



## **DEPARTMENT OF CHEMISTRY**

AMBROSE ALLI UNIVERSITY,

P.M.B. 14, EKPOMA

EDO STATE

***NIGERIA***

## **HANDBOOK**

FOR

## **UNDERGRADUATE AND POSTGRADUATE PROGRAMMES**

**2020/2021 ACADEMIC SESSION TO DATE**

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## Preface

The need for a departmental handbook arose when the accreditation team from the Nigerian Universities Commission (NUC) repeatedly insisted that there should be a departmental handbook besides the Faculty handbook. The aim therein stated was to keep the students in the department as informed as possible on the administrative and academic structure of the department and to help to bud and nurture to development the Chemistry culture necessary for professionalism; these attributes cannot be assimilated from the faculty handbook which encompasses diverse interests as many as there are different departments in the Faculty of Physical Sciences.

This handbook therefore, which was developed in 2011/2012 session and printed in 2012/2013 academic session in the first comprehensive and internally generated handbook for chemistry department since its inception in 1982.

I therefore welcome on board all staff and students of Chemistry department; their contributions, suggestions and /or criticisms will always be welcome for the purpose of developing this handbook into a more robust tool for departmental guidance and management.

The handbook succinctly captures and unfolds the departmental vision and aspirations in its statements of Philosophy and Objectives in students' development, and in its policy on academic staff employment.

This handbook encompasses the academic programs, structure, course distribution and description of the undergraduate and postgraduate studies. It therefore provides administrative, regulatory and academic guidelines to undergraduate, postgraduate and postgraduate diploma students. Nevertheless, because of the size of the book which must be kept wieldy, students will need to posses the Faculty or the School of postgraduate studies handbook as may be necessary in order to avail themselves of such information that will enable them interact auspiciously with other departments as required for graduation.

While wishing every student God's guidance in his/her academic pursuit, it is hoped that this handbook will be of immense assistance in this regard.

**Dr. E.O Jatto**

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Ag. Head of Department

### **HISTORY OF THE PROGRAMMES /DISCIPLINES**

The department of chemistry of the Ambrose Alli University, Ekpoma was established in 1982.

It commenced academic activity with the teaching and training of students at undergraduate level for the award of Bachelor's Degree only. In the late 1980s postgraduate programs leading to the award of Master of Science (M.Sc) and Doctor of Philosophy (Ph.D) Degree in Chemistry were introduced.

By 1995, the Department felt formidable enough to mount another undergraduate program besides B.Sc. Chemistry. The Bachelor of Science (B.Sc) Degree in Industrial chemistry was introduced. This same period, diploma programs in industrial chemistry was also introduced. But this was short-lived as the Nigerian University Commission (NUC) scrapped diploma programs in some courses, inclusive of industrial chemistry, in all Nigerian Universities.

Presently, the Department of Chemistry Ambrose Alli University Offers the following degree and postgraduate diploma programs:

1. Bachelor of Science (B.Sc) Degree in Chemistry.
2. Bachelor of Science (B.Sc) Degree in Industrial Chemistry.
3. Postgraduate Diploma in Chemistry.
4. Master of Science (M.Sc) Degree in Chemistry.
5. Master of Science (M.Sc) Degree in Industrial Chemistry.
6. Doctor of Philosophy (Ph.D) Degree in the different areas in Chemistry.

#### **Departmental Policy on Employment of Academic staff.**

The policy aims at ensuring appropriate and relevant backgrounds of prospective Academic Staff in the department. Besides the possession of a Masters or a doctorate degree as the case may be, the applicant must possess one of the following as background: at least a second class (honours) lower degree of

1. B.Sc Chemistry or Industrial Chemistry
2. B.Sc Chemistry education plus a postgraduate diploma.
3. B.Sc Biochemistry
4. B.Sc Chemical Engineering.  
OR at least,
5. Upper Credit Higher National Diploma (HND) Certificate.

#### **ACADEMIC STAFF**

<b>S/N</b>	<b>NAME</b>	<b>QUALIFICATIONS</b>	<b>STATUS</b>
1.	Jatto E.O	B.Sc, (Ed)( Ekpoma) M.Sc,( Benin) Ph.D (Ekpoma)	Senior Lecture /Ag. HOD
2.	Egharevba, F.	B.Sc. M.Sc. (Ibadan), Ph.D (Benin).	Professor

3.	Asia, I.O.	B.Sc, MBA(Ekpoma), PGDE, M.Sc, Ph.D (Benin)	Professor
4	Osuide, M.O	B.Sc, M.Sc, Ph.D, (Uniben)	Professor
5	Okojie, V.U	B.Sc (Zaria), M.Sc (Ekpoma) Ph.D (Benin)	Professor
6	Odia, A	B.Sc. M.Sc, Ph.D (Ekpoma)	Professor
7.	Egbon, E.E	B.Sc, (Ed), M.Sc (Benin), Ph.D (Ekpoma)	Reader
8.	Ize-Iyamu O.K.	B.Sc, M.Sc (Benin), Ph.D (Ekpoma)	Reader
9	Azih, M.C	B.Sc, M.Phil (Benin)	Lecturer I
10.	Chukwuedo, M.E	B.Sc (Ekpoma), PGDCE, M.Sc (Benin)	Lecturer I
11.	*Umarein A.I	B.Sc (Ekpoma), M.Sc (Ekpoma)	Assist. Lecturer
12.	*Shaka, A.	B.Sc (Ekpoma)	Graduate Assistant
13.	Nweke, C. J.	B.Sc (Ekpoma)	Graduate Assistant

\*Leave of absence/  
study leave

## NON-ACADEMIC STAFF

14. Ibizugbe. O.O.O	HND, ( Ilaro)ANIST	Senior Technologist
15. Irabor G.E	HND (PTI, Warri)	Technologist I
16. Ikhide, N.O.	ND (Enugu), B.Sc (Ekpoma)	Technologist II
17. Barnabas C. B	B.Sc (oturu)	Laboratory Instructor
18. Oseigba, H. I	HND (Auchi)	Secretary to Department
19. Nkem- Smart, M.O.	B.Sc (Ed) (Ekpoma),	Senior Clerical Officer
20. Arebamen, B.	NECO, 2007	Lab. Assistant
21. Ohunyon, B.	Primary Sch. Leaving Cert.	Snr. M/Cleaner.
22. Ehizutomhin, B.	WAEC, 2014	M./Cleaner

## ADMINISTRATION OF PROGRAMMES IN GENERAL.

### Personnel Administration.

#### a) Organization Structure.

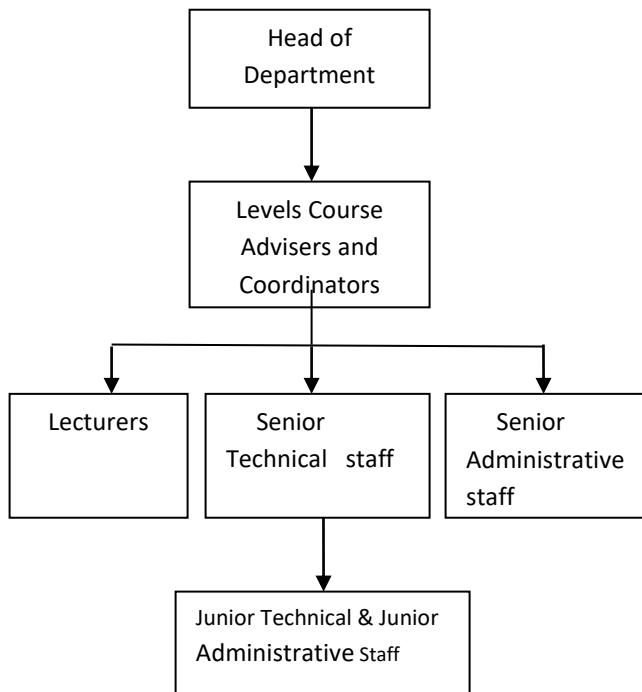
The Head of department (HOD) is the academic and administrative Head of the Department. However, there is a Departmental Board of studies with the HOD as chairman, which controls academic programmes at the Departmental level. To facilitate academic & administrative supervision, the following Departmental responsibilities are assigned to specific lecturers:

- i. Examination Officer/committee
- ii. Post- graduate coordinator.
- iii. Admission Officer.
- iv. Curriculum Officer.
- v. Industrial Training Coordinator.
- vi. Seminar Coordinator

- vii. Project (colloquium) Coordinator.
- viii. Time table Coordinator.
- ix. Library officer.
- x. Research & Publication Coordinator.
- xi. Staff Welfare Officer
- xii. Course level Advisers.

Course level advisers serve as Counselors to students at the respective levels under the general coordination of the Head of Department.

Generally, the organizational structure of the department is as shown in the following chart.



## DEPARTMENTAL PHILOSOPHY

The department aims particularly at equipping students with the theories, principles and methodologies in Chemistry, necessary for living, capacity building, national development and technological progress in our modern world.

## **OBJECTIVES**

The courses offered in the Department of chemistry have the following objectives. To:

- a) Stimulate in the students sustained interest and enthusiasm in chemistry and applications.
- b) Build in students a culture of continuing enquiry
- c) Provide students with a broad and balanced base of chemical knowledge and practical skills
- d) Develop in students a range of skills applied in chemical and non-chemical areas that can provide confidence for employment
- e) Provide students with a solid base of chemical knowledge and skills that are required for postgraduate studies and research.
- f) Inculcate in students an appreciation of chemistry in all human endeavours.



**SECTION A**  
**UNDERGRADUATE PROGRAMMES**

**ADMISSION REQUIREMENTS**

- a) Candidates must possess credit passes at, WASSCE,GCE or NECO (O—Level) in at least five subjects including English Language, Chemistry, Physics, Mathematics and one other subject at not more than two sittings.
- b) The minimum admission requirement for the three year degree programme (direct entry) are GCE ‘A’ level passes, NCE, ND in chemistry and physics or mathematics in addition to ‘O’ level requirements.

**Students Work Load:**

The maximum student work load per session is 48 units; and the minimum full time student’s work load is 30 units. The recommended number of units per session [or the normal student] is 48.

**Examination Results Scoring and Grading.**

Credit unit	Percentage Score	Letters Grade	Grade points (GP)	Weighted grade point (WGP)	*WGPA or Simply sessional GPA.
As assigned	70 – 100	A	5	Unit of course X	Sum of WGP of

to the course by the department e.g CHM 101 = 3 units.	60 – 69	B	4	grade point e.g CHM 101 assuming score is B and unit is 3. WGP= 3x5= 15.	all courses for the year ÷ sum of all course units for the year. i.e $\frac{\text{Total WGP}}{\text{Total units}}$
	50 – 59	C	3		
	45 – 49	D	2		
	00 – 44	F	0		

\*WGPA → weighted grade point Average.

Pass mark for all courses is 45% made up of 30% Continuous Assessment and 70% Examination Score.

Example: An average 100 level student's result is shown below:

Course Code	Grade	Grade point	WGP
CHM 101	B	4	12
CHM 102	A	5	10
MTH IOI	C	3	9
STA 101	D	2	6
CSC 101	B	4	8
PHY 101	C	3	9
PHY 102	D	2	6
BIO 101	C	3	9
GST 101	B	4	16
GST 102	C	3	6
CHM 112	A	5	15
MTH 112	B	4	12
PHY 103	D	2	4
PHY 111	F	0	0
BIO 111	C	3	9
GST 111	D	2	4
GST 112	D	2	4

Total WGP = 139

Total units = 48

For 100 level therefore, the WGPA or sessional GPA = 2.896 (3 decimal places only).

The sessional GPA tells you your performance that year. You can even calculate your semester GPA at the end of each semester. For year II (200 level) do the same for all your courses to get your sessional GPA for that year. Note that this candidate failed PHY 111. This must be registered **first** before any other course(s) in year

II. Assuming at 200 level, the average student acquires the following: TOTAL WGP = 168

TOTAL UNITS = 48

WGPA or sessional GPA =  $168 \div 48 = 3.500$  (3 decimal places).

The candidate has improved academically compared with 100 level 2.933. Now, another grading parameter comes in, called the cumulative grade point average (CGPA). The parameter captures as one, the GPA of 100 level and the GPA of 200 level. It is calculated as

$$\frac{\text{Total WGP for YR I + YR II}}{\text{Total units taken for YR I + YR II}}$$

For our average student above it gives

$$\text{CGPA} = \frac{139 + 168}{48 + 48} = \frac{307}{96} = 3.20 \text{ (2 decimal places approximation)}$$

For year III (300 level):

Total WGPA = 116.

Total units = 47

Sessional GPA = 2.468 (3 decimal places approximation)

$$\text{CGPA} = \frac{\text{Total WGP for YR I + YR II + YR III}}{\text{Total units for YR I + YR II + YR III}}$$

$$= \frac{139 + 168 + 116}{45 + 48 + 47} = \frac{423}{140} = 3.02 \text{ (2 decimal place approximation)}$$

Analysis: with a sessional GPA of 2.468 at 300 level the students performance has dropped compared with 200 level GPA of 3.500. He needs to work harder.

The CGPA right from 100 level already places the student in second class lower class of degree (2<sup>1</sup>).

For Year IV (400 level):

$$\text{GPA} = \frac{\text{Total WGPA} = 256}{\text{Total units} = 47} = \text{sessional GPA} = 4.596$$

$$\text{CGPA} = \frac{679}{208} = 3.63$$

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Analysis: With a sessional GPA of 4.596, the student has improved greatly compared to YR III. With a CGPA of 3.63, the student did so well that he/she successfully pulled out of second class lower class of degree (2<sup>2</sup>) to second class upper class of degree (2<sup>1</sup>). All levels, 100, 200, 300 and 400 levels contribute equally to a student's class of degree i.e. 25% contribution each.

#### CLASSIFICATION OF DEGREE

CGPA	CLASS OF DEGREE
4.50 – 5.00	1 <sup>st</sup> Class Honours (1 <sup>st</sup> )
3.50 – 4.49	2 <sup>nd</sup> Class (Honours) upper division (2 <sup>1</sup> )
2.40 – 3.49	2 <sup>nd</sup> Class (Honours) lower Division (2 <sup>2</sup> )
1.50 – 2.39	3 <sup>rd</sup> Class Honours (3 <sup>rd</sup> )
Less than 1.49	Fail.

#### 100 LEVEL B.Sc CHEMISRTY

##### FIRST SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT UNITS.
<b>Core Courses</b>					
CHM 101	General chemistry I	3		3	3
*CHM 102	Practical chemistry	2	-	2	2
CSC 101	Introduction to Computer.	2			2
GST 101	Electricity & Magnetism.	4			4
GST 102	Use of English & Library Philosophy & Logic	2			2
<b>Required Course</b>					

MTH 101	Algebra & Trigonometry	3			3
STA 101	Statistics for Physical Sciences and Engineering	3			3
PHY 101	General Physics I (Mechanics)	3			3
BIO 101	General Biology I	3			3
PHY 102	General Physics II (Electricity & Magnetism)	3			3
<b>Elective Nil.</b>					
<b>Total Units</b>					<b>28</b>

#### 100 LEVEL SECOND SEMESTER .

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 112	General chemistry II	3			3	
MTH 112	Calculus	3			3	
*PHY 103	General Physics Laboratory		3	2	2	
PHY 111	General Physics II	2			2	
GST 111	Nigerian People & Culture	2			2	
GST112	History & Philosophy	2			2	
<b>Required Courses</b>						
BIO 111	General Biology II	3			3	
<b>Elective Nil</b>						
<b>Total Units</b>					<b>17</b>	
<b>Total Units For Session</b>					<b>45</b>	

\* Course run through both semesters.

**100 LEVEL B.Sc INDUSTRIAL CHEMISTRY.****FIRST SEMESTER**

<b>COURSE CODE</b>	<b>TITLE OF COURSE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>COURSE CREDIT UNITS.</b>
<b>Core Courses</b>					
CHM 101	General chemistry I	3		3	3
*CHM 102	Practical chemistry	2	-	2	2
CSC 101	Introduction to Computer.	2			2
GST 101	Electricity & Magnetism.	4			4
GST 102	Use of English & Library Philosophy & Logic	2			2
<b>Required Course</b>					
MTH 101	Algebra & Trigonometry	3			3
STA 101	Statistics for Physical Science/Engineering	3			3
PHY 101	General Physics I (mechanics)	3			3
BIO 101	General Biology	3			3
PHY 102	General Physics II Electricity & Magnetism	3			3
<b>Elective Nil.</b>					
<b>Total Units</b>					<b>28</b>

**100 LEVEL SECOND SEMESTER .**

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 112	General chemistry II	3			3	
MTH 112	Calculus	3			3	
*PHY 103	General Physics Laboratory		3	2	2	
PHY 111	General Physics II	2			2	
GST 111	Nigerian People & Culture	2			2	
GST112	History & Philosophy	2			2	
<b>Required Courses</b>						
BIO 111	General Biology II	3			3	
GEE 112	Engineering Drawing	2			2	
<b>Elective Nil</b>						
<b>Total Units</b>					<b>19</b>	
<b>Total Units For Session</b>					<b>47</b>	

\* Course run through both semesters.

## 200 LEVEL (B.Sc. CHEMISTRY)

### FIRST SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses.</b>						
CHM 201	Physical Chemistry II	3			3	CHM 101
CHM 202	Inorganic Chemistry II	3			3	CHM 112
CHM 203	Organic Chemistry II	3			3	CHM 112
*CHM 204	Experimental chemistry II	-	-	3	2	CHM102
CHM 205	Analytical Chemistry	3			3	
<b>Required Courses</b>						
CSC 203	Computer Programming I	3			3	
MTH 205	Elementary Differential Equation I	3			3	
CHM 206	Industrial Chemistry Laboratory	2	-	-	2	

Electives						
MTH 201	Mathematical method	3			3	
<b>Total Units</b>					<b>22</b>	

## SECOND SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	
<b>Core Courses.</b>						
CHM 211	Carbohydrate Chemistry	2			2	
CHM 212	Polymer Chemistry I	3			3	
CHM 213	Environmental Science.	2			2	
ENT 211/215	Entrepreneurial Studies	3			2	
GST 222	Peace and Conflict Resolution Studies	2			3	
<b>Required Courses</b>						
CHM 214	Radio & Nuclear Chemistry.	2			2	
FRH 101	Basic French I	3			3	
<b>Elective CHM 215 Industrial Management</b>						
<b>Total Units For Session</b>					<b>16</b>	
<b>Total Units For Session</b>					<b>38</b>	

\* Course run through both semesters.

## 200 LEVEL (B.Sc. INDUSTRIAL CHEMISTRY)

### FIRST SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 201	Physical Chemistry II	3			3	
CHM 202	Inorganic Chemistry II	3			3	



CHM 203	Organic Chemistry II	3			3	
*CHM 204	Experimental chemistry II	-	-	3	2	
CHM 205	Analytical Chemistry	3			3	
CHM 206	Industrial Chemistry Laboratory	2	-	-	2	
ENT 211	Entrepreneurial studies					
<b>Required Courses</b>						
CSC 203	Computer Programming I	3			3	
MTH 205	Elementary Differential Equation I	3			3	
MTH 201	Mathematical Method	3			3	
<b>Electives</b>						
BCH 201	General biochemistry I	3	3			
<b>Total Units</b>					<b>27</b>	

## SECOND SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 211	Carbohydrate Chemistry	2			3	
CHM 212	Polymer Chemistry I	3			3	
CHM 213	Environmental Science.	2			2	
GST 222	Peace and Conflict Resolution Studies	2			3	
CHM 216	Unit Operation/Process Chemistry	2			2	
<b>Required Courses</b>						
CHM 214	Radio & Nuclear Chemistry.	2			2	
FRH 101	Basic French I	3			3	
<b>Elective</b>						
BCH 211	General Biochemistry II	3			3	
CSC 215	Computer Programming II	3			3	

<b>Total Units For Session</b>	<b>17</b>
<b>Total Units For Session</b>	<b>37</b>

\* Course run through both semester.

### 300 LEVEL (B.Sc CHEMISTRY)

#### FIRST SEMESTER

<b>COURSE CODE</b>	<b>TITLE OF COURSE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>COURSE CREDIT</b>	<b>PRE-REQUISITE(S)</b>
<b>Core Courses</b>						
CHM 301	Physical Chemistry III	3			3	CHM201
CHM 302	Inorganic Chemistry III	3			3	CHM 202
CHM 303	Organic Chemistry III	3			2	CHM 203
*CHM 304	Experimental chemistry III	-	-	3	2	CHM 204
CHM 309	Instrumental Methods of Analysis	3			3	
<b>Required Courses</b>						
CHM 305	Polymer Chemistry II	2	2		2	CHM 212
CHM 306	Petroleum Chemistry	2	2		3	
CHM 307	Organometallic Chemistry	2			2	
CHM 308	Natural Product Chemistry	2			2	CHM 203
CHM 321	Applied Surface & Colloid Chemistry	2			2	
<b>Elective</b>						
CHM 322	Industrial Chemical Processing & Technology I	2			2	
<b>Total Units</b>					<b>28</b>	

**SECOND SEMESTER**

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE (S)
CHM 311	Students Industrial Work Experience (SIWES)	-	-	15	15	
<b>Required Courses</b>		<b>Nil</b>				
<b>Elective</b>		<b>Nil</b>				
<b>Total Units</b>					<b>15</b>	

<b>Total Units For Session</b>	<b>43</b>
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**300 LEVEL (B.Sc. INDUSTRIAL CHEMISTRY)**
**FIRST SEMESTER**

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 301	Physical Chemistry III	3			3	CHM201
CHM 302	Inorganic Chemistry III	3			3	CHM 202
CHM 303	Organic Chemistry III	3			2	CHM 203
*CHM 304	Experimental chemistry III	-	-	3	2	CHM 204
CHM 305	Polymer Chemistry II	2	2		2	CHM 212
CHM 306	Petroleum Chemistry	2	2		3	
CHM 309	Instrumental Methods of Analysis	3			3	
CHM 322	Industrial Chemical Processing & Technology I	2			2	
<b>Required Courses</b>						
CHM 307	Organometallic Chemistry	2			2	
CHM 308	Natural Product Chemistry	2			2	CHM 203
CHM 321	Applied Surface & Colloid Chemistry	2			2	

<b>CHM 322</b>	Industrial chemical procession & Technology I	3			3	
<b>Elective</b>						
<b>Total Units</b>					<b>28</b>	

**400 LEVEL (B.Sc. CHEMISTRY)**

**FIRST SEMESTER**

<b>COURSE CODE</b>	<b>TITLE OF COURSE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>COURSE CREDIT</b>	<b>PRE- REQUISITE(S)</b>
<b>Core Courses</b>						
CHM 401	Quantum Chemistry/ Atomic Physics	2			2	CHM 309
CHM 402	Advanced Chemistry Kinetic	3			3	CHM 301
CHM 403	Advance Electrochemistry	2			2	CHM 301
CHM 405	Organic Synthesis	3	-	3	3	CHM 303
CHM 406	Co – ordination Chemistry	3			3	CHM 302
CHM 407	Applied Spectroscopy	2			2	
CHM 409	Colour Chemistry	3			3	
<b>Required Courses</b>						
CHM 408	Environmental Management	2			2	
<b>Electives</b>						
CHM 404	Polymer Technology	3			3	CHM 305
<b>Total Units</b>					<b>18</b>	

**SECOND SEMESTER**

<b>COURSE CODE</b>	<b>TITLE OF COURSE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>COURSE CREDIT</b>	<b>PRE- REQUISITE(S)</b>
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<b>Core Courses</b>						
CHM 410	Research Project		6		6	
CHM 411	Seminar	2			2	
CHM 413	Physical Organic Chemistry	2			2	CHM 303 & 308
CHM 414	Natural Product Chemistry	2			2	CHM 303 & 308
<b>Required Courses</b>						
CHM 412	Group Theory and Symmetry	2			2	
CHM 415	Non-aqueous Solvents	2			2	CHM 302
CHM 415	Non – Aqueous Solvents	2			2	CHM 309
CHM 416	Chemistry of Lanthanides & Actinides	2			2	CHM 301
CHM 418	Molecular Spectroscopy	3			3	CHM 309
CHM 432	Organometallics Chemistry II				2	CHM 301
CHM 433	Heterocyclic Chemistry	3			3	CHM 303
<b>Elective</b>						
CHM 417	Industrial Chemical Processing and Technology II	3			3	
CHM 434	Quality Control in Industries	2			2	
CHM 435	Chemistry of Compounding and Production	2			2	
CHM 436	Food Processing Technology	3			3	
<b>Total Units</b>					<b>25</b>	
<b>Total Units For Session</b>					<b>43</b>	
<b>COURSE CODE</b>	<b>TITLE OF COURSE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>COURSE CREDIT</b>	<b>PRE-REQUISITE(S)</b>
<b>Core Courses</b>						
CHM 410	Research Project		6		6	
CHM 411	Seminar	2			2	
CHM 413	Physical Organic	2			2	CHM 303 &

	Chemistry				308
CHM 414	Natural Product Chemistry	2		2	CHM 303 & 308
<b>Required Courses</b>					
CHM 412	Group Theory and Symmetry	2		2	
CHM 415	Non-aqueous Solvents	2		2	CHM 302
CHM 415	Non – Aqueous Solvents	2		2	CHM 309
CHM 416	Chemistry of Lanthanides & Actinides	2		2	CHM 301
CHM 418	Molecular Spectroscopy	3		3	CHM 309
CHM 432	Organometallics Chemistry II			2	CHM 301
CHM 433	Heterocyclic Chemistry	3		3	CHM 303
<b>Elective</b>					
CHM 417	Industrial Chemical Processing and Technology II	3		3	
CHM 434	Quality Control in Industries	2		2	
CHM 435	Chemistry of Compounding and Production	2		2	
CHM 436	Food Processing Technology	3		3	
<b>Total Units</b>				<b>25</b>	
<b>Total Units For Session</b>				<b>43</b>	

#### 400 LEVEL (B.Sc. INDUSTRIAL CHEMISTRY)

##### FIRST SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 402	Advanced Chemistry Kinetic	3			3	CHM 301
CHM 403	Advance Electrochemistry	2			2	CHM 301
CHM 405	Organic Synthesis	3			3	CHM 303
CHM 406	Co – ordination Chemistry	3			3	CHM 302
CHM 407	Applied Spectroscopy	2			3	
<b>Required Courses</b>						
<b>Electives</b>						
CHM 404	Polymer Technology	2			2	CHM 305
CHM 408	Environmental Management					
<b>Total Units</b>					<b>21</b>	

##### SECOND SEMESTER

COURSE CODE	TITLE OF COURSE	L	T	P	COURSE CREDIT	PRE-REQUISITE(S)
<b>Core Courses</b>						
CHM 410	Research Project		6		6	
CHM 411	Seminar	2			2	
CHM 417	Industrial Chemical Processing and Technical II	3			3	
CHM 418	Molecular Spectroscopy	3			3	CHM 309
CHM 414	Natural Product	2			2	CHM 303 &

	Chemistry		
CHM 435	Chemistry of Compounding and production	2	
CHM 434	Selected Topics in Industrial Chemistry	2	
<b>Required Courses</b>			
CHM 432	Organometallics Chemistry		2
CHM 436	Food Processing Technology		3
<b>Electives</b>			
CHM 412	Group Theory and symmetry	2	
CHM 413	Physical Organic Chemistry	2	
CHM 415	Non – Aqueous Solvents	2	
CHM 416	Chemistry of Lanthanides & Actinides	2	
CHM 419	Photochemical & pencyclic Chemistry	2	
CHM 433	Heterocyclic Chemistry	2	
<b>Total Units</b>			
<b>Total Units For Session</b>			

## COURSE DESCRIPTION.

### 1. CHM 101: GENERAL CHEMISTRY 1: (3 UNITS).

Atoms, Molecules: Atomic structure; the development of the atomic theory, Electronic configuration, Chemical equations, Stoichiometry. Gases: The gas Laws, The ideal (or perfect) gas equation. Real gases . Critical constants .Chemical equilibrium, Equilibrium constant ( $K_c$  and Relationship with the position of equilibrium) Le- Chatellier's principle. Solubility products; partition law; colligative properties; Acid and bases. Thermodynamics: various types of thermodynamic systems. Laws of electrolysis and their applications.

### 2. CHM 102: PRACTICAL CHEMISTRY: (2 UNITS).

Acid – base titrations; Redox titrations, synthesis and preparation of inorganic compounds. Analysis of selected anions and cations. Preparations and qualitative analysis of organic compounds. pH measurement.

- 3. CHM 112: GENERAL CHEMISTRY II: (3 UNITS)** Periods, relationship in the table of main Group elements, the periodic law; anomalies in the periodic table; valence forces, structure of solids, chemistry of classification of organic compounds, nomenclature, homologous series; functional group (e.g alkanes, alkenes, alkynes, alcohols, phenols, thiols, aldehydes, ketone, carboxylic acids, ether, esters, amide, nitriles, haloalkanes, sulphoxides and sulphones. Basic stereochemistry, electronic theory in organic chemistry, saturated hydrocarbons; unsaturated hydrocarbons.
- 4. GEE 112: BASIC ENGINEERING WORKSHOP: (2 UNITS):** Drawing instruments and their uses, lettering, types and use of lines, geometric construction (cones, cylinder, pyramids, cuboid), tangency loci, orthographic projection. Introduction to workshop machines and tools, cutting, shaping and finishing of wood products. Foundry workshop, moulding, metal cutting, shaping.
- 5. CHM 201 PHYSICAL CHEMISTRY II (3 UNITS):** Gases: Qualitative treatment of the Maxwell distribution of molecular velocities, mean free path, transport properties of gases; viscosity, diffusion, calculation of molecular diameters from viscosity and diffusion data. The principle of equipartition of energy. Chemical kinetics: rate laws, order of reaction (mathematical deviation). Arrhenius equation and dependence on temperature of reaction velocities: chemical Thermodynamics: law of thermo chemistry (Hess's law); heat of reactions. Energy level diagrams of exothermic and endothermic reactions, thermochemical calculations. **Phase Equilibria:** Heterogeneous equilibrium. Phase rule, phase diagrams. Thermodynamic treatment of equilibrium, the Van't Hoff's equation. The Helmholtz equation.
- 6. CHM 202 INORGANIC CHEMISTRY II (2 UNITS).** **Pre-requisite – CHM112.** a). Chemistry of the main group elements group IA – VIIA: the noble gasses. b). Diagonal relationship chemistry of the transition metals; basic co – theory; comparative chemistry of the following elements. c). (I) Ga, In Ti (II) Ge, Sn, Pb (III) As, Sb, Bi (IV) Sr, Te, Po. Elementary introduction to organometallic chemistry: significance of metals in biochemical systems.
- 7. CHM 203 ORGANIC CHEMISTRY II (3 UNITS).** **Pre-requisite – CHM 112.** Factors affecting structure and physical properties of organic compounds; factors affecting directional movements of electrons in organic reactions; energy of activation; entropy of activation; transition – state theory diagrams; free radical substitution reactions: in alkenes; organic reactions addition. Elimination, nucleophilic and electrophilic substitutions (displacement); aromaticity illustrated with benzene, aromatic electrophilic and nucleophilic substitutions.
- 8. CHM 204 EXPERIMENTAL CHEMISTRY II (2 UNITS)** **Pre-requisite – CHM 102.** The laboratory course consisting of a group of experiments drawn from physical, inorganic, organic and analytical chemistry.
- 9. CHM 205 ANALYTICAL CHEMISTRY (3 UNITS).** Theory of error; statistical methods in analysis; theory of sampling; chemical methods of analysis including volumetric, gravimetric and optical methods. Introduction to potentiometric, electrolytic, radiochemical and chromatographic methods.
- 10. CHM 211 CARBOHYDRATE CHEMISTRY (2 UNITS)** **Pre-requisite – CHM 112.** Classification, structure and nomenclature. Chemical properties of monosaccharides, oxidation, reaction in base: reduction; Ruff degradation; Killiani – Fischer synthesis. Osazone formation, configurations; epimerization.
- 11. ENT 211 (ENTREPRENEURIAL TRAINING I).** **THEORY AND PRACTICE OF ENTREPRENEURIALSHIP.**
- a) **CLARIFICATION OF CONCEPT ASSOCIATION WITH ENTREPRENEURIALSHIP.** The concept of entrepreneur, entrepreneurship managers and entrepreneurs. Distinction between and a professional manager. Relationship between entrepreneurship and entrepreneur/corporate entrepreneurship.



- b) THEORIES OF ENTREPRENEURSHIP AND ITS CHARACTERISTICS.**
- c) ELEMENTS OF ENTREPRENEURS.** Characteristics and qualities of entrepreneurs. Skills required from entrepreneur. Functions/role and scope of entrepreneur. What do you need it for as a student.
- d) RISK AND REWARDS ENTREPRENEURSHIP.** Risk and reward associated with entrepreneurship. Success factors for entrepreneurship. Benefit/contribution of entrepreneurship.
- e) ENTREPRENEURSHIP DEVELOPMENT.** Approaches to entrepreneurial development path. Factors that influence entrepreneurial development. Barriers/constraints/problems to entrepreneurial development. Business plan and how to write business plan, who needs a business plan? Need for a Business – incubator.
- f) ENTREPRENEURSHIP LAW.** Entrepreneurial law overview of Nigeria Legal system. Registration and regulations of business names, partnerships, companies. Capital and securities – offer and subscription of share debentures, preparing prospectuses, Guarantee and indemnities. Scale of Goods: Carriage of goods, Hire Purchase (Equipments leasing); insurance negotiable instrument and principles of banking law; Bankruptcy and insolvency, consumer protection law and practice. Introduction principle of the law of contract offer, acceptance consideration, vitiation elements.
- 12. CHM 212 POLYMER CHEMISTRY I (2 UNITS).** Polymer – meaning and nomenclature. Formation of polymers, Types of polymers, Natural Rubber latex; Sources, Collection, Concentration, Quality control test on latex, polymerization reactions, sources of raw materials for polymers, addition and condensation polymerization. Initiators for polymerization reactions. Fibres, meaning and characteristics, synthetic fibres, polyamides (nylon), Polyesters (Dacron), polyacrylonitrile (orion) and isotactic polypropylene.
- 13. CHM 213 ENVIRONMENTAL SCIENCE (2 UNITS).** Concept of elementary cycles. Characteristics of the atmosphere. Elementary treatment of land, air and water pollution. Sources, types and effects of primary air pollutants. Ozone layer as a shield and as a pollutant. Thermal air pollution. Green house gas effect. Economic importance of environmental pollution.
- 14. CHM 214 RADIO AND NUCLEAR CHEMISTRY (2 UNITS).** Natural radioactivity, fusion, fission decay process, nature of radiation, Nuclear reaction, Principles and measurement of radioactivity. Application of radioactivity. Radiation Hazards.
- 15. CHM 215 INDUSTRIAL MANAGEMENT (3 UNITS).** Management definitions, management tools, planning, organizing, directing, staffing e.t.c. management as a science, organizational goal, manufacturing process; job, batch, process and mass production, costing method and Techniques, marginal costing, break – even analysis, Budgeting and budgeting control. Variance analysis. Personnel management. Leadership. Capital budgeting and project analysis.
- 16. CHM 301 PHYSICAL CHEMISTRY III (3 UNITS).** **Pre – requisite – CHM 201.**  
Electrochemistry, electrical conduction in solution, Ohm's law, conductance and conductivity, molar and equivalent conductivities. Experimental evaluation of conductivity. Variation of conductivity with concentration, Kohlrausch's law of independent migration of ions and its applications, electrodes and electrode potentials, type of electrode, equilibrium electrochemistry: electrochemical cell, electromotive force (e.m.f), measurement of e.m.f, standard electrode potentials, diagram, the sign convention, cell reaction. The Nernst equation. Equilibrium constants from standard cell. E.m.f concentration cell. Chemical thermodynamics: heat capacities ( $C_p$  and  $C_v$ ) derivation of the expression  $C_p - C_v = R$  from principles. Entropy and free energy. The second law of thermodynamics. Qualitative and quantitative applications of the expression  $\Delta G = H\Delta - T\Delta S$  to spontaneity of reaction and

evaluation of entropy changes in phase transition dependence of  $\Delta G$  on temperature and pressure. The third law of thermodynamics. Statistical thermodynamics. Energy states and levels: Microstates and Macrostates. Thermodynamic probability. The Maxwell Boltzman distribution law. The partition function. The statistical interpretation of entropy. The Bose – Einstein and Fermi-Dirac statistics.

**17. CHM 302 INORGANIC CHEMISTRY III (3 UNITS).**

**Pre – requisite CHM 202.**

The noble gases; hydrogen; electronic structure and general properties and comparative study of Group IA and Group IIA elements. Chemistry of boron; carbon and silicon; nitrogen and phosphorus; oxygen and sulphur, the halogens. Transition elements; separation of metals coordination chemistry; ligand and crystal field theories; introductory radiochemistry radioactivity and the periodic table. Theories of structure and bonding, physical method of structural spectrochemical series. The nephelauxetic series and the Jahn teller distortion. Stabilization of unusual oxidation states by complex formation. Thermodynamic stability of complex compounds, the stability of complexes, kinetics and mechanisms.

**18. CHM 303 ORGANIC CHEMISTRY III (3 UNITS).**

**Pre – requisite CHM 203.**

Classification of organic compounds aromatic and alicyclic chemistry. Alcohols: nomenclature, preparation and reactions. Ethers and epoxides; carboxylic acids; nomenclature, preparation and reactions. Amines :nomenclature, preparation and chemical properties. Polyfunctional compounds: heterocyclic chemistry.

**19. CHM 304 EXPERIMENTAL CHEMISTRY III (2 UNITS).**

**Pre – requisite CHM 203.**

Selected

important experiments designed to improve the practical skill of the students and to enhance their understanding of relevant theories. Topics contained in this package ensure a wide coverage of the diverse areas of chemistry.

**20. CHM 305 POLYMER CHEMISTRY II (2 UNITS).**

**Pre – requisite CHM 212.**

Polymerization

mechanism; detailed treatment of addition polymerization. Stereospecific polymerization. Copolymerization phase systems for polymerization. Industrially important thermoplastic and thermosetting polymers; polyurethanes (spandex). Rubber elasticity, mechanical properties of polymers. Analysis and testing of polymers. Degradation of polymers.

**21. CHM 306 PETROLEUM CHEMISTRY (2 UNITS).**

The consequence of growing energy use; perspectives on energy; energy

conservation; petroleum; its origin and place in the contemporary energy scene; classification, composition of crude oil (petroleum) and natural gas, global distribution of petroleum and natural gas resources (with emphasis on Nigeria's situation); fractions obtained from the distillation of petroleum. Petroleum technology; survey of refinery products and process. Petrochemical industry in Nigeria.

**22. CHM 307 ORGANOMETALLIC CHEMISTRY I (2 UNITS).**

**Pre – requisite CHM 203**

Classification of organometallic compounds; preparation and structure of organometallic

compounds. Use of organometallic compound in synthesis: organoborane compound, organocadmium compounds, organolithium compounds and organozinc compounds.

**23. CHM 308 NATURAL PRODUCTS CHEMISTRY I (2 UNITS).**

Terpenoids. Isoprene rule. Carotenoids: alkaloids: meaning classification, economic

importance; steroids: sex hormones, androgens; estrogens; progestins; contraceptives; adrenocortical steroids; D vitamins; other vitamins e.g. cholic acid and diosgenin; biosynthesis of cholesterol; lipids.

- 24. CHM 309 INSTRUMENTAL METHODS OF ANALYSIS (3 UNITS)** Introduction to spectroscopy; electromagnetic radiation. Interaction of electromagnetic radiation with matter. Electromagnetic spectrum, UV and visible spectrophotometry. Infrared, NMR. Mass spectroscopy, Colorimetry. Photometry. Fluorescence method. X – ray. Refractometry and interteferometry, polarimetry. Calorimetry and Polarography.
- 25. CHM 321 APPLIED SURFACE AND COLLOID CHEMISTRY (2 UNITS).** General principles relation to surface . electrical potential, attractive forces, solid – gas interface. Definition of colloids; historical survey of colloid development, Types of colloids; polymers; proteins gels; association colloids, concepts of detergency.
- 26. CHM 322 INDUSTRIAL CHEMICAL PROCESSING AND TECHNOLOGY I (2 UNITS).** Fundamental principles and problems of industrial chemistry: scope and Research in chemical industry. Survey of Nigeria’s industries and their raw materials requirements. Mineral chemistry. Fossils and their uses, plant and animal products. Energy management, nuclear, solar and hydro source of energy. Potential’s and application of locally available raw materials as industrial feedstock. Production of primary intermediate and synthesis of industrial organic chemical, polymer, adhesives, dyes, explosives, insecticide, herbicides, flavouring agents and pharmaceuticals, fermentation process. Heat transfer and mass transfer processing unit operations. Some equipment for chemical technology.
- 27. CHM 311 STUDENTS INDUSTRIAL WORK EXPERIENCE (SIWES) (15 UNITS)** The aim is to expose students to applied and technological aspect of industrial chemistry in any relevant industry or research institution.
- 28. CHM 401 PHY 308 QUANTUM CHEMISTRY/ ATOMIC PHYSICS (3 UNITS).** Postulates of quantum theory; operators angular momentum; solution of the hydrogen atom problem. Theory of atomic spectra. Self – consistent field theory. Computational aspects. Perturbation and variation methods. Idea of quantum states, orbital shape and energy. Simple valence theory; electron pair repulsion theory; atomic spectra; determination of molecular shape, bond lengths and angles. The structure and chemistry of some compounds of main group elements Schrodinger equation; helium atom; ground and excited state; spin; Pauli’s Exclusion principle; Hund’s rule; hydrogen molecule . comparison of molecular orbital and valence bond theory. Concept of resonances and configuration interaction. Coulson Fischer function: molecular orbital for diatomic molecules. Simple pi electron theory. Huckel Theory; walsh rules. Rotational vibrational and electronic spectra; determination of bond length and angles, Russel Saunders coupling; orbital and spin angular momentum; use symmetry in chemistry.
- 29. CHM 402 ADVANCED CHEMICAL KINETICS (3 UNITS).** **Pre-requisite CHM 301.** Complex reacton systems; distinction from elementary reactions. Concurrent reactions, opposing reactions, consecutive reactions. Radical reactions, theories of reaction rates – collision theory and absolute (transition state) theory. Relationship between two theories; theory of unimolecular reactions. Lindermain’s theory modifications and treatments by Hinshelwood, RRK, Slater phosphorescence, photosensitization. Radiation chemistry. Interaction of radiation with mater, ion and electrons, Radiolysis.
- 30. CHM 403 ADVANCED ELECTROCHEMISTRY (2 UNITS)** **Pre-requisite CHM 301.** Electrical double layer, potential at zero charge, polarizable and non polarizable interface, mass transport concentration polarization, fick’s law, levie equation, Electronics polarography.
- 31. CHM 404 POLYMER TECHNOLOGY (3 UNITS).** Pre – requisite CHM 303. Large scale industrial polymerization process. Rubber technology, natural rubber, grades, SBR polymer, polybutadiene rubber, butyl rubber, ethylene propylene rubber. Nitrile rubber ,Silicon rubber, Fluoro - elastomers, Poly-chloroprene rubber, Plastics, properties and application, cellulose plastics,

polycarbonates. Polymer processing; injection, extrusion, compression and transfer moulding of thermoplastics, polymer additives. Polymeric surface coating, adhesives.

**32. CHM 405 ORGANIC SYNTHESIS (3 UNITS)**

**Pre – requisite CHM 303.**

Concept of synthesis. Use of basic functional group concepts in complex synthetic schemes. Methods of formation C-H, C-C, C-X and C-N of complex molecules.

**33. CHM 406 CO – ORDINATION CHEMISTRY (3 UNITS).**

**Pre – requisite CHM 302.**

**Co –**

ordination compounds – definition, application, nomenclature, co – ordination formula and isomerism in complexes, stereochemistry of complex molecules. Theories of structure and bonding, physical methods of structural spectro-chemical series. The Nephelaumzetic series and John Teller distortions. Stabilization of unusual oxidation states by complex formation. Thermodynamic stability of complex compound, the stability complexes, kinetics and mechanisms.

**34. CHM 407 APPLIED SPECTROSCOPY (2 UNITS).**

The course is weighted heavily on the application of various spectroscopic techniques e. g. UV, IR, NMR and mass spectroscopy for structural elucidation of predominantly organic compounds.

**35. CHM 408 ENVIRONMENTAL MANAGEMENT (2 UNITS).**

Water/wastewater chemistry and analysis, management of solid, liquid and gaseous waste. Composition of waste. Domestic, municipal and industrial. Units processes, physical, chemical, biological and integrated treatment process. Treatment technologies for wastewater and sludge. Chemical and instrumentation in environmental science. Environmental impact assessment.

**36. CHM 409 COLOUR CHEMISTRY AND TECHNOLOGY (3 UNITS).**

Colour and constitution; chemistry theory and properties of dyeing and pigment.

Classification of dye and pigment. Some natural dyes and pigment (emphasis on those obtained in the locality). Dyeing mechanisms, preparation and dyeing of natural and synthetic fibers; application of reactive dyes. Colour fastness, property of dyes. Industries based on colour chemistry: dyeing machineries, printing, colouring matter for food, drugs and cosmetics, dyes used in paper industry and colour photography.

**37. CHM 410 RESEARCH PROJECT (6 UNITS).**

An original investigation aimed at involving the students in the

investigative approach to science. The research is carried under the supervision of the department and emphasis is placed on advancing a hypothesis, experimental planning and data presentation.

**38. CHM 411 SEMINAR (2 UNITS).**

**39.** A critical review of the literature in an area of interest. The course is aimed at giving the students a good knowledge on how to prepare and deliver seminar papers.

- 40. CHM 412 GROUP THEORY AND SYMMETRY (2 UNITS).** Review of molecular symmetry operations, definition of groups. Molecular representation. Detailed study of group  $e_n$ ,  $D_n$ ,  $C_{nv}$  and full rotation group application. General symmetry application. Symmetry of crystal lattices.
- 41. CHM 413 PHYSICAL ORGANIC CHEMISTRY (2 UNITS).** **Pre-requisite – CHM 303 and 308.** Preparation and reaction of stereoisomers, stereoselective neighbouring group effect, and a few special topic in physical organic chemistry.
- 42. CHM 414 NATURAL PRODUCTS CHEMISTRY II (2 UNITS)** **Pre-requisite CHM 303 and 308.** Chemistry of terpenoids; and alkaloids; antibiotic flavonoids; prostaglandin and chlorophylls. Other natural products of pharmaceutical importance. General method of isolation; separation; purification and structural determination of the natural products. Classifications. Discussion of chemistry of important members: biogenesis.
- 43. CHM 415 NON – AQUEOUS SOLVENTS' (2 UNITS).** **Pre-requisite CHM 302.** Classification and general characteristics, solute interaction. Protic solvents, aprotic solvents, liquid halides, Dinitrogen tetroxide, sulphur dioxide.
- 44. CHM 416 CHEMISTRY OF LANTHANIDES AND ACTINIDES (2 UNITS).** **Pre-requisite – CHM 302.** The elements and the position of the series in the periodic table. Comparison of series. The electronic configuration of their sequence on oxidation states, relationship, magnetic properties and colour. Chemical properties and structure of the elements and their compounds. Recovery and separation of the elements and their compounds.
- 45. CHM 417 INDUSTRIAL CHEMICAL PROCESSING AND TECHNOLOGY II (3 UNITS).**  
**Pre – requisite – CHM 319.** Optimization of operation equilibrium constants and reaction yields: theoretical and practical principles in the management of industrial chemical processes; chemical processing of minerals. Metallurgy and hydrometallurgical processes, industrial electrochemistry, plant technology, Manufacture of some heavy inorganic chemical, Cement and binding materials, Inorganic fertilizer. Hydrogen and carbon monoxide synthesis, gas, oxoprocess, water gas, source of hydrogen and it's application, Industrial inorganic materials. Raw materials, technical and economic principles of process and product routes, Flow's diagram. Selected oils and fats, soaps and detergents, sugar, paints vanishes, plastic wool pulp and paper environmental pollution.
- 46. CHM 418 MOLECULAR SPECTROSCOPY (3 UNITS).** **Pre – requisite – CHM 301, 311 and 401.** Quantum theory of microwave. IR, Raman UV Visible and NMR spectroscopy. General introduction to electron spin resonance, Mossbauer effect, nuclear quadruple resonance and other modern techniques.

**47. CHM 419 PHOTOCHEMISTRY AND PERI CYCLIC REACTION (2 UNITS). Pre-requisite – CHM 303.**

Interaction of radiation with matter electronic excitation; selection rules, deactivation routes; sensitization quenching; photofragmentation; oxidation reduction; rearrangements; pericyclic reactions and molecular orbital symmetry.

**48. CHM 432 ORGANOMETALLIC CHEMISTRY II (2 UNITS). Pre – requisite- CHM 303.**

Introduction to

organometallic compounds of the transitory elements. Classification of ligands, electron rules, bonding, preparation of organo transition metal compounds. Reaction and structure of organo transition elements. The organic chemistry of ferrocene and related compounds. The role of organometallic compounds in some catalytic reactions.

**49. CHM 433 HETEROCYCLIC CHEMISTRY (2 UNITS). Pre – requisite CHM 303.**

The synthesis and mechanistic

aspects of fused heterocyclic system particularly duinolines; Benzofurans; Benzothiophenes; iodoles Benzopyrylium salts; coumarances chromones. Application of heterocyclic system in drug synthesis.

**50. CHM 434 SELECTED TOPICS IN INDUSTRIAL CHEMISTRY (2 UNITS).**

Issues of topical interest selected from any of the following chemistry, mineral processing polymer and rubber technology, dyes. Pigments, water treatment, consumer products and pharmaceuticals.

**51. CHM 435 CHEMISTRY OF COMPOUNDING AND PRODUCTION (2 UNITS).**

An integrated laborer courses covering all the 400 level courses. Raw materials sources, formulation, roles of additives, chemistry of production, processes involved and characterization of the following: Domestic and surgical gloves balloons, toothpaste, some cosmetics. Silicate chemistry, soils, clay and ceramic production, e.t.c.

**52. CHM 436 FOOD PROCESSING TECHNOLOGY (3 UNITS).**

Analysis of food – proteins, carbohydrates, fats and oils, minerals, Vitamins, Crude fibre. An overview of small scale processing of local foods. Post harvest preservation and problems. Microbiological concept in food processing, legislation and NAFDAC regulations. FOOD CONSTITUTIONS: Desirable and undesirable constituents of foods. ANALYSIS: Analysis of food products – proteins, carbohydrate. Fat and oils, minerals, vitamin; crude fibre. PROCESSING AND PRESERVATION: Overview of small scale processing of local foods- vegetables, tubers, cereals and fruits with special attention to food dehydration, cooling and freezing. Food canning, food additives and toxicology. Water activity, chemical and physical principles behind different methods of food processing and preservation. PRODUCTION: Production of wines, spirits, jams, juices, ice cream and selected milk products, margarine, vegetable oil, chocolate and selected Nigerian foods.



## SECTION B

### POSTGRADUATE PROGRAMMES

#### INTRODUCTION.

The graduate programme in the department leads to the award of Master of Science (M.Sc) degrees in Chemistry and Industrial Chemistry, while Doctor of Philosophy (P.hD) Degrees in the following areas:

- i. Analytical/Environmental Chemistry.
- ii. Inorganic Chemistry.
- iii. Organic Chemistry.
- iv. Physical Chemistry.
- v. Industrial Chemistry.
  - a) Industrial Inorganic Chemistry.
  - b) Industrial Organic Chemistry.
  - c) Polymer Chemistry

#### AIM OF THE PROGRAMME

The postgraduate programme in Chemistry involves prescribed course work carefully designed to expose the student to advanced theoretical chemical principles and concepts. Such a background will considerably assist the student in the understanding, interpretation and analysis of his /her experimental results from laboratory research, formulate concepts that have practical relevance to research and development, and to make sound empirical deductions on natural and large scale changes.

#### A. Masters Degree Programme (M.Sc):

##### ADMISSION REQUIREMENTS.

In addition to university matriculation requirements for admission into the undergraduate programmes in chemistry or industrial chemistry, candidates who possess any of the following qualifications may be considered for admission:



- i. At least a second class honours lower degree in chemistry , industrial chemistry or chemical engineering from Ambrose Alli University or any other recognised university.
- ii. At least a third class honour degree in chemistry, industrial chemistry, chemistry education, chemical engineering or biochemistry with a post graduate diploma in chemistry from Ambrose Alli University or any other recognised University. The postgraduate diploma requirement may be waived for candidates with second class honours upper division in biochemistry or Chemical engineering.
- iii. At least a lower credit pass in Higher National Diploma (HND) in polymer Technology, Food Technology from a recognised polytechnic plus 60% average pass on postgraduate diploma in chemistry also from Ambrose Alli University or any other recognised University.

**DURATION OF STUDIES:** Four semester minimum.

**COURSE DISTRIBUTION:**

	Course code	Course title	Status	Credit/units
<b>First Semester</b>				
1	CHM 701	Advance chemical kinetics	C	3
2	CHM 702	Co-ordination chemistry	C	3
3	CHM 703	Polyfunctional groups & aromatic chemistry with reaction mechanism	C	3
4	CHM 704	Electrochemical and optical method of Analysis	C	3
5	CHM 705	Advanced Environmental chemistry	R	3
<b>Second Semester</b>				
6	CHM 710	Research project/thesis	C	6
7	CHM 711	Analysis of experimental data	C	3
8	CHM 712	Separation techniques	R	3
9	CHM 713	Applied spectroscopy	R	3
10	CHM 709	Presentation of, and Attendance at pre-& post data seminars	R	0
<b>Elective courses</b>				
11	CHM 714	Pericyclic reactions, heterocyclics, and synthesis methods		2
12	CHM 706	Molecular spectroscopy		2
13	CHM 707	Reactions in non-aqueous inorganic solvent systems		2
14	CHM 708	Organometallic chemistry		2
15	CHM 715	Radiation & photochemistry		2
16	CHM 716	Hydride chemistry & interstitial		2

		compounds	
17	CHM 717	Poly acids & silicates, soil chemistry	2
18	CHM 718	Physical organic chemistry	2
19	CHM 719	Advanced polymer chemistry	2

### STRUCTURE OF PROGRAMME.

- A student on the graduate programme in chemistry is normally required to achieve satisfactory performance in specified number of taught courses.
- All courses and their corresponding examinations shall be completed within the first year of the graduate programme.
- All courses are to be registered for according to the postgraduate school regulations.
- Research projects shall be embarked upon mainly in the second year of the M.Sc graduate programme.
- A compulsory seminar shall be given by each postgraduate student for the M.Sc on his/her research work before and after completion of research work.

### REQUIREMENTS FOR GRADUATION.

To qualify for the award of M.Sc degree in chemistry, a student shall be required to pass a minimum of 30 units including core, required and elective courses. A student is required to choose two courses from the available elective courses to make up the required 30 units in addition to the core and required courses. Such elective course(s) should be chosen in accordance with the student's area of specialization. In addition, a student shall present at least two seminars- a pre and a post data presentation. Pass mark for all post graduate courses is 50%.

### RESEARCH THESIS.

A STUDENT FOR THE M.Sc DEGREE PROGRAMME shall be expected to undertake a research under two supervisors, major supervisor and co – supervisor. Research project shall normally be approved by the department Postgraduate committee chaired by the Head of Department. A student shall be expected to successfully defend the thesis in accordance with the post graduate school regulations.

### Course Description for M.Sc Degree in Chemistry.

#### CHM701. Advanced Chemical Kinetics.

Experimental methods in gas phase and fast reactions in solution. Theoretical interpretation of reaction rates and application of vant Hoof equilibra for chemical equation and forcing functions, chemical relaxation times, amplitude and enthalpies. Temperature jump techniques including state, stopped – flow and temperature jump spectrophotometer.

#### CHM 702. Co – ordination chemistry.

Historical development of coordination compounds; coordination numbers; ligands; bonding; stereochemical aspects; complex structures, spectra; magnetic properties.

**CHM 703. Polyfunctional Groups and Aromatic Chemistry with Mechanism of Reactions.**

The chemistry of aromatic compounds compared with their aliphatic counterparts, nitrile, Grignard reaction, chemistry of bifunctional compounds. Aldol and related reactions. Energetic, kinetics and the investigation of reaction mechanism. Simple alicyclic carbon compounds and their synthesis. Representative polycyclic compounds surveyed. Nomenclature and structure.

**CHM 704 Electrochemical and optical methods of analysis.**

Electrode processes; ion selective electrode; current potential, equations, D.C.A.C and pulse polarography; instrumentation of spectrometric analysis; polarimetry; refractometry and microscopic methods; their recent developments.

**CHM 705. Advanced Environmental Chemistry.**

Water chemistry; ecological aspects of surface and ground water chemistry; sources and characteristics of municipal and industrial wastewaters; water and wastewaters; sampling and analysis for chemical and bacteriological parameters. Water pollution control measures – biological and physico – chemical methods of treatment for disposal / recycling. Physical, Chemical, mineralogical and biological properties of soil, sources and nature of solid wastes, pollution and residual toxicity from application of pesticides and synthetic fertilizers. Disposal and management of solid wastes and their recycling. Chemistry of lower atmosphere; air pollution; method of analysis of air for various parameters.

**CHM 706. Molecular Spectroscopy.**

Application of quantum theory to the interpretation of absorption and emission spectra in terms of molecular properties, theories of electronic absorption and emission (fluorescence and phosphorescence), selection intensities and polarization and transitions. Theory of vibrational and rotational spectra. IR, Raman, Resonance Raman, F.S.R, NMR, Hyperfine splitting and g-factor. Simple magnetic resonance spectra.

**CHM 707. Reaction in non – aqueous, Inorganic solvent systems.**

Non – aqueous solvent system such as liquid ammonia; liquid H<sub>2</sub>S; hydrogen cyanide; hydrogen fluoride and SO<sub>2</sub> reactions; uses.

**CHM 708. Organometallic Chemistry.**

Synthesis; structure and reactivity, bonding in transition metal compounds. Metal carbonyls, arenes; aryls; alkyls, cyclopentadienyls. Uses of organometallics commercially and in synthetic chemistry.

**CHM 709 : Seminar-** Attendance at all postgraduate Seminars are compulsory and are scored.

**CHM 710. Research Project/Thesis.**

**CHM 711. Analysis of Experimental Data.**

Evaluation of analytical data; statistical treatment of small sets of data; types of error in quantitative measurements; precision and accuracy; experimental.

**CHM 712. Separation Methods In Chemistry.**

Definition of Separation . The need for separation . Classification of separation methods . Physical versus Chemical methods . Decantation, filtration , distillation, crystallization and precipitation. Solvent extraction, super-critical fluid extraction. Chromatographic methods : paper, thin-layer, gas –liquid , gas-solid, ion exchange , molecular exclusion. High performance liquid chromatography (HPLC), ultra-HPLC. Instrumentation in separation techniques . Method development for the separation of real samples. Determination of yield.

**CHM 713. Applied Spectroscopy.**

Fundamental concepts; definitions and law; instruments for measuring absorption of radiation: UV, Visible, infrared, and N.M.R. spectroscopy; mass spectrometry; limitations of spectrometry.

**CHM 714. Pericyclic Reaction, Heterocyclic and Naturally Occurring Compounds and synthetic methods.**

Ring formation and ring fission reaction and Woodward – Hofman Rules. Sigmatropic shifts. Indole, quinoline, imidazole and selected monocyclic heterocycles with N, O, and S, introductory alkaloids, terpenoid, coumarin and flavonoid chemistries and biogenesis, chemical fossils, organic synthetic strategies illustrated by the synthesis of three or more complex natural products; survey on general synthetic reaction and methods.

**CHM 715. Radiation and Photochemistry .**

Interaction of radiation with matter; Radiolysis of gases; liquids and solids; excited states; production and detection of free radicals, measurement of radical yield; application of radiation chemistry such as polymerization; sterilization; food preservation and radiobiology. Laws of photochemistry; intra and intermolecular processes; fluorescence and phosphorescence; thermo and chemiluminescence's; photosynthesis; photoelectron – chemical cells; lasers.

**CHM 716. Hydride Chemistry and Interstitial compound.**

Hydrides of the elements of main groups I – IV; synthesis; physical properties and reactions; some interstitial and non – stoichiometric compounds; carbides; nitrides; borides and silicides.

**CHM 717. Poly – acids and silicates, soil chemistry.**

Condensation processes in polyacids; systems; heteropolyacids; structure of polyacids; polyphosphoric; silicates; Aluminosilicates; Zeolites.

**CHM 718. Physical Organic Chemistry.**

Physical methods of investigating reaction mechanism. Molecular orbital theories with emphasis on the Huckel theory and their chemical application; structure properties correlation; Mammert equation applications and modification – Okamoto and Brown Taft Nishioka and Fujita, etc. solvent effects and catalyses.

**CHM 719. Advanced Polymer Chemistry.**

Polymerization reactions, condensation and addition: Polyester; resin fibres; polyamides and linear and non – linear polymers; molecular size; it's control and reactivity; kinetic and molecular weight distributions ring formation; cross linking; gel point; ring – scission; electronic structure motion, termination and transfer; degree of polymerization transfer constant; cationic polymerization; anionic polymerization, living polymers; stereo specific polymerization; block and graft co – polymerization.

**B. Doctorate Degree Programme (Ph.D).**

In addition to university matriculation requirements for admission into the undergraduate programmes in chemistry and industrial chemistry candidates who possess any of the following qualifications may be considered for admission:

- i. First class honours degree in chemistry or industrial chemistry of Ambrose Ali University or any other recognised university.
- ii. A Master's degree in chemistry or industrial chemistry with 60% average of Ambrose Alli University Ekpoma or any other recognized university.

**METHOD OF STUDY:** Doctoral studies in Chemistry dept is by research work.

**DURATION OF STUDIES:** Minimum of six (6) semesters.

**OTHER REGULATION GOVERNING POST GRADUATE PROGRAMMES :**

Other regulation governing method of application, registration, renewal of registration, approval of thesis title, standard and presentation of thesis/Dissertation, Board of examiners, submission of thesis, award of the degree etc is contained in the school of postgraduate prospectus.

**C. Postgraduate Diploma Programme [PGDC] :**

The postgraduate diploma programme in chemistry is primarily aimed at the remediation of the general chemistry background of Chemistry graduates who cannot proceed directly to the Master's degree programme for academic reasons, and for graduates of allied discipline who wish to later take a Master's degree in chemistry or industrial Chemistry. It is also meant for Higher National Diploma (HND) holders in relevant discipline from Polytechnics and other tertiary institutions who wish to obtain a Master's Degree in Chemistry or Industrial Chemistry. Candidates who possess any of the following qualifications may be considered for admission.

- i) At least third class honour's degree in chemistry, industrial chemistry, chemical engineering, biochemistry or chemistry education of the Ambrose Alli university or any other recognised university.
- ii) At least lower credit pass in higher national diploma (HND) in polymer technology ,food technology or science laboratory technology (SLT) from recognized polytechnics.

**DURATION OF STUDIES ;** Two (2) semesters minimum.

### **STRUCTURE OF THE PROGRAMME & GRADUATION REQUIREMENTS**

The structure of the programme and requirements for graduation is as applicable to the Master's programme except that :

1. All courses are core
2. Only one project supervisor is required
3. Project defense panel will not require an external Examiner.

### **COURSE DISTRIBUTION :**

	<b>Course code</b>	<b>Course title</b>	<b>Status</b>	<b>Credit/units</b>
<b>First Semester</b>				
1	PGDC 601	Physical Chemistry I: Gas Laws, physical properties & deductions. Thermodynamics & Enthalpy Changes.	C	3
2	PGDC 602	Inorganic Chemistry I: Atomic theory & Periodicity of the properties of Elements.	C	3
3	PGDC 603	Organic Chemistry I: Functional groups & Aromatic chemistry with reaction mechanism	C	3
4	PGDC 604	Analytical Chemistry.	C	3
5	PGDC 605 (CHM 304)	Experimental Chemistry (PRACTICALS)	C	3
	PGDC 606	Attendance at Pre- & Post- data Seminars	C	3
<b>Second Semester</b>				
6	PGDC 610	Research project/thesis	C	6
7	PGDC 611	Physical Chemistry II: Chemical		

8	PGDC 612	Equilibrium & Chemical Kinetics Inorganic Chemistry II : Introductory Organometallic Chemistry & Co- ordination Chemistry	C	3
			C	3
9	PGDC 613	Organic Chemistry II : Reaction Mechanisms & Classification of Organic reactions.	C	3

### Course Description for Postgraduate Diploma in Chemistry

**PGDC 601: Physical Chemistry I** – Deduction of Gas laws from kinetic gas equation, Distribution of molecular speeds, calculation of molecular speeds and collision properties. First Law of thermodynamics, thermodynamic terms, complete differential and homogeneous functions, work, heat and energy. Heat content (enthalpy), heat capacities. Spontaneous processes, conversion of heat to work.

**1. PGDC 602: Inorganic Chemistry** – Atoms, Molecules: Atomic structure; the development of the atomic theory, Electronic configuration – details of the spdf notations. The Periodic Table of elements, its evolution to present state and major classifications and relationships in the Table- e.g metals, transition metals, metalloids etc, theories of the classifications. Characteristics of each group and periods, Head element characteristics, Trends of properties across the periodic table such as- metallicity, non-metallicity, electronegativity, atomic & ionic radii etc, anomalies in the periodic table. Bond types and bond formation theories in inorganic compounds.

**2. PGDC 603: Organic Chemistry - Functional group Chemistry and Aromaticity** : Classification of organic compounds, nomenclature, homologous series; functional group (e.g alkanes, alkenes, alkynes, alcohols, phenols, thiols, aldehydes, ketone, carboxylic acids, ether, esters, amide, nitriles, haloalkanes, sulphoxides and sulphones. Basic stereochemistry, electronic theory in organic chemistry, saturated hydrocarbons; unsaturated hydrocarbons.

**3. PGDC 604: Analytical Chemistry** – Statistical methods in analysis, theory of sampling. Chemical methods of analysis including volumetric, gravimetric and optical methods. Introduction to potentiometric, electrolytic and radiochemical methods. Electromagnetic radiation and its interaction with matter. Electromagnetic spectrum, UV and visible spectrophotometry, including atomic absorption spectrometry. Photometry,

fluorescence, X-ray and refractometry, Electroanalytical methods : polarography, amperometry and conductometry. Chromatography.

**4.\*PGDC 605: EXPERIMENTAL CHEMISTRY (PRACTICALS)**- Selected important experiments designed to improve the practical skill of the students and to enhance their understanding of relevant theories. Topics contained in this package ensure a wide coverage of the diverse areas of chemistry.

**5. PGDC 606 : Seminar**- Attendance at all postgraduate Seminars are compulsory and are scored.

**6. PGDC 610: Research Project/Thesis.**

**7. PGDC 611 :** Reversible reactions , law of mass action . Relationship between  $K_c$  ,  $K_p$  and  $K_x$ . Solutions, colligative properties, electrolytic conduction, ionic equilibrium ,electrochemical cells. Rate laws, collision theory, order of reactions (First, second and third) Molecularity of reactions.

**8. PGDC 612:** Introductory Organometallic Chemistry. Co – ordination compounds – definition, application, nomenclature, co – ordination formula and isomerism in complexes, stereochemistry of complex molecules. Theories of structure and bonding, physical methods of structural spectro-chemical series. The Nephelaumzetic series and John Teller distortions. Stabilization of unusual oxidation states by complex formation. Thermodynamic stability of complex compound, the stability complexes, kinetics and mechanisms.

- Runs through the session.

**9.PGDC 613 :** Factors affecting structure and physical properties of organic compounds; factors affecting directional movements of electrons in organic reactions; energy of activation; entrophy of activation; transition – state theory diagrams; free radical substitution reactions: in alkenes; organic reactions addition. Elimination, nucleophilic and electrophilic substitutions (displacement); aromaticity illustrated with benzene, aromatic electrophilic and nucleophilic substitutions. Chemistry of terpenoids; and alkaloids; antibiotic flavonoids; prostaglandin and chlorophils. Other natural products of pharmaceutical importance.

LIST OF PAST HEADS OF DEPARTMENT

OSAYANMO I. EGUAVOEN ... 1982-1987; 1990-1991; 2005-2006

STEVE A. OKECHA .....1987-1990; 2000-2002

LINUS C. NDIOKWERE .....1991-1995.

FELIX EGHAREVBA .....1995-1997; 1999-2001; 2009

JUSTUS E. EBHOAYE .....1997-1999; 2002-2005.

IMOHIMI O. ASIA .....2006-2008;

MICHAEL O. OSUIDE ..... 2008-2009; 2011-2013

VICTOR U. OKOJIE ..... 2009-2011.

OSARO K. IZE-IYAMU .....2013-2015.

EGHE E. EGBON .....2016-2018.



Odia Amraibure .....2018-2020

**LIST OF EXTERNAL EXAMINERS**

Prof. FANIRAN - University of Ibadan- 1986-1992

Prof. A AJAYI - University of Ibadan- 1992-1994

Prof. F. E. Okieimen - University of Benin -1994-1999

Prof. K.O. Ipinmoroti -The Fed. University of Tech. Akure-2008-2010.

Prof. A.A. Oshodi- The Federal University of Technology, Akure-2010- 2012.

Prof. C.A. Odilora Anambra State Universty, Uli, Anambra State. 2013-2014

Prof. A.A. Oshodi- The Federal University of Technology, Akure-2015- 2017

Prof E.Egboh – Delta state University, Abraka, 2018-till date.

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