 relaxations, spin echo and pulse sequences, inversion recovery and gradient echo. Per fusion and diffusion contrast, signal from flow and magnetization, contrast localization of the MR signal K-space data acquisition and image reconstruction and 3-dim Fourier transform image acquisition, image characteristics and transfer contrasts, artifacts, MR 1 instrumentation.

Ultrasound: Interaction of ultrasound with matter, ultrasound transducers, beam properties, image data acquisition and storage, image quality and artifacts. Doppler ultrasound, Bio-effects of ultrasound.

PHY 921: Clinical Physics Practicals (3 credits)

The students will undergo a three (3) months clinical attachment to the Department of Medical Physics or Radiology in any Tertiary Health Institution, where these Departments are well established. They are expected to acquire the necessary practical clinical experience required of Medical Physicists in a Hospital environment. The work of the practicals will be supervised and their logbooks will be marked and graded. The students will also submit a detailed report of the practicals duly endorsed by the Head Radiology or Medical Physics from the Hospital where the work was carried out to the Department of Physics for grading.

Academic Staff

S/N	Name of Staff	Rank	Qualification	Area of Specialization
1	Dr. M. D. Tyona	Snr. Lect/ HOD	B.Sc., M.Sc. (Jos) PhD (UNN).	Materials Science & Solar Energy, Electronics & Communications
2	Prof. J.O. Fiase	Professor	B.Sc. (ABU), Adv Dip. Physics (Manchester) PhD	Theoretical & Computation Physics, Nuclear Physics
3	Prof. E. H. Agba	Professor	B.Sc., M.Sc., PhD (Benin)	Medical Physics & Biophysics, Applied Physi
4	Dr. A. A. Akombo	Lecturer I	B.Sc., M.Sc. (Jos) PhD (ABJ)	Solid State Physics & Electronic
5	Dr. F. Gbaorun	Associate Prof.	B.Sc. (BSU), M.Sc. (Benin),PhD (BSU)	Theoretical Physics
6	Dr. B. A. Ikyo	Snr. Lecturer	B.Sc.(BSU), M.Sc.(UAM), PhD(Surrey, UK)	Environmental & Medical Physics, Photonics
7	Mr. J. O. Tsor	Lecturer I	B.Sc., M.Sc, (Jos)	Atmospheric & Environmental Physics
8	Dr. N.B. Akaagerger	Lecturer I	B.Sc., M.Sc., PhD (BSU)	Radiation & Medical Physi
9	Dr. Grace Ihongo	Lecturer II	B.Sc. (BSU), PhD (Aberdeen, UK)	Space Physics
10	Dr. T. Daniel	Asst. Lecturer	B.Sc., M.Sc. (BSU), PhD (Surrey UK)	Theoretical Physics, Nuclear Physics

CHAPTER SIX
DEPARTMENT OF SOCIOLOGY

MASTER OF SCIENCE (M.Sc.) PROGRAMME IN RURAL SOCIOLOGY AND AGRICULTURAL EXTENSION

Philosophy

The underlying philosophy of the Master of Science programme in Rural Sociology and Agricultural Extension is to produce competent individuals who are well-grounded in sociological concepts, theories, and the methodology needed to analyze and proffer solutions to problems relating to Rural Sociology and Agricultural Extension at the local, national and global levels.

Rationale

The Master of Science programme in Rural Sociology and Agricultural Extension will provide opportunities for advanced knowledge and skill acquisition for a career in the private and public sectors of the national and global economies. The aim is to strengthen the capacity in problem analysis and solving in Rural Sociology and Agricultural Extension. Students should be able to articulate, develop and implement research using Rural Sociology and Agricultural Extension concepts and methodologies.

Objectives

The objectives of this Programme are:

i. To equip students with relevant skills in the areas of theory and empirical research.

ii. The students should be able to apply knowledge in Rural Sociology and Agricultural Extension to effectively meet the challenges of a dynamic society.

iii. When successfully completed the programme graduates should be able to deal with rural development issues with the view to making contribution to national development effort as a teacher, researcher, administrator, or entrepreneur.

Admission Requirements for M.Sc. Rural Sociology & Agricultural Extension

The criteria for admission into the programme will be as follows:

i. Candidate must have the requisite matriculation requirement of 5 O'Level credits including English language and at least a pass in Mathematics plus credit pass in either Government or History and three other arts/social science subjects.

ii. Candidates who hold a first class or second class upper degree in Sociology, Anthropology, Social Work, Agricultural Extension and related disciplines. Holders of second class (Lower Division) however must have a CGPA of not less than 3.0 on a 5 - point scale from a recognised University.

iii. Candidates with PGD in Sociology, Social Work, Social Welfare, Farm Management & Extension and other related programmes at credit level pass on weighted percentage average.

Requirements for Graduation

To be awarded a Master of Science Degree in Rural Sociology and Agricultural Extension, candidates must obtain a minimum of 46 credit units made up as follows:

Core courses of Twenty one (24) credit units; Elective courses of nine (9) credit units; Seminar (3) credit units. A student shall present at least one seminar, submit and defend a dissertation proposal. A student shall carry out research in the area of specialization and submit an acceptable dissertation of ten (10) credit units.

The dissertation must be defended before an external examiner

Duration of Programme

a) Full-Time: A minimum of 4 (four) semesters and a maximum of 6 (six) semesters

b) Part-Time: A minimum of 6 (six) semesters and a maximum of 10 (ten) semesters

Examinations

Course Work

a) The minimum pass mark shall be 50%. Continuous assessment shall constitute 40% of the examination for each course.
b) Any student who fails in any core course shall repeat the course.
c) Any student whose CGPA falls below 2.50 at the end of the session shall be advised to withdraw from the programme.

Dissertation

A Panel of examiners shall be constituted to orally assess the candidate's Dissertation in accordance with set regulations/criteria of the university. The following shall constitute panel of examiners for the programme:

a. Head of Department (Chief Examiner)
b. Supervisor
c. A Representative of the Dean of Faculty of Social Sciences
d. A Representative of the Dean of Postgraduate School
e. A Representative of Director of Centre for Food Technology and Research (CEFTER)
f. External Examiner

Courses

Course Code	Course Title	Credit Units
	CORE COURSES	
	First Semester	
RSE 801	Advanced Theories in Rural Sociology and Agricultural Extension	3
RSE 803	Advanced Research Methods in Rural Sociology and Agricultural Extension	3
RSE 805	Issues in Entrepreneurship	3
RSE 807	Structure and Dynamics of Rural Societies	3

RSE 809	Seminar	3
	Electives	
RSE 813	Comparative Rural Social Systems	3
RSE 815	Agricultural Cooperatives and Rural Institutions	3
RSE 819	Culture, Environment and food habits	3
RSE 821	Agricultural Commodity Marketing Extension Service	3
RSE 823	Consumer Food Psychology 1	3
RSE 825	Diffusion and Adoption of innovation	3
	Second semester	
RSE 802	Agricultural Extension Organization and Administration	3
RSE 804	Statistical Methods in Rural Sociology and Agricultural Extension	3
RSE 806	Computer Applications in Rural Sociology and Agricultural Extension Analysis	3
RSE 808	Sociology of Food	3
RSE 810	Dissertation	10
	Elective courses	
RSE 812	Rural Development Planning and Evaluation	3
RSE 814	Land Tenure and Resource Management	3
RSE 816	Political Economy of Rural Development	3
RSE 818	Food and Nutrition Policy and Food Security	3
RSE 820	Food commodity Value Chain Analysis	3
RSE 822	Consumer Food Psychology 11	3

RSE 824	Project Monitoring and Evaluation	3
RSE 826	Agricultural Extension Communication and Teaching methods	3

Course Synopsis

First Semester

Core courses

RSE 801: Advanced Theories in Rural Sociology and Agricultural Extension (3 units).

The focus of the course will be on in-depth examination of application of general sociological theories in the analysis of rural social systems and the relationship of individual to his social environment with reference to group processes, interaction, social structure and attitudes.

RSE 803: Advanced Research Methods in Rural Sociology and Agricultural Extension (3 units)

The focus is on the logic of scientific social inquiry, ethical and epistemological problems of research in Africa. Sampling problem, survey research, quantitative methods, the application of Participatory Rapid Appraisal (PRA) tools such as Focus Group Discussions (FGD), Semi-Structured Interviews (SSI), matrices, and institutional mapping among other tools will be presented and discussed.

RSE 805: Issues in Entrepreneurship (3 units)

The course will discuss issues surrounding the definition and conceptualization of entrepreneurship from the perspective of various social science disciplines. Theories and models of entrepreneurship with respect to the push and pull factors in entrepreneurship development, barriers to entrepreneurship development will be examined. The role of entrepreneurship in national economic development and in the global economy will be also examined.

RSE 807: Structure and Dynamics of Rural Societies (3 units)
The course examines the ecological, institutional, organizational and social differentiation approaches to the study of social structure; selected theories of social change; process of planned social change and technology transfer involving the entire value chain in agriculture (e.g. technologies of managing post-harvest losses) will be considered.

RSE 809: Seminar
This seminar will involve selected topics in Rural Sociology and Agricultural Extension. This seminar is the first opportunity for the student to demonstrate research competence before embarking on fieldwork.

Elective Courses

RSE 811: Comparative Rural Social Systems (3 units)
This course focuses on the examination of selected rural and agricultural systems with reference to organization and institutions; and comparative analysis of rural communities in different social settings with respect to elements and processes of social change, innovation and decision-making, communication and diffusion, leadership and social action. Special attention will also be laid on systems of managing post-harvest losses in different societies.

RSE 813: Agricultural Cooperatives and Rural Institutions
The focus of this course will be on agricultural cooperative principles and systems of farmer organizations. Emphasis will be on organization and management issues relating to farmer organizations and modalities for effective linkage between farmer organizations and other organizations and service providers.

RSE 815: Culture, Environment and Food habits (3 units)
The course focuses on analysis of different cultural habits, social appetite, food taboos as well as values attached to various foods, food preparation and eating habits. The role of branding, packaging, labelling as they affect food habits will be considered.

RSE 817: Agricultural Commodity Marketing Extension Service (3 units)
The focus is on food marketing and prevention of post-harvest losses. Food marketing, farmers' marketing plans and challenges, price analysis and exchange function as well as food consumption and the role of market information system including transportation for the food industry.

RSE 819: Consumer Food Psychology I
This course explores the principles of consumer psychology as they are applied to food, the social, ethical and moral values that influence our individual decision making with respect to food and explore the interrelationship between consumer food psychology and new food product development and innovation. The course draws on a range of psychological theories most prevalent in consumer food psychology: perceptions and attitudes; personality; learning; motivation; environmental influences; family and peer influences; cultural influences; consumer decision process, and food advertising.

RSE 821: Diffusion and Adoption of innovations (3 units)
The concept of diffusion, major elements of diffusion, and characteristics of innovations that influence adoption will be examined. Innovations-decisions/adoption theories, innovativeness and adopter categories, adoption rate/penetration index, measures to enhance adoption of agricultural innovation, fertilizer distribution models and opinion leadership shall be discussed.

Second Semester

Core courses

RSE 802: Agricultural Extension Organization and Administration (3 units)
The focus of this course is on the basic concepts and principles of agricultural extension Administration, organizational framework and special demands of agricultural administration under different agrarian systems will be discussed, including historical evolution and problems of organization and administration of agricultural extension in Nigeria.

The role of extension in food production, storage, preservation and prevention of post-harvest losses will be highlighted.

RSE 804: Statistical Methods in Rural Sociology and Agricultural Extension (3 units)

The focus of this course will be on statistical method and reasoning and application of advanced statistical methods. Prior knowledge of statistics is required. Topics like probability sampling, contingency problems, correlation and regression analysis, analysis of variance and T-test statistics will be covered.

RSE 806: Computer Applications in Rural Sociology and Agricultural Extension Analysis (3 units)

The practical application of computers in data analysis would be presented with particular emphasis on Statistical Package for Social Sciences (SPSS), Epidemiological Information (Epi Info), Microsoft Excel and other data based programmes. Emphasis would also be placed on the use of computers in sampling design and selection, sampling distribution and parameter estimation. Furthermore, the use of computers in hypothesis testing correlation and regression analyses, chi-square and other inferential statistical tools will be presented and discussed.

RSE 808 Sociology of Food (3 units)

The focus will be on the place of food in the history and development of society. This covers production, consumption, distribution and preservation of food, environment, gender roles and division of labour issues. Food business, changes in the food supply chain, with particular reference to globalization, food politics, ethical and cultural issues relating to food will also be covered.

RSE 810: Dissertation (10 units)

Students are expected to choose a topic in the field of Rural Sociology and Agricultural Extension for field or library research. A dissertation of a minimum of 60 or a maximum of 150 pages would be written on such topic and presented. Students are expected to display a good knowledge in the formulation of research problem and research

questions, the setting of research objectives, formulation of basic assumptions or hypothesis, a wealth of exposure to literature, selection of a research methodology/instrument, and a good knowledge of data analysis, interpretation and recommendation.

RSE 812: Rural Development Planning and Evaluation (3 units)
This course examines the conceptual framework for planning socio-economic programmes; programme planning models; programme planning and change, top-down versus participatory planning; the concept of programme evaluation techniques; and practical problems of programme planning and evaluation.

RSE 814: Land Tenure and Resource Management (3 units)
The course starts by defining land tenure. It focuses on the Nigerian case where land tenure system comprises the customary and legalized rights to the use and control over land (and water) which constitute the most basic resources of man.

RSE 816: Political Economy of Rural Development (3 units)
This course will examine the place of agriculture and rural development in national development; strategies and models of rural development while emphasizing the processes of social, economic and political integration of rural areas into national society; and rural infrastructure and institutional development. Analysis of special rural development programmes in Nigeria will be undertaken. Furthermore, this is an interdisciplinary course dwelling on the social, political and economic factors in rural development; Theories from sociology, political science, economics, demography, ecology and planning are used to examine the emergence of new forms of social organization and their implications for rural development in Nigeria.

RSE 818: Food and nutrition policy and Food Security (3 units)
The course will examine food production, nutrition policies, population and income-food security link; food sharing and distribution. It will analyse government policy options and established programmes that aim at ensuring food security for rural households. This will encompass adopted approaches, achievements, challenges and impact on rural

households, socio-cultural, political, economic, security and environmental factors that affect food security.

RSE 820: Food Commodity Value Chain Analysis (3 units)
This course examines food production, processing and marketing systems. Assessment of different food production, preparation, processing and preservation techniques will be undertaken, with emphasis on the opportunities and challenges, including implications of the environmental and societal conditions.

RSE 822 Consumer Food Psychology II
Theoretical concepts will be applied to food choice and will show the role that consumer psychology plays in post-harvest losses through the processes of: market segmentation; new product development and the product lifecycle; and societal acceptance of novel foods and technologies. Students will be introduced to and asked to reflect on the wider social, ethical and moral issues that influence food choice decision making and how these affect post-harvest losses.

RSE 824: Project Planning, Monitoring and Evaluation (3 units)
Development of planning, monitoring and evaluation systems, concepts such as participatory planning, monitoring and evaluation, impact assessment, adequacy, efficiency and effectiveness, monitoring indicators, and monitoring formats would be presented and discussed.

RSE 826: Agricultural Extension Communication and Teaching methods (3 units)
The concept of communication, elements of communication and types of communication. Communication barriers, ways of improving interpersonal communication, agricultural extension teaching methods, mass communication, group approaches and individual approaches. The concepts of homophily, heterophily and empathy as they affect effective communication will be studied.

Staff List

S/No.	Name Of Staff	Rank	Qualifications	Status
1.	Gowon Benjamin Ahule	Snr. Lecturer	B.Sc. 1990 (ABU), M.Sc. 1996 (JOS), PhD 2012 (BSU).	Full time
2.	Iyorbee Justin Tseayo	Professor	DPSA 1964 (Oxon), M.A. 1969 (Essex), D.Phil 1972 (Sussex).	Full time
3.	Alegwu Ega Lawrence	Professor	B.Sc.1973 (ABU), M.Sc. 1978, PhD 1980 (Cornell)	Full time
4.	Rev. Fr. Shagbaor Francis Wegh	Professor	B.A. 1986, M.A. 1984, M.Sc. 1986, PhD 1992 (Louvain)	Full time
5.	Idu Ogbe Ode	Professor	B.Sc. 1984 (ABU), M.Sc. 1991, (UNN) PhD. 2005 (Benin)	Full time
6.	Alamveabee Efihraim Idyorough	Professor	B.Sc. 1984, M.Sc. 1989, PhD 2001, MSW 2007 (Jos)	Visiting
7.	Wansua Igbana Ajir	Snr. Lecturer	B.Sc. 1982, M.Sc. 1991 (ABU), PhD 2014 (BSU).	Full time
8.	Agbanugo Agnes Ikwuba (Mrs)	Snr. Lecturer	B.Sc. 1991, M.Sc. 2005, PhD 2012 (BSU)	Full time
9.	Margaret Bai-Tachia	Snr. Lecturer	B.Sc. 1999, M.Sc. 2005 (BSU), PhD (Abuja) 2011	Full time
10.	Terngu Elizabeth Sugh	Snr. Lecturer	B.Sc. 2001, M.Sc. 2005, PhD 2014 (BSU)	Full time
11.	Fasoron Stella Saror (Mrs)	Snr. Lecturer	B.Sc., 1978, MBA 1983, (ABU) PGDE 1989, PhD. 2005 (FUAM)	Part-Time
12.	Shimayohol Daudu	Snr. Lecturer	B.Sc. 1986 (RSUST) M.Sc. 1994, PhD. 2009	Part-Time

			(FUAM).	
13.	Venatus Kakwagh	Snr. Lecturer	B.Sc.1999 , M.Sc. 2005, PhD 2014 (BSU)	Part-Time
14.	Elima Comfort Ugbem (Mrs)	Lecturer I	B.Sc.2000, M.Sc.2005 (BSU) PhD 2015 (Ibadan)	Full time
15.	Timbee James Aan	Lecturer I	B.Sc. 1990, M.Sc. 1995, (Jos)	Full time

DOCTOR OF PHILOSOPHY (PhD) PROGRAMME IN RURAL SOCIOLOGY AND AGRICULTURAL EXTENSION

Philosophy

The underlying philosophy of the Doctor of Philosophy programme in Rural Sociology and Agricultural Extension is to produce competent individuals who are well-grounded in sociological concepts, theories, and the methodology needed to analyze and proffer solutions to problems relating to Rural Sociology and Agricultural Extension at the local, national and global levels.

Rationale

The Doctor of Philosophy programme in Rural Sociology and Agricultural Extension will provide opportunities for advanced knowledge and skill acquisition for careers in the private and public sectors of the national and global economies. The aim is to strengthen the capacity in problem analysis and solving in Rural Sociology and Agricultural Extension. Students should be able to articulate, develop and implement research using Rural Sociology and Agricultural Extension concepts and methodologies.

Objectives

The objective of the PhD in Rural Sociology & Agricultural Extension

a. Is to equip the student with relevant skills in the areas of theory and empirical research.

b. This programme should enable the student to apply Rural Sociology and Agricultural Extension theory to effectively meet the challenges of a dynamic society.
c. After completing the programme, the graduate would be in a better position to appraise agricultural and rural development issues, and contribute towards the national development effort as a teacher, researcher, administrator or entrepreneur.

Admission Requirements: Candidate must have the requisite matriculation requirement of 5 O'Level credits including English language and at least a pass in Mathematics plus credit pass in either Government or History and three other arts/social science subjects. Admission is principally open to all graduates of Sociology, Anthropology, Social Development and Agriculture at Masters Level with an equivalent of "B" grade average or a CGPA of 3.50 on a 5-point scale from Benue State University and other recognized universities.

Student Status: The PhD. programme shall be on part-time or full-time basis. All candidates admitted to the PhD programme are required to have attended 75 in their lectures in the first two semesters at the University. Doctorate students are also required to attend colloquia, guest lectures and Post-Graduate seminars.

Requirements for Graduation:

a. After registration, each full-time student requires a minimum of six (6) Semesters, and a part-time student a minimum of ten (10) Semesters for the programme before being examined for the degree. The duration of the programme shall not exceed ten (10) Semesters for full-time students and fourteen (14) Semesters for part-time students (Postgraduate School General Regulation, 8.3).

b. The PhD. programme consists of a course work component and a thesis. A student is required to complete a minimum of thirty two (32) credit units of course work and 30 credit units of research.

Thesis Proposal Defence:

The Thesis Proposal defence is mainly a departmental affair to which some academics outside the department may be invited. The proposal defence challenges the student to demonstrate sufficient knowledge of the chosen field of study, show that a research issue on which fieldwork is based has been identified. The proposal defence process is made up of two components: written and oral. It is expected that the doctoral candidate presents and defends a thesis proposal of about 20,000 words. The thesis proposal defence is expected at the end of the fourth semester of registration in the doctoral programme.

COURSES

Course Code	Course Title	Credit Units
	CORE COURSES	
	First Semester	
RSE 901	Advanced Theories in Rural Sociology and Agricultural Extension	4
RSE 903	Advanced Research Methods in Rural Sociology and Agricultural Extension	4
RSE 905	Computer Applications in Rural Sociology and Agricultural Extension analysis	4
RSE 907	Entrepreneurship	4
RSE 909	Research Seminar	4
	Second semester	
RSE 902	Comparative Rural Social System	4
RSE 904	Statistical Methods in Rural Sociology and Agricultural Extension	4
RSE 906	Advanced course in area of specialization	4
RSE 908	Thesis	30

Course Synopsis

First Semester

Core Courses

RSE 901: Advanced Theories in Rural Sociology and Agricultural Extension (4 units).

The course aims at deepening knowledge of the students in both classical and contemporary sociological theories and their application in the analysis of rural social systems. The thrust of the course is on understanding the relationship of individual to his social environment with reference to group processes, interaction, social structure and attitudes.

RSE 903 Advanced Research Methods in Rural Sociology and Agricultural Extension (4 Units)

Topics like probability and sampling distribution, contingency problems, correlation and regression analysis of variance, and test statistic will be covered here.

RSE 905: Computer Applications in Rural Sociology and Agricultural Extension Analysis (4 Units)

The practical application of computers in data analysis would be presented with particular emphasis on Statistical Package for Social Sciences (SPSS), Epidemiological Information (Epi Info), Microsoft Excel and other data based programmes. Emphasis would also be placed on the use of computers in sampling distribution and parameter estimation. Furthermore the use of computers and other inferential statistical tools are presented discussed.

RSE 807: Issues in Entrepreneurship (3 units)

The course will discuss issues surrounding the definition and conceptualization of entrepreneurship from the perspective of various social science disciplines. Theories and models of entrepreneurship with respect to the push and pull factors in entrepreneurship development, barriers to entrepreneurship development will be

examined. The role of entrepreneurship in national economic development and in the global economy will be also examined.

Second Semester

Core Courses

RSE 902: Comparative Rural Social Systems (4 units)

This course will involve an in-depth analysis of selected rural and agricultural systems with reference to organization and institutions; and comparative analysis of rural communities in different social settings with respect to elements and processes of social change, innovation and decision-making, communication and diffusion, leadership and social action, e.g. systems of managing agriculture in different societies.

RSE 904: Statistical Methods in Rural Sociology and Agricultural Extension (4 Units)

The focus is on logic of scientific social inquiry, ethical and epistemological problems of research in Africa, sampling problem, survey research, qualitative and quantitative methods with computer application.

Advanced course in area of specialization – Independent Study (4 units)

Students are expected to take an advanced course in their own areas of specialization. The aim is for the students to broaden their academic scope. This will involve specialized areas in the field of Rural Sociology and Agricultural Extension such as:

RSE 910: Agrarian systems
RSE 912: Agricultural Extension organization and Administration
RSE 914: Agricultural Cooperatives and Farmer organizations
RSE 916: Programme Planning, Monitoring and Evaluation
RSE 918: Agricultural/Rural Development process and programme implementation issues
RSE 920: Gender roles and Gender mainstreaming in programmes

RSE 922: Food policy and Food security
RSE 924: Food Psychology
RSE 926: Comparative Extension Systems
RSE 928: Indigenous Knowledge Systems
RSE 930: Leadership in Community Development

RSE 909 Research Seminar (4 Units)

This seminar will involve selected topics in Rural Sociology and Agricultural Extension. This seminar is the first opportunity for the student to demonstrate research competence before embarking on fieldwork.

RSE 908: Thesis (30 Units)

Ph.D. students are expected to choose a topic in the field of Rural Sociology and Agricultural Extension for a field or library research. A Thesis of a minimum of 150 pages would be written on such topic and presented. Students are expected to display a good knowledge in the formulation of a research problem and research questions, the setting of research objectives, formulation of basic assumptions or hypothesis, a wealth of exposure to literature, selection of a research methodology/instrument, and a good knowledge of data analysis, interpretation and recommendations.

Staff List

S/No.	Name of Staff	Rank	Qualifications obtained	Status
1.	Gowon Benjamin Ahule	Snr. Lecturer	B.Sc. 1990 (ABU), M.Sc. 1996 (JOS), PhD 2012 (BSU).	Full time
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12.	Shimayohol Daudu	Snr. Lecturer	B.Sc. 1986 (RSUST) M.Sc. 1994, PhD. 2009 (FUAM).	Part-Time
13.	Venatus Kakwagh	Snr. Lecturer	B.Sc.1999 , M.Sc. 2005, PhD 2014 (BSU)	Part-Time
14.	Elima Comfort Ugbem (Mrs)	Lecturer I	B.Sc.2000, M.Sc.2005 (BSU) PhD 2015 (Ibadan)	Full time
15.	Timbee James Aan	Lecturer I	B.Sc. 1990, M.Sc. 1995, (Jos)	Full time

CHAPTER SEVEN

DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION

M.Sc. PROGRAMME POST HARVEST ENGINEERING AND TECHNOLOGY.

Philosophy

The M.Sc. Programme in Post-Harvest Engineering and Technology for Food Processing and Preservation is aimed at training graduates to acquire skills and knowledge in the field of Food Processing and Preservation Technology in Nigeria, Africa and the World at large. Experts in this field are needed as field extension staff, researchers, plant developers and managers as well as general entrepreneurs in the specialized Agricultural business of Food Crop Processing and Preservation. This is necessary for value chain addition to prevent Post-Harvest losses and guarantee quality products that can ensure market penetration, availability, and consumption and extended shelf life. The programme would provide the students with the platform to obtain in-depth training in Mechanical Technology theory and practices, including processing and preservation technologies, both artisanal and advanced, for value chain addition and improvement of incomes and livelihoods for the "technology entrepreneur" of the new millennium.

Rationale

In view of the current level of Technological achievements and the potential for continuous advancement in the future, there is obvious need to strengthen the training of graduates in design and fabrication of food and crop storage equipment and facilities.

The Department of Vocational and Technical Education has therefore, designed this master's degree programme to cater for research and

human capital developmental needs in curbing Post-Harvest loses in the immediate environment as well as the wider society.

Objectives of the Programme

The postgraduate programme is designed to:

(i) Impact a deeper knowledge and training in design and fabrication of post-harvest equipment and facilities.

(ii) Produce knowledgeable and highly skilled technical manpower with high level competence in post-harvest loss reduction.

(iii) Broaden the understanding of the students in the subjects with emphasis on the applied aspect especially as they relate to environment, food technology, equipment and facilities.

(iv) Meet the manpower needs of Tertiary Institutions, industries, government ministries and parastatals.

Admission Requirements

All candidates for M.Sc Post Harvest Engineering and Technology must in addition to satisfying the Benue State University Postgraduate School requirements for admission, also satisfy any one of the under listed requirements.

(a) Graduates of Benue State University, Makurdi who have obtained at least a Second-class honours degree with a CGPA of not less than 60% weighted average or its equivalent in Industrial, Technical and Technology Education related courses.

(b) Graduates of related disciplines in Engineering and Technology who have obtained a Second Class Honours with a CGPA of not less than 60% weighted average.

(c) Holders of the Higher National Diploma or Third Class degree in Engineering/Technology related courses who have in addition obtained a Post Graduate Diploma in such courses at credit level and above.

(d) Evidence that they meet the matriculation requirements of Benue State University.
(e) Evidence of NYSC discharge certificate or exemption/exclusion certificate is required.
(f) Candidates may only be admitted for master's degree, if their transcripts for certificates are received at Postgraduate school at the time of consideration of application for admission.

Mode of Study

The M.Sc. Post-Harvest Engineering and Technology dissertation can be in any or combinations of the component areas of the programme, namely: Mechanical, Electrical and Refrigeration technology. The mode of study for M.Sc. degree is by comprehensive course work to be examined in oral and written papers, special projects and activities together with original research work embedded in a M.Sc. Technology dissertation.

Residency/Duration of Study

The duration of the programme is stipulated in the Regulations Governing Postgraduate degrees issued by Benue State University Makurdi. Thus, the maximum and minimum duration of M.Sc. Post-Harvest Engineering and Technology programme shall be:

Full-Time **Minimum -** 4 Semesters
Maximum - 6 Semesters

For extension beyond this maximum period a special permission of the university senate shall be required.

Graduation Requirements

To qualify for the award of the M.Sc. degree in Post-Harvest Engineering and Technology, the candidate must have fulfilled the following requirements:

i. Candidates must have duly registered for each semester and paid all the prescribed fees.

ii. Candidates must have registered and passed all the prescribed courses and earned a minimum of 38 credit units. Candidates shall be required to achieve a minimum grade of "C" in each course in order to pass the course work.
iii. Candidates must obtain a Cumulative Grade Point Average (CGPA) of 2.5 in order to graduate.
iv. Candidates must have submitted a dissertation not exceeding 30,000 words in length. Candidates must successfully defend the dissertation at an oral examination.
v. Candidates must have attended 75% of all lectures and must be present at all departmental workshops and seminars.
vi. The award of the M.Sc. degree in Post-harvest engineering and technology shall further be governed by regulations guiding similar programmes prescribed from time to time by the University Postgraduate Scho

Course Work Grading

(a) Course Work Examination: This shall consist of ;
   i. Continuous assessment (30%)
   ii. Written examination (70%)

A pass mark is as specified by the Postgraduate School. Computation of GPA and CGPA shall normally be on the course registered.

A pass mark is as specified by the Postgraduate School. Computation of GPA and CGPA shall normally be on the courses registered.

(b) **Seminar:** This shall consist of
   i. Oral presentation assessment (30%)
   ii. Major Supervisor assessment (70%)

(c) **Project:** Supervisors may be assigned to eligible students within the first semester of the second year of the M.Sc. programme but assessed and graded at the end of second semester. The grading shall be 'Pass' or 'Fail', at the defense which will follow the format provided by the postgraduate school.

First Semester

S/N	Course Code	Course Title	Credit Units
1.	VTE 801	Advanced Research Methods	2
2.	VTE 807	Food Engineering	2
3.	MTE 805	Computer Aided Drafting	2
4.	MTE 807	Design for Environmental Control	2
5.	MTE 809	Cold Storage	2
6.	MTE 811	Produce Packaging System	2
7.	VES 801	Technology Entrepreneurship	2
8.	ETE 803	Alternative Energy Resources in Food Processing	2
Electives: Choose between 4 – 6 credit units			
9.	TED 801	Advanced Engineering Mathematics	2
10.	ETE 805	Energy Saving Mechanisms in Food Processing	2
11.	PHY 853	Thermodynamics, Refrigeration and Energy Balances	3
12.	HPM 801	Post-Harvest Physiology, Technology, and Management	2
TOTAL			**18 - 24**

Second Semester

S/No	Course code	Course Title	Credit Units
1	VTE 802	Advanced Statistics for Engineering and Technology	2
2	MTE 802	Farm Structures and Storage Facilities	2
3	MTE 806	Advanced Computer Aided Design	2
4	MTE 808	Food Equipment Design, Construction, and Material Selection.	2
5	MTE 812	Packing Technology	2

5	VTE 810	Dissertation	10
6	ETE 804	Control and Automation in Food Processing.	2
7	VES 802	Internship	2
	Elective: Choose 2 – 4 credit units		
1	ETE 806	Electrical/Electronic Prospecting, Equipment Repairs and Maintenance	2
2	MTE 810	Food Drying	2
	FPM 802	Food standard Quality Control and Assurance	3
TOTAL			**22 - 26**

Course Synopsis

VTE 801 Advanced Research Methods (2Credit Units)

To acquire an understanding of the generic nature of the research process; the methods employed in scientific problem solving approaches, formulation of research questions and hypotheses, justification of study, review of literature, design of the study, population and sample, sampling technique, validity and reliability, instrumentation, methods of data analysis, summary, conclusion and recommendations. Presentation of research proposals and technical reports etc.

VTE 807 Food Engineering (2Credit Units)

Principles underlying unit processes. Heat treatment of food including sterilization, pasteurization, evaporation, dehydration, etc. Factors affecting choice of methods. Canning theory and technology. Food packaging, refrigeration energy conservation and management.

MTE 805 Computer Aided Drafting (2 Credit Units)

Students will be provided the opportunity to become proficient in virtual product development within the context of the research and

development of a new product in response to an executive brief. Upon completion the students will have experience of undertaking the rigorous research required for modern engineering product design and the methods, techniques and virtues of the virtual prototyping process. Content include; Introduction to Computer Aided Drafting (CAD); Design intent, Robust Modeling, Materials Properties and selection for purpose. Introduction to CAE; virtual prototyping and testing Static and dynamic analysis. Electrical drawing for building purpose and other circuits understanding of Electrical symbols, theory and principles of illuminations.

MTE 807 Design for Environmental Control (2Credit Units)

To provide students with the fundamental knowledge necessary to understand structural and environment control design parameters for agricultural buildings. Train the students in the use of current computational software and computer data acquisition and control equipment used for analysis of environmental design, environmental monitoring and control, and analysis of environmental control systems.

- Environmental System
- Psychometrics
- Heat and Moisture Transfer
- Insulation
- Steady State heat transfer
- Determination of type and thickness of insulation
- Determination of type and thickness of vapor barrier
- Analysis of Environmental systems
- Energy loads from livestock
- Greenhouse systems
- Energy Balances and Environmental Control Components
- Fans and evaporative coolers
- Polyphase Energy meters
- Testing of energy meters

- Frequency meters
- Measurement of power
- Heaters and refrigeration
- Humidification and dehumidification
- Analysis of weather data
- Solar energy considerations
- Environmental Control Systems
- Data acquisition and Control algorithms

MTE 809 Cold Storage (2 Credit Units)

Heat load estimation for design and construction of cold-rooms for food preservation as well as refrigeration and cooling systems including cabinet display case, fast-freezers, dry-freezers and multi-temperature cold-rooms. Special considerations for humidity, design temperature, k-factors, condensing unit sizing, evaporator sizing, cabinet sizing and insulation. The course emphasis is on the provision of refrigeration requirements for different food products through practical fabrication and installation of cold-rooms for long term storage and transportation.

MTE 810 Drying of Foods 3(3-0-9)

Moist air properties. Air movement. Equilibrium moisture contents, thermos-physical properties of food. Analysis of food drying: fixed- bed and moving-bed drying, spray drying, drum drying. Solar drying: natural and forced convection, type of solar dryers. Mathematical modelling of drying process and drying mechanics.

VES 801 Technology Entrepreneurship (2 Credit Units)

The course will cover business environment, general management, financial management, entrepreneurship development, feasibility studies, marketing and managerial problem solving. Concepts of innovation, creativity and potency, studies on small scale enterprise and cottage level product development; hands on practical experience to establish bakeries; fish processing firm; oil expression and refining;

fruit juice bottling and canning; food processing and preservation etc (Invitation of successful entrepreneurs to give seminars). Preparation costing, training on personnel management, time management, and marketing.

ETE 803 Alternative Energy Resources in Food Processing (2 Credit Units)

Wind energy-pattern of world energy consumption, solar charge and non-fossil fuel. The standards for testing solar collectors and storage device, solar energy applied to homes, solar heaters, solar cookers, space cooling, circuit services, water, planning solar energy utilization in houses and industries for food processing, estimating cost; problems of tracking the sun in concentrating collectors, the method of dimensions in design theory. LED and semiconductor laser radioactive transition, Light-Emitting Diodes, Semi-conductor laser, operating characteristics, photo detector, photoconductor, photodiodes and avalanche diode photo transistors.

MTE 811 Produce Packaging System

Physical and chemical properties of packaging materials. Packing and packaging system. Preparing produce for packaging. Mathematical models to produce packs. Computerized pallet and container dimension. Wholesale and retail produce packaging. Shipping containers and transport system. Graphic and package design. Governmental regulations, public health aspects associated with produce packaging. Recycling.

MTE 812 Packing Technology

Packing technology system, selection and protective test of packages in relation to handling and transportation and its impact, Effect of packages to the product quality. Types and quality of material for suitable packages. Development of the graphic and structural design of packages.

ETE 805 Energy Saving Mechanisms in Food Processing (2 Credit Units)

Achieving energy saving for food processing with: Motors, gearing, variable frequency drives, soft starts, belting, thread sealants and inverters. Energy conservation and efficiency in food processing; and improving energy efficiency.

TED 801 Advanced Engineering Mathematics (2 Credits)

Linear and complex algebra – Numerical analysis of matrices, determinants; inverse of a matrix. Trigonometric, exponential and logarithmic fornications. Real number, sequences and series. Theory of linear and non-linear equations, Eigen values and Eigen vectors. Analytic geometry – Co-ordinate transformation – solid geometry, polar, cylindrical and spherical coordinates. Differentiation and integration. Ordinary and partial differential equations. Numerical differentiation, solution of ordinary differential equations. Elements of linear algebra. Elements of functions of several variables. Curve fitting. Simple linear programming. Fourier series – Ruler coefficient, even and odd functions, some and cosine functions, simple applications. Differential equations of second order series solutions. Legend and Bessel functions and their properties. Vector theory – Dot product, cross product, divergence, and curl and Del operators. Gradient; line, surface and volume integrals and related theorems.

VTE 802 Advanced Statistics for Engineering and Technology (2 Credit Units)

Exploring Data with Graphs, Exploring Assumptions, Examination and utilization of mathematical and statistical tools in solving problems and decision making. Use of parametric and non-parametric statistics such as: Comparing two means (t-tests), Comparing Several Means: ANOVA, Analysis of Covariance (ANCOVA), Factorial ANOVA, Repeated Measures Designs, Mixed Designs, Correlation, Regression,

Categorical Data, Logistic Regression, Exploratory Factor Analysis, Causal Modeling: Path Analysis and Structural Equation Modeling. Presentation Introducing Application Project.

MTE 802 Farm Structures and Storage Facilities (2 Credit Units)

Introduction to agricultural structures. Selection of materials in relation to use – steel, wood, concrete and masonry. Types of structural frames. Estimating loads on agricultural structures (such as Livestock housing, Plants production, Storage), stress analysis. Introduction to structural design. Philosophy of design, elastic and plastic design concepts. Design of concrete, Wood and Steel structures. Design for axial loadings. Design of beams, foundation, slab, columns, connections and joints. Computer Methods for Drafting and Structural Analysis. This course should culminate into a design project to be completed by the students.

MTE 806 Advanced Computer Aided Design (2 Credit Units)

The module provides engineering and product design students with an introduction to the use of advanced features and analysis tools that form part of most contemporary 3D CAD systems. The module covers advanced solid modeling aspects and introduces surface modeling techniques for the creation of more advanced product geometry. A brief introduction is then made to computer aided engineering and then extends into the use of finite element analysis and computational fluid dynamics as design optimization tools.

Content includes: Advanced Solid Modeling; Advanced Drawing; Surface Modeling; Stress, frequency and thermal analysis; design optimization.

MTE 808 Food Equipment Design, Construction and Material Selection.

(2Credit Units)

Principle of machine design and construction of simple food handling and processing equipment such as juice extractors, garri processors, yam pounders and other food processors. Construction and operation of food equipment for cleaning, sorting, grading, mixing, homogenization, centrifugation and filtration. Choice of materials for construction of equipment. Efforts should be geared towards improving upon the available local technology. Mechanisms in food dehydration. Trends in food dehydration. Detailed treatments in the principles, design and construction of drying equipment such as solar dryer, spray dryer, drum dryer, fluidized bed dryer and cabinet dryer.

VTE 810 Research/ Design Project (Dissertation/Written Work) (10 Credit Units)

An original research will be carried out in a topic chosen from the area of specialization under the supervision of an academic staff not below the rank of lecturer I.

VES 802 Internship (2 Credit Units)

The student is expected to liaise with the Postgraduate Coordinator for the details of the Internship programme (The internship duration should last 3months).

ETE 804 Control and Automation in Food Processing. (2 Credit Units)

Sensors and transducers, signal conditioning data acquisition systems, data transmission and telemetry, Display devices and recorders, microprocessors and controllers.

ETE 806 Electrical/Electronic Prospecting, Equipment Repairs and Maintenance (2 Credit Units)

Maintenance management, factors affecting maintenance, predictive, preventive and corrective maintenance, value analysis. Fault diagnostic techniques in electronic system, analogue and digital system. Common defects in electronic system, convectional electronic test tools, dedicated instruments. Fault detection and location, methods of fault location; sequential and non-sequential methods of fault allocation, systematic fault tracing and fault rectification, the complete maintenance circle. Repair system, spare part management and modern trends in fault diagnosis with respect to food processing equipment. Electrical potentials in food processing: Theory, interpretation techniques, computer modeling and inversion of electrical resistively data. Wiring, perspective of electric cookers, ovens, and heaters. Rewinding of motor and transformer coils. Electrical installation works of all types on buildings, laboratory, workshops and processing plants. IFE regulations on distribution boards, fuses, conductors, insulators, cookers, heaters, air conditions etc.

ETE 808 Food Drying (2 Credit Units)

Moist air properties. Air movement Equilibrium moisture contents, thermo-physical properties of food. Analysis of food drying: fixed bed and moving-bed drying, spray drying, and drum drying. Solar drying: natural and forced connection type of solar dryer. Mathematical modeling of drying process and drying mechanics.

PHM 801 Post Harvest Handling of Crops (2 Credit Units)

Advanced Post Harvest Technology. Causes of Postharvest Losses, Postharvest Treatments to Minimize Produce Contamination and Maximize Quality Crop Processing.

PHM 809 Postharvest Physiology and Technology (2 Credit Units)

Overview of physiological processes related to maturation and senescence of plant products and their responses to postharvest stresses. Targeted approaches and technologies to maintain product quality and limit postharvest disorders.

PHY 853 Thermodynamics, Refrigeration and Energy Balances (3 Credit Units)

Temperature; Heat and Enthalpy; Basic principles and laws of thermodynamics; Classification of phase transitions; Heat transfer in foods; Calorific value of foods; Calorific (energy) equivalent of the human body; Measurement of calorific (combustion) values; Thermal analysis; Thermoelectric refrigeration; Vortex tube refrigeration; Industrial refrigeration; Residential refrigeration; Commercial refrigeration; Low temperature refrigeration; solar refrigeration; Food preservation: Causes of food spoilage, advantages of food preservation, methods of food preservation, food preservation by refrigeration, cold storage for food preservation; Energy balances.

List of Staff

S/N	**Name**	**Qualification/ Institution**	**Rank**	**Specialization**
1.	Benedict Iorzer Labe	PhD (Yola) - 2012 M. Tech. Industrial Technology Education (Yola) – 2006 B.Tech. Ed. Mechanical	Associate Professor/Acting Head of Department	Mechanical Technology

		Production Technology (Yola) – 2001		
2.	Livinus Chwukura Ezugu	PhD (UNN) – 2004 M.Sc. Ind. Tech. Ed. (ISU) – 1987 B.Sc. Ind. Tech. Ed. (UNN) 1983	Professor	Electrical Technology
3.	Joseph Shi-an Alakali	PhD(U.A.M) – 2004 M. Eng. Agric Eng (UNN) – 1990 B.Eng. Agric Eng. Uni-Jos) – 1987	Professor	Mechanical Engineering
4.	Simon V. Irtwange	PhD (Ibadan) M. Eng (Unn) B.Tech (Akure)	Professor	Agric. Engineering
5.	Elizabeth Mngusen Kembe	PhD (Jos) – 2006 M.Ed. (UNN)1997 B.d. (Zaria) 1987	Professor	Home Economics
6.	Solomon Kwaghkur Agishi	PhD (UNN) – 2010 M.Ed. (UNN) – 1998 B.Sc. (Norfolk) 1988	Associate Professor	Construction Technology
7.	Simon Iordye Andural	PhD (Yola) – 2010 M.Ind. Ed.	Associate Professor	Construction Technology

		(USA)- 1988 B.Sc. Ind. Ed. (USA) - 1983		
8.	T. U. Nwakonobi	PhD (UNN)	Associate Professor	Agric. Engineering
9.	Daniel Momngu Tiough	PhD(UNN) – M.Ed Ind. Tech. Edu. (UNN) - 2005 B.Sc.Voc & Ind. Edu. (Norfolk) – 1987	Senior Lecturer	Construction Technology
10	Joy Obiagali Nwokolo-Ojo	PhD(UNN) – 2010 M.Ed. Ind. Tech (UNN) – 2005 B.Ed Tech. (UNN) – 1992.	Senior Lecturer	Mechanical Technology
11	Elijah Akaakase Hime,	PhD (Yola)- 2013 M.Ed. Ind.Tech. (Yola) – 2006 B.Tech Ed. (Yola) - 1998	Senior Lecturer	Construction Technology
12	Polycarp Mtswenen Nyiahule	M.Sc.Wisconsin (USA)- 1983 B.Sc. Wisconsin (USA)	Lecturer I	Refrigeration and Air-conditioning
13	Nathaniel Nguuma Afaor	M.Ed.(UNN) M.Ed. Ind. Tech. Ed (UNN) – 2007 B.Ed. Tech (Kaduna) - 2001	Lecturer I	Electrical/Electronic Technology
14	Michael Mlahaga Iorbee	PhD (Yola)- 2016 M.Tech. Ind. Tech. Ed. (Yola)	Lecturer I	Electrical/Electronic

		2007 B.Tech. Ed. (Yola) 1999		Technology
15	T. D. Ipilakyaa	PhD (UAM)	Lecturer I	Mechanical Engineering
16	B. Anaka	PhD (UAM)	Lecturer I	Agric. Engineering
17	Engr. M. Ekoja	M.Eng. (UAM)	Lecturer I	Mechanical Engineering
18	Boniface Kwaghar Nande	PhD(UNN)- 2013 M.Sc. Ind. Tech. Edu.(UNN) 2002 B.Sc. Ind. Tech. Edu. (UNN) 1994	Lecturer I	Electrical/Electronic Technology

CHAPTER EIGHT

PROCEDURE FOR REPORTING AND HANDLING OF EXAMINATION IRREGULARITY, MISCONDUCT AND MALPRACTICE

EXAMINATION IRREGULARITY, MISCONDUCT, MALPRACTICE AND CORRESPONDING SANCTIONS

Any of the following shall prima facie constitute examination irregularity, misconduct or malpractice.

Irregularity

Irregularity shall be deemed to have occurred if the candidate sits for an examination for which he/she is not eligible as may occur when the candidate.

(a) Does not register for the approved course

(b) Does not satisfy the attendance requirements of 75%

(c) Has not complied with any other requirements(s) prescribed by the Senate, Faculty of Department. Sanctions: Candidate whose positions are irregular as identified under this heading shall not be allowed to sit for the examination. Where the irregularity is discovered after the conditions shall be nullified.

Misconduct

Misconduct shall be deemed to have occurred under the following instances.

(i) Failure to observe silence. The only permissive way for attracting the invigilator is by the candidate raising up his hand.

(ii) Smoking in the Examination hall or rooms when an examination is in progress.

(iii) Act(s) of insubordination or insolence to-the- investigator(s)

(iv) Fighting in the examination hall

(v) Any act(s) of commission or omission that may negatively affect the smooth conduct of the examination.

Sanctions: All cases of misconduct shall attract a written warning issued by the Dean and copied the Registrar. Except that candidate guilty of (iv) shall in addition have their case referred to student' Disciplinary Committee.

Malpractice

Examination malpractice shall be deemed to have occurred under the following:

a) Any act of omission which contravenes any of the provisions of section 3 (2) of the miscellaneous Offences Decree of 1984.

(b) Any unlawful attempts, acts, omissions, successful or unsuccessful, directed at obtaining re-knowledge of examination question(s) or influencing the marking of scripts or award of marks by the University or External examiner.

(c) Any attempt, successful or unsuccessful to impersonate a candidate in any university examination.

The following shall constitute impersonation:

(i) Writing examination for a candidate

(ii) The exchange of examination numbers of names or answer script/sheets

(iii) The intentional use of someone else's examination number.

(d) Introduction of relevant foreign materials and cheat notes into the examination hall, whether used (copied from, consumed) or not. Relevant materials shall be taken to refer any material that is considered to be relevant to the subject matter or course being examined irrespective of whether it is relevant to the specific examination questions of the subject matter course or not.

(e) Exchange of relevant materials in the examination hall while the examination is in progress. These materials may involve any of the following:-

(i) Question paper containing relevant jottings and materials

(ii) Collaborated copying

(iii) Exchange of answer scripts.

(f) Any unlawful attempt, whether successful or unsuccessful to:-

(i) Remove submitted examination answer script(s) or material

(ii) Alter, add or delete any written materials in the submitted answer script(s) after the examination,

(iii) Replaces submitted examination scripts(s) with extraneous one after the examination either in part or in whole.

(iv) Submit manuscript not written under supervision in the examination hall during or after the examination.

(v) Destroy submitted examination scripts or materials by fire or any other method.

(g) Theft or removal of examination script/materials, whether used or not

(h) Consulting notes and other relevant materials outside the examination hall when such a candidate has not yet submitted his/her script(s)

(i) Assisting facilitating, adding or abetting cheating.
Leaving the examination room without permission, and later returning to continue with the examination.

(k) Receiving or giving irregular assistance.

(i) Non-submission or incomplete submission of answer scripts.

(rn) Uncollaborated copying grafting inspite of a written (as maybe

(n) Writing on question paper/script) page of answer booklet and/or any material other than the examination booklet and sheets supplied by the University.

Sanctions

(i) Expulsion A candidate found guilty of any examination malpractices (a) to (h) above shall be punishable by expulsion.

(ii) Rustication A candidate found guilty of any examination malpractice (i) to (k) above shall be punishable by rustication for a minimum period of one academic year. A student who is so suspected shall upon his/her return, continue with the academic programme where he/she stopped.

Cancellation of Relevant Examination Paper (s)

A candidate found guilty of any examination malpractice (i) to (k) above shall be pushiable by cancellation of the relevant examination paper(s). Any candidate whose paper is so cancelled shall be required to carry over the affected course(s).

PROCEDURE FOR REPORTING AND HANDLING CASES OF EXAMINATION IRREGULARITY MISCONDUCT AND MALPRACTICE.

Any alleged examination malpractice misconduct and irregularity shall be disposed of in accordance with the procedure herein out lined.

(i) Where the alleged offence was-discovered before the examination the staff or any other person who made the tidings shall be required to make a report to the Head of department who shall forward this among with his comments to the Dean of the faculty without delay. Where there are reports of leakage before the examination the submission to head of Department shall include the leakage questions. Where the head of department confirms the leakage he may advise the Dean accordingly.

(ii) Where the alleged offence was discovered or notified after the examination the finding shall forward a written report giving details of the offence together with script(s) of the affected

candidate(s) and any other relevant documents or materials to the head of department who shall forward same with his/her comments to the Dean without delay.

(iii) The Dean shall on receipt of the report memorandum and any other relevant documents or materials immediately refer the matter to the relevant Faculty committee for investigation and report. The Dean shall deliver to the committee all the relevant documents and materials relating to the matter as deposited with him.

(iv) The Faculty committee shall without delay examine all the relevant documents and materials and shall in that regard have power to call for further documents, or oral statements if need be from any students, shall or other persons who are concerned in the report. The Committee shall investigate the matter further and report its findings through the Dean to the Faculty Board.

(v) The Faculty Committee shall consider each case on its merit and where a prime facie case of examination malpractice, misconduct or irregularity has been established, the Faculty Board, through the Dean shall refer the matter further to the vice- chancellor, together with a copy of the report of the Faculty committee and other relevant documents and materials.

(vi) The vice-chancellor shall, on receipt of the other supporting documents and materials further refer the matter to the senate Committee on Examination regulations and irregularities. The committee shall carefully examine and may, if considered necessary, take oral evidence from all concerned (students staff or outsiders).

(vii) The Senate committee shall, after full consideration the matter shall be recommended to the Senate for appropriate penalty if it finds a student guilty. If not, it shall recommend a discharge.

(viii) The committee's report decision and recommendation shall be tabled before the full meeting of the Senate as early as possible. The full senate shall have the power to adopt, reject, modify or amend the decision and/or recommendation of the committee.

(ix) The Registrar shall convey in writing to a student whose guilt has been confirmed by the senate. The Senate committee together with the punishment imposed. The student shall however have the right to appeal to the University Council within fourteen (14) days.

(x) Where a prime facie case has not been established, the affected student(s) or staff shall be discharged save that the Vice-chancellor may re-open the case by referring the matter to the Senate Committee on Examination Regulation and Irregularities, if he is in possession of further evidence or information or has other reason to do so.

(xi) Where a staff of the University has been found guilty of examination malpractice misconduct or irregularity, his case shall be referred to the appropriate Staff Disciplinary Committee for appropriate panel.

(xii) Where a person who is neither a student nor a staff of the University has been found guilty of examination malpractice, misconduct or irregularity his case shall be reported to the appropriate penalty.

All organs of committee dealing with matters relating to examination malpractice, misconduct or irregularity shall act with dispatch on a such matters referred to then on the basis that all such matters in any particular academic year MUST be disposed of before commencement of a new session.

CHAPTER NINE

BENUE STATE UNIVERSITY SEXUAL MISCONDUCT POLICY STATEMENT

It is the policy of Benue State University to prohibit misconduct of employees and students on the basis of sex.

The purpose of this policy is to manage incidences of Sexual Misconduct at the University and to contribute to maintaining a campus culture of inclusivity and respect; upholding the rights of Employees and Students to fair treatment.

This policy expresses the behaviour expected of the University Community regarding Sexual Misconduct.

Definitions of Consent within the concept of this sexual misconduct policy document

Consent is affirmative, conscious, voluntary, and revocable. Consent to sexual activity requires of each person an affirmative, conscious, and voluntary agreement to engage in sexual activity. ‚ence‘‘‘

It is the responsibility of each person to ensure they have the affirmative consent of the other to engage in the sexual activity. Lack of protest, lack of resistance, or silence do not, alone, constitute consent. Affirmative consent must be ongoing and can be revoked at any time during sexual activity.

The existence of a dating relationship or past sexual relations between the Complainant and Respondent will never by itself be assumed to be an indicator of consent (nor will subsequent sexual relations or dating relationship alone suffice as evidence of consent to prior conduct).

The Respondent’s belief that the Complainant consented will not provide a valid defence unless the belief was actual and reasonable. In making this determination, the factfinder will consider all of the facts and circumstances the Respondent knew,

or reasonably should have known, at the time. In particular, the Respondent's belief is not a valid defence where:

1. The Respondent's belief arose from the Respondent's own intoxication or recklessness;
2. The Respondent did not take reasonable steps, in the circumstances known to the Respondent at the time, to ascertain whether the Complainant affirmatively consented; or
3. The Respondent knew or a reasonable person should have known that the Complainant was unable to consent because the Complainant was incapacitated, in that the Complainant was:

a. asleep or unconscious;

b. unable to understand the fact, nature, or extent of the sexual activity due to the influence of drugs, alcohol, or medication; or

c. unable to communicate due to a mental or physical condition.

Note: Incapacitation is a state beyond drunkenness or intoxication. A person is not necessarily incapacitated merely as a result of drinking, using drugs, or taking medication. Sexual Misconduct

Sexual Misconduct is instances of:

- Sexual Harassment
- Sexual Violence
- Sexual Abuse

Sexual Harassment

Sexual Harassment is defined in legislation as conduct with a sexual component which is unwelcome, unsolicited and unreciprocated. Sexual Harassment means advances, requests for sexual favours, and any verbal, non verbal, visual or physical conduct of a sexual nature and includes:

• Unwanted touching or pinching the skin to arouse or excite sexual feeling.
• Unwanted sexual looks, gestures, comments, jokes, teasing, remarks, questions or laughter.
• Unwanted sexual notes, letters, telephone calls or materials, using a computer or any communication or related device, electronic or mechanical, to convey sexual messages.
• Unwanted sexual pressure for dating a woman or a man.
• Sexual-related images associated with certain words such as girl, babe, honey, sweetheart, sugar, darling, etc.
• Whistling at someone with sexual intention.
• Converting talks at work places into sexual discussions at both working and leisure hours.
• Sexual hugging, embracing, kissing, patting or stroking someone.
• Telling lies, spreading rumours, gossiping or blackmailing about an individual's personal sexual life.
• Sexual comments or remarks about a person's body dress, appearance, voice, face or manner of walking.
• Sexual games, sports, singing or dancing at the leisure centre.
• Expressions of sexual innuendoes or remarks.
• Asking questions about someone's sexual life, history, preferences, interests or fantasies.
• Touching someone's sensitive part of the body, hair, dress or jewelry in a sexual-motivating manner.
• Displaying sexually suggestive signs or signals for drawing someone's attention to unexpressed sexual desire.
• Unsolicited, unwelcome flirtations, advances, and/or propositions of a sexual nature;
• Insults, jokes etc or anecdotes that belittle or demean an individual or a group's sexuality or gender;

• Unwelcomed sexually-oriented gestures, verbal expressions, or comments of a sexual nature about an individual's body, clothing, or sexual experience;
• Inappropriate displays of sexually suggestive objects or pictures;
• Unnecessary and inappropriate touching, such as patting, pinching, hugging, or brushing against an individual's body;
• Suggestions that submission to or rejection of sexual advances will affect decisions regarding such matters as an individual's assignments, examination, tests, job evaluation, promotion, etc.

Sexual Harassment involving persistent following or stalking, and indecent exposure, may be considered sexual assault and possibly a criminal offence. Any individual who is subjected to such incidents should seek advice and support concerning reporting the matter to the police and/or the University Management.
Sexual Harassment may be perpetrated or experienced by people of any sexual orientation or gender identity.
Sexual Harassment may be a single incident or a persistent pattern of unwelcome behaviour.
Sexual Harassment does not include mutual attraction and consensual romantic involvement or friendship.
The University may consider behaviour to constitute Sexual Harassment if individual relationships change and non-consensual, unwelcome and unreciprocated behaviours continue.
Unwanted sexual touching and incidents that occurred before the age of 15 are not included; the University considers this Sexual Abuse.

Sexual Violence
Sexual Violence will mean instances of:
• Sexual Assault

• Sexual Threat

Sexual Violence involving a physically violent and/or coercive component, or threats of physical violence, such as physical molestation or assault, may constitute a criminal offence.

Sexual Violence may be perpetrated or experienced by people of any sexual orientation or gender identity.

Sexual Violence may be a single incident or a persistent pattern of unwelcome behaviour.

Unwanted sexual touching and incidents that occurred before the age of 15 are not included; the University considers this Sexual Abuse.

Sexual Assault

Sexual Assault may mean unwanted sexual acts or behaviours which an individual did not consent to, or was not able to consent to, through the use of physical force, intimidation or coercion, including but not limited to:

• aggravated sexual assault (sexual assault with a weapon)

• attempted rape

• indecent assault

• penetration by objects and forced sexual activity that did not end in penetration

• rape (sexual penetration without consent).

Sexual Threat

Sexual Threat will mean an act of a sexual nature carried out against an individual's will through the use of physical force, intimidation or coercion made face-to-face.

Sexual Abuse

Sexual Abuse will mean Sexual Harassment and/or Sexual Violence and/or any other sexual activity involving a child (under the age of 15), beyond their understanding or contrary to currently accepted community standards.

Institutional Scope

The scope of this policy extends to all University Community premises and includes but is not limited to the University:

- campuses
- managed employee accommodation
- managed student accommodation
- sporting and recreational clubs and facilities to the extent that they fall within the University Community
- managed digital environments
- activities and situations related to University business that are not conducted on University premises, including but not limited to:
- field trips
- conferences
- student's camps
- inter-University events
- parties and other social functions.

Sexual Misconduct on Premises Outside of the University Community

A member of the University Community may, while performing duties as an Employee, as a Student or as any other individual while undertaking official duties for the University, experience Sexual Misconduct on premises outside of the University Community. The University will liaise with the responsible authority to ensure proper procedures will be followed and will continue to provide support services.

The University understands that Sexual Misconduct conducted on a digital environment not managed by the University will be subject to this policy, where a Respondent is an Employee or Student, only where it impacts on their individual safety within the scope.

Individual Scope

The scope of this policy extends to all members of the University Community, including but not limited to:

- the University's Employees
- the University's Students
- individuals not employed by the University that undertake official duties for the University

Sexual Misconduct by an Individual Outside of the University Community

The University understands that a member of the University Community may, while performing duties as an Employee, as a Student or any other individual while undertaking official duties for the University, experience Sexual Misconduct by an individual outside of the University Community. In such circumstances, the University will liaise with the responsible authority to ensure proper procedures will be followed and will continue to provide support services.

The scope of this policy extends to all individuals of the University Community performing duties as an Employee, as a Student or any other individual while undertaking official duties for the University while performing those duties on premises outside of the University Community.

Intent to Commit Sexual Misconduct

The University considers behaviour to be Sexual Misconduct if an individual harassed is, or has reasonable grounds for believing that rejection, refusal or objection to a request, advance or other conduct will disadvantage them in any way related to their working, studying or living environment. Disadvantage here also includes psychological and emotional distress affecting that

individual's ability to pursue their usual work, study or individual activities.

The University will therefore not consider the intention of a Respondent in determining if Sexual Misconduct has occurred.

The University will consider the perception of a recipient (the Complainant) of conduct by a Respondent in determining whether Sexual Misconduct has occurred.

The University does not consider it necessary for the Complainant to have told a Respondent that their behaviour was unwelcome for the behaviour to constitute Sexual Misconduct.

Conflict of Interest

No individual should be placed in a situation where there is real or perceived conflict of interest. If a complainant or respondent believes that a real or perceived conflict of interest exists when a matter involving them is to be investigated, they can ask for an alternative case manager to be appointed.

A conflict of interest includes any circumstance, whether actual or perceived, arising from conflict between the performance of public duty and private or individual interests. All parties involved in the preliminary inquiry into and possible resolution of complaints of sexual harassment will ensure:

• they have no conflict of interest or bias in relation to any party to the complaint

• there is no perception by the parties that a conflict of interest exists

• they adhere to the University's Code of Ethics and Code of Conduct

• Individuals who have concerns about perceptions of possible conflict of interest or partiality should exclude themselves from the process.

Seeking Support

Someone who has experienced Sexual Misconduct can seek support from a range of people across campus and external to the University.

Taking Action

Where appropriate and where an individual feels safe to do so, they are encouraged to raise their concern with the other individual directly. Taking action can be as simple as:

• talking to the individual, or sending them an email, telling them what it is you have a concern about and asking them to stop doing it

• seeking appropriate support and advice.

Where it has not been appropriate to approach the individual directly, or where this step has been taken but the matter is still not resolved, an individual can consider making a Disclosure or a Report to the University. Not speaking directly to the individual(s) who have caused the concern does not prevent someone from making a Disclosure or Report.

Reports or Complaints

Individuals who have experienced unwelcomedd sexual behaviour or sexual harassment are encouraged to report it, even if they are not certain whether a violation of this policy has occurred.

1. Allegations of unwelcomed sexual behaviour may be addressed through the informal process even if no prohibited conduct has occurred.

2. A report or complaint must state specific and credible allegations of sexual harassment to warrant a formal investigation. There is no time limit for making allegations; however, it may be difficult to substantiate the allegations if they are made after

significant time has passed. Therefore, prompt reporting is strongly encouraged.

3. Individuals are encouraged to inform law enforcement authorities about instances of unwelcomed sexual behaviours that involve violence, threatening behavior, or physical assault. Individuals are encouraged to contact law enforcement whenever they believe a crime may have been committed.

4. Any academic or administrative officer of the University who observes sexual harassment or unwelcomed sexual behaviours, or who becomes aware of allegations of unwelcomed sexual behaviours or sexual harassment through the report of a complainant (including a third party) shall notify the Head of Unit of the allegations within two business days.

5. In any case in which the alleged victim is a non-student employee of the University (including any member of the faculty or staff), the academic or administrative officer must inform the complainant of the options available under this policy (i.e., informal resolution or formal investigation) and provide notice of the allegations to the Head of Unit in which the alleged behaviours occurred or, when incidents do not occur within a unit, notify the Registry..

Sanctions for violation of the policy

1. Violations of the Policy on Sexual Harassment may lead to disciplinary sanctions up to and including termination and/or separation from Benue State University. Sanctions for violations of this policy should be commensurate with the nature of the violation and the respondent's disciplinary history.

2. Those who violate this policy should bear the consequences of their actions, even if factors such as substance abuse or personal problems contribute to misconduct. When the offense is serious, it is appropriate to consider separation from the

University even in cases of first offense, and even when the respondent experiences remorse and/or did not intend to cause the resulting degree of harm.

3. In addition to other disciplinary action, persons who are found to have violated this policy may be required to participate in group counselling or personal therapy sessions, complete community service, enrol in a specific academic course, attend an educational workshop, and/or make restitution for economic damages caused by their behaviour.,

4. It is the responsibility of the appropriate administrator to follow up with the parties at a reasonable interval(s) to assess their compliance with the disciplinary and/or remedial sanctions imposed. More serious sanctions, up to and including termination of employment or separation from the University, may be imposed in the event that the respondent fails to comply with the sanctions initially imposed.

Protection of alleged victims, complainants, and others

5. Alleged victims will be informed of relevant procedural steps taken during the investigation and any interim protective measures taken. An alleged victim may be accompanied by a victim advocate and other support persons during the investigation process if the alleged victim so desires.

6. Throughout the investigation and resolution of a complaint, steps will be taken to protect alleged victims, complainants, witnesses, and others from harm caused by continuation of the alleged harassing behaviour.

7. Retaliation against alleged victims, complainants, and/or witnesses who provide information during an investigation pursuant to this policy is prohibited. Reasonable action will be taken to assure that alleged victims, complainants, and/or witnesses will suffer no retaliation as the result of their activities

with regard to the process. Retaliation may result in disciplinary action against the person committing the retaliatory act(s).

8. Steps that may be taken to protect alleged victims, complainants, witnesses, and others from continued harassment and/or retaliation might include:

i. lateral transfers of one or more of the parties in an employment setting and a comparable move if a classroom setting is involved, and

ii. arrangements that academic and/or employment evaluations concerning the complainant or others be made by an appropriate individual other than the respondent.

Protection of respondents

Prohibition against knowingly false allegations. This policy shall not be used to bring knowingly false or malicious allegations of unwelcomed sexual behaviour or sexual harassment. Making such allegations may subject the complaining party to remedial and/or disciplinary action up to and including termination or separation from the University. Any such disciplinary action will be initiated by the appropriate administrator overseeing the complainant(s). When seeking private advice and support from these offices or any University employee, persons should always confirm whether legal confidentiality applies to their communications with the person to whom they are speaking.

Confidentiality

9. In order to empower community members to voice concerns and report unwelcomed sexual behaviour or sexual harassment, the confidentiality of all parties will be protected to the greatest extent possible. However, confidentiality cannot be guaranteed in all cases, and academic and administrative officers of the university are expected to take some action once they are

made aware that unwelcomed sexual behaviour or sexual harassment in violation of this policy may be occurring.

10. Anyone (victims or others) who wishes to consult with someone about a specific situation without making a report of unwelcomed sexual behaviour or sexual harassment, or who wishes simply to learn more about enforcement of the policy, may contact any of the following offices or organizations:

11. Alleged victims, third-party complainants, and respondents are expected to maintain confidentiality as well. They are not prohibited from discussing the situation outside of the work or educational environment. However, the matter should not be discussed in the work or educational environment.

12. Dissemination of documents relating to reports or complaints of unwelcomed sexual behaviour or sexual harassment and/or to the investigation of such reports or complaints, other than as necessary to pursue an appeal, grievance, or other legal or administrative proceeding, is prohibited.

13. Failure to maintain confidentiality by a respondent may be considered to be a form of retaliation. Failure to maintain confidentiality by any party (alleged victim, third party complainant, or respondent) may result in disciplinary action.

Breach of Policy

Failure to comply with this policy by a member of the University Community may be considered a breach of the Code of Ethics and Code of Conduct and may result in disciplinary action

Disciplinary Procedure

(i) Disciplinary action may ordinarily be taken at the Departmental/Faculty level by the Head of Department/Dean/Provost/Director/Coordinator (each of which is hereinafter simply called “Head of Department”).

(ii) A Head of Department shall be responsible to the Vice-Chancellor of the University for the discipline of the staff assigned to his Department in all matters relating to the Department; and consequently, all members of staff shall obey all lawful directives of the Head of Department.

(iii) The Head of Department shall have power to issue written queries to staff assigned to his Department in respect of any act of misconduct; and such staff shall reply in writing to such queries within 72 hours.

(iv) The Registrar shall be copied all written queries and responses for filing and or further action.

(v) The Head of Department shall comment on the response of the staff; and the nature of his response shall determine the next course of action, as provided for in the next-following provisions:

(a) If the Head of Department is satisfied with the response, there shall be no need for further action; and in that case, he shall communicate in writing to the staff and the Registrar appropriately.

(b) If the Head of Department is not satisfied with the response, he shall write his report to the Registrar who shall, through the Establishment Division, process and forward same to the Vice-Chancellor for further action.

(vi) Upon receiving written communication from the Registrar, the Vice-Chancellor shall direct referral of the disciplinary process to the Senior Staff Disciplinary Committee (SSDC) for further investigation and recommendation to Council: Provided that the SSDC shall strive to conclude each disciplinary case referred to it within six months.

(vii) Any staff not satisfied with the outcome of any disciplinary proceeding or action may, if he so desires, appeal to the University Council, which shall deal with it as stipulated in the University Law or the Council's Standing Rules.

(viii) Any staff of the University concerned with taking any action stipulated in the provisions of these Regulations on disciplinary procedure, apart from the staff facing the disciplinary action, shall take the prescribed action not more than two weeks from the time disciplinary processes were received by him.

(ix) Any staff who fails or defaults in making a former protest against the decision based on the recommendation of the SSDC within six months from the date the decision is communicated to him shall forfeit his right as provided here above.

(x) All disciplinary processes and proceedings, terminating at whatever level, shall be kept by the Registrar in the affected staff's file.

Senior Staff Disciplinary Committee

Composition of the Senior Staff Disciplinary Committee (SSDC)

The SSDC shall be comprised of the following, namely:

(i) The Chairman of the Council or his nominee

(ii) Deputy Vice-Chancellor (Administration)

(iii) Two external members of the Council

(iv) Two members of Senate to be elected by Senate as alternate members to participate when cases against academic staff are to be considered.

(v) Two members of senior administrative staff to be appointed by the Registrar as alternate members to participate when cases against administrative and Technical staff are to be considered.

(vi) The Registrar as Secretary.

(vii) In attendance: A Legal Officer of the University.

Powers of the Senior Staff Disciplinary Committee (SSDC)

The SSDC shall, in the discharge of its functions, have and exercise the following powers, namely:

(i) To investigate, consider and determine all disciplinary cases involving all senior members of staff of the University except the Vice-Chancellor, the Deputy Vice-chancellors, and other Principal Officers of the University.

(ii) To make recommendations to the Council on any matter where the punishment prescribed in the Regulations Governing the Conditions of Services is considered insufficient in the circumstance.

(iii) To adopt its own procedure of proceedings as it deems fit from time to time.

(iv) To determine from time to time sanctions to be meted for offences not contained in these Regulations; and any such determination shall be recommended to the Council.

(v) To make recommendations to the Council on any matter that will promote proper and appropriate discipline of members of staff of the University.

(vi) To report to the Council from time to time.

Types of Disciplinary Measures

The Senior Staff Disciplinary Committee (SSDC) shall, depending on the severity of the misconduct shall recommend the following disciplinary measures:

(i) Serious reprimand (in writing)

(ii) Loss of annual increment for a specified period.

(iii) Delay of promotion/ denial of appointment for a specified period.

(iv) Loss of headship or other administrative position of honour and responsibility for a specified period.

(v) Deferment, confirmation and withholding of appointment.

(vi) Surcharge.

(vii) Withholding of salary.

(viii) Suspension for a specified period without pay

(ix) Denial of Sabbatical Leave

(x) Compulsory retirement

(xi) Forced resignation

(xii) Termination of appointment

(xiii) Demotion and termination where termination alone is not considered adequate punishment

(xiv) Dismissal.

Interdiction

(i) Where a staff is under investigation for a criminal offence, whether or not connected with the University; or is facing disciplinary proceedings for gross misconduct that may lead to dismissal, the Registrar may interdict him from his duties forthwith.

(ii) Formal notice of interdiction shall be given to the staff concerned in writing; and such notice shall state the date of the interdiction and the reasons for such interdiction.

(iii) Where a staff has been interdicted, he shall be placed on half salary.

(iv) A staff who is under interdiction shall be required to hand over all property of the University in his possession to the Head of Department and shall be forbidden from carrying out his duties and visiting his place of work except with the permission of the Registrar.

(v) Where a staff under interdiction is found not guilty of all charges, his interdiction shall be lifted and he shall receive the balance of his salary for the whole period of his interdiction.

(vi) The period of interdiction shall not exceed six (6) months within which it is expected that the investigation and/or a decision must have been reached on the matter, otherwise the staff shall be placed on suspension pending the determination of the matter.

Suspension

(i) A staff who is under investigation for a criminal offence, whether or not connected with the University that last for more than six months shall be placed on suspensions by Management pending the determination of the criminal matter.

(ii) On the recommendation of SSDC Management may suspend a staff for a specified period of time.

(iii) When a staff has been suspended, he shall there-upon be forbidden to carry out his duties and shall not visit his place of work without the written consent of the Registrar. He shall surrender account books and records and other property of the University in his charge to such other staff as the Head of Department may direct.

(iv) A staff under suspension is not entitled to any emoluments until the suspension is lifted: provided that a staff placed on suspension pending the determination of a criminal matter shall be entitled to retrospective emolument for the period under suspension if discharge and acquitted at the end of the exercise.

Procedure after Dismissal of Staff

(i) A staff dismissed shall not be entitled to any benefits or emoluments, commencing from the date of the dismissal, except if his dismissal is reversed by the Council or the Court.

(ii) Dismissal shall take effect from the date on which the staff concerned is officially notified that he has been dismissed.

(iii) Any staff dismissed for gross misconduct shall immediately hand over University property in his possession and vacate the University premises forthwith.

Termination

A confirmed staff whose appointment is terminated by the University shall be entitled to:

(a) Gratuity where he has put in up to five years but less than ten years of continuous service in the University;

(b) Pension where he has put in up to ten or more years of continuous service in the University;

A staff whose appointment is terminated for gross misconduct shall immediately hand over University property in his possession and vacate the University premises forthwith.