OBAFEMI AWOLOWO UNIVERSITY,
ILE-IFE, NIGERIA.

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

HANDBOOK

2023

FOREWARD

Chemistry Department at Obafemi Awolowo University, Ile-Ife is one of the foundation departments that were established in 1962. From the days of its humble beginning, the Department has grown into one of the largest chemistry departments in the nation. From a predominantly foreigner dominated academic staff strength, with gradual capacity building the department can now boast of a fully national staff composition. At the moment, we have 38 academic staff, consisting of 15 Professors, 4 Readers, 15 Senior Lecturers, 3 Lecturers and 1 Assistant Lecturer. In addition, the department has 10 Technical staff and 2 Administrative staff. The department teaches about 5,000 undergraduate students per year from various faculties ranging from Science, Pharmacy, Agriculture, Technology, and Education to the College of Health Sciences.

Located in the Physical Sciences Building (White House), the department has made significant contribution in the nation over its 60 year history. Within the university system nationwide, the department has produced former Vice-Chancellors, Provosts, Deans, Directors and Vice Deans. Outside the university system the department has had the privilege of having among its past staff and students Special Advisers, a Head of Service, Managers in companies, as well as several others in various industries, research institutes, civil service, and government departments. With a current yearly output of over 30 peer-reviewed scientific articles, the department continues to strive for excellence in research, despite the dwindling state of scientific facilities in the country.

This handbook serves to build a bridge of sorts between the history of the department and its future. It lays bare the basics for newly admitted students and arms them to be able to make the most of their sojourn in such a huge department. From knowing what courses to register for to knowing how to calculate the Cumulative Grade Point Average (CGPA), this handbook is basically compiled to be a guide for all our undergraduate students who will then be guided on practical decisions by their Part Advisers.

It is the expected that with the information contained herein in hand, our students would be better guided in making the right choices while maximizing the array of seasoned staff in the department to their benefit. Above all, all students must realize that being an excellent student in chemistry is not a cheap task. It takes hard-work to overcome the energy barrier of success in any of the chemistry programmes and it takes strong determination to be able to complete the journey at a good rate.

I wish you a pleasant experience in the department.

Akinsehinwa Akinlua
Professor and Head of Department

DEPARTMENT OF CHEMISTRY

MEMBERS OF ACADEMIC STAFF

S/ No	N A M E	QUALIFICATIONS	RANK	AREA OF SPECIALISATION
1	O. O. Soriyan	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Physical Chemistry
2	A. O. Ogunfowokan	B.Sc. (Ogun State), M.Sc. (Ife), Ph.D. (Ife)	Professor	Environmental/Analytical Chemistry
3	E. A. Oluyemi	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Environmental/Analytical Chemistry
4	O. S. Falade	B.Sc. (Ado-Ekiti), M.Sc. (Ife), Ph.D. (Ife)	Professor	Food/Applied Chemistry
5	A. Akinlua	B.Sc. (Ife), M.Sc. (Ibadan), Ph.D. (Ibadan)	Professor	Organic Geochemistry
6	M. A. Aderogba	B.Sc. (Ed.) (Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Organic Chemistry
7	F. M. Adebiyi	B.Tech. (FUTA), MBA. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Environmental/Analytical & Petroleum Chemistry
8	J. A. O. Oyekunle	B.Sc. (Ed) (ACE Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Environmental/Analytical Chemistry
9	O. Owoyomi	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Physical Chemistry
10	G. O. Ogunlusi	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Physical Chemistry
11	I. O. Olabanji	B.Sc.(Ed) (ACE Ife), M.Sc. (Ife), Ph.D. (Ife)	Professor	Environmental/Analytical Chemistry
12	A. S. Adekunle	B.Sc. (FUNAAB), M.Sc. (Ife), Ph.D. (Pretoria, South Africa)	Professor	Environmental/Analytical Chemistry
13	J. K. Adesanwo	B.Sc. (Ibadan), M.Sc. (Ibadan), Ph.D. (Ibadan)	Professor	Organic Chemistry
14	L. M. Durosinmi	B.Sc. (Ibadan), M.Sc. (Ibadan), Ph.D. (Ife)	Professor	Inorganic Chemistry
15	T. O. Olomola	B.Sc. (Ibadan), M.Sc. (Ibadan), M.Phil. (Ife), Ph.D. (Rhodes, South Africa)	Professor	Organic Chemistry
16	I. O. Otemuyiwa	B.Sc. (UNN), M.Sc. (Ife), Ph.D. (Ife)	Professor	Food/Applied Chemistry
17	A. A. Adenuga	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Oregon State, USA)	Reader	Environmental/Analytical Chemistry
18	O. F. Akinyele	B.Sc. (Ibadan), M.Sc. (Ibadan), Ph.D. (Ibadan)	Reader	Inorganic Chemistry
19	S. O. Famuyiwa	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Bostwana)	Reader	Organic Chemistry
20	A. A. Fodeke	B.Sc. (ABU), M.Sc. (Lagos), Ph.D. (Ibadan)	Reader	Physical Chemistry
21	R. C. George	B.Sc. (UNN), M.Sc. (Ife), Ph.D. (Ife)	Reader	Inorganic Chemistry
22	L. O. Olasunkanmi	B.Sc.(Ife), M.Sc. (Ife), Ph.D. (North-West, South Africa)	Reader	Physical Chemistry
23	O. S. Balogun	B.Sc. (Ilorin), M.Sc. (Ibadan), Ph.D. (Ibadan)	Reader	Organic Chemistry
24	O. S. Ajayi	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Reader	Organic Chemistry

25	S. O. Sanusi	B.Sc. (Ife) , M.Sc. (Ife), Ph.D. (Rhodes, South Africa)	Reader	Physical Chemistry
26	K. N. Awokoya	B.Sc. (Ogun State), M.Sc. (Ibadan), Ph.D. (Rhodes, South Africa)	Reader	Industrial Chemistry
27	O. A. Ogunkunle	B.Sc. (Ibadan), M.Sc. (Ibadan), Ph.D. (Ibadan)	Senior Lecturer	Industrial Chemistry
28	T. O. Aiyelabola	B.Sc. (Lagos), M.Sc. (Lagos), Ph.D. (Ife)	Senior Lecturer	Inorganic Chemistry
29	V.O. Oninla	B.Sc. (Ilorin), M.Sc. (Ibadan), Ph.D.(Ibadan)	Senior Lecturer	Physical Chemistry
30	F. O. Taiwo	B.Sc. (Ed) (Ife), M.Sc. (Ife), Ph.D. (Ife)	Senior Lecturer	Organic Chemistry
31	O. A. Fadare	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Ife)	Senior Lecturer	Organic Chemistry
32	A. O. Ayeni	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Rhodes, South Africa)	Senior Lecturer	Inorganic Chemistry
33	E. H. Umukoro	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (University of Johannesburg, South Africa)	Senior Lecturer	Physical Chemistry
34	T. A. Ajayeoba	B.Sc. (Ibadan), M.Sc. (Ibadan), Ph.D.(Ibadan)	Senior Lecturer	Inorganic Chemistry
35	A. T. Famojuro	B.Tech. (LAUTECH), M.Sc. (Ife), Ph.D. (Ife)	Lecturer I	Inorganic Chemistry
36	W. O. Doherty	B.Sc. (Ife), M.Sc. (Ife), Ph.D. (Monash, Australia)	Lecturer I	Inorganic Chemistry
37	S. S. Durodola	B.Sc. (), M.Sc. (Ife)	Lecturer II	Analytical Chemistry
38	B. W. Akinbola	HND (), M.Sc. ()	Assistant Lecturer	Industrial Chemistry

MEMBERS OF TECHNICAL STAFF

M. A. Ramoni	Chief Technologist
E. O. Aderanti	Chief Technologist
O. A. Aliyu	Assistant Chief Technologist
Miss. A. A. Adegbite	Technologist II
Mrs. A. A. Omidire	Laboratory Superintendent
Mrs. A.F. Babatunde	Laboratory Superintendent
O. I. Olayinka	Laboratory Superintendent
Mrs. G.F. Ogundeji	Senior Laboratory Supervisor
Z. A. Odesanmi	Senior Laboratory Supervisor
M. A. Ademiju	Laboratory Supervisor

ADMINISTRATIVE STAFF

Mr. T. Odusina	Assistant Chief Clerical Officer
Mrs. O. W. Falana	Senior Office Assistant

HISTORICAL NOTES

History of the University

Obafemi Awolowo University, Ile-Ife is one of three Universities established in Nigeria between 1961 and 1962 as a result of the report submitted to the Federal Government in September, 1960, by a Commission it appointed in April 1959 under the Chairmanship of Sir Eric Ashby, Master of Clare College, Cambridge, to survey the needs of postsecondary and higher education in Nigeria over the next twenty years.

The Government of Western Nigeria first announced in 1960 its intention to establish as soon as possible a University in Western Nigeria which would be of the highest standard. Its policy would be to open its doors to students from all parts of the Federation and of the World.

The planning of the Obafemi Awolowo University was entrusted to two Committees. The first one, a University Planning Committee comprising persons qualified to advice on the planning of new University, and who in effect undertook the preparatory work connected with the establishment of the University pending the setting up of the Provisional Council of the University. The other, a University Parliamentary Committee, which would be advisory to the Minister of Education. On 8th June, 1961, the Law providing for the establishment of the Provisional Council of the University was formally inaugurated under the Chairmanship of Chief Rotimi Williams.

On 11th June, 1970, an Edict known as the University of Ife Edict, [1970] was promulgated by the Government of the Western State to replace the Provisional Council Law of 8th June, 1961. This Edict has since been amended by the Obafemi Awolowo University, Ile-Ife (Amended) Edict No. 11 of 1975 (Transitional Provision) Decree No 23 of 1975. This New Decree effected a takeover of the Obafemi Awolowo University by the Federal Military Government established a Provisional Council as an interim governing body of the University which shall subject to the general direction of the Head of the Federal Government control the policies and finances of the University and manage its affairs. Governing Council has since replaced this Provisional Council.

The site selected for the University was at Ile-Ife, a town about 80 kilometers northeast of Ibadan in the Oyo State. Ife is famous as the centre of ancient

civilization and home of the Museum, which contains the renowned Ife heads. It was intended that temporary buildings should be put up on the site to enable teaching to commence in October 1961 while the permanent buildings were planned and erected. But when the Federal Government transferred the Ibadan Branch of the Nigerian College of Arts, Science and Technology to the University, it was decided that it would BE unnecessary to put up temporary buildings at Ife and the University was temporarily located on the site of Ibadan Branch of the Nigeria College.

Teaching began in October 1962 with an initial enrolment of 244 students. The teaching, administrative and technical staff, either transferred from the Nigerian College or newly recruited from abroad numbered about eighty.

The University started with five Faculties: Agriculture, Arts, Economics and Social Studies (now Social Sciences), Law and Science. Six new faculties have since been added, namely the Faculty of Education (established on 1st October, 1967), the

Faculty of Pharmacy (established on 1st October, 1969), the Faculties of Technology and Health Sciences (now College of Health Sciences) (both established on 1st October, 1970) Faculty of Administration (which replaces the former Institute of Administration with effect from 1st October, 1979) and Faculty of Environmental Design and Management (established on April 6, 1982).

In 1992, the University established a collegiate system with five Colleges. The system did not function effectively and was abandoned after two years. However, the Postgraduate College and the College of Health Sciences were retained. The College of Health Sciences now comprises of the Faculties of Basic Medical Sciences, Clinical Sciences and Dentistry. The Adeyemi College of Education located in Ondo and the Institute of Agricultural Research and Training in Ibadan were initially integral part of the University. Although the Adeyemi College was separated from the University in 1975, however, there is still a close relationship between the two institutions. The College offers degree programme of the University under a system that is closely monitored by University.

The Institute of Agricultural Research and Training, [IAR&T] Ibadan with a branch at Akure in Ondo State, used to be fully superintended by the University in 1991. However, the Akure branch and the College of Animal Science of the Institute continued to report to the Federal Government through the Director of the institute. In terms of funding, the Institute of Agricultural Research and

Training now relates to the Federal Ministry of Agriculture while the University still has administrative responsibility for the Research and Administrative staff of the Institution. The Director and the Secretary of the institute are responsible to the University through the Vice- Chancellor and Registrar respectively. The Vice-Chancellor is the Chairman of the Institute's Governing Board.

Other Institutes and major units existing in the University include:

The Natural History Museum

The Institute of Ecology and Environmental Studies

The Centre for Gender and Social Policy Studies

The Centre for Industrial Research and Development

The Institute of Public Health

The Institute of Cultural Studies

The Computer Centre

Technology Planning and Development Unit (TPDU)

The Drug Research and Production Unit

The Equipment Maintenance and Development Centre

The Central Technological Laboratory Workshop

The Central Science Laboratory

The Centre for Distance Learning (CDL)

Finally, some other agencies over which the University has no direct, or, in some case limited control, have premises within the 'University. They include:

The Regional Centre for Training in Aerospace Survey (RECTAS)

The National Centre for Technology Management (NACETEM)

The Centre for Energy Research and Development (CERD)

The Africa Regional Centre for Space Science and Education in English

The student population rose steadily from 244 in the 1962/1963session to 28,758 at the end of the 2005/2006 session.

Mission, Vision, and Objectives of the University

(a) MISSION

To create a teaching and learning community for imparting appropriate skills and knowledge, behaviour and attitude; advance frontiers of knowledge that is relevant to national and global development; engender a sense of selfless public service; and promote and nurture the African culture and tradition.

(b) VISION

The vision is of a top rated University in Africa, ranked among the best in the world, whose products occupy leadership positions in the public and private sectors of the Nigerian and global economies, that has harnessed modem technology, social, economic and financial strategies, built strong partnerships and linkages within and outside Nigeria and whose research contributes a substantial proportion of innovations to the Nigerian economy.

(c) STRATEGIC OBJECTIVES

*To produce graduates of international standard, with appropriate knowledge and skills in their fields of study, who will be highly employable and able to employ themselves.

*To provide high quality research and development activities that will promote the development of the Nation and enhance the image of the University and the researchers.

*To harness modern technology especially ICT and modern social, economic and financial strategies to run a cost of efficient and effective academic programme and institutional management.

*To provide services that has relevance to and impact on the local community and the Nation.

*To provide conditions of study, work and living in the University Community that are of appropriate standard.

*To expand access to tertiary education in the face of unmet demand.

*To operate as an equal opportunity educational institution, sensitive to the principle of gender equity and nondiscriminatory on the basis of race, ethnicity, religion or physical disability.

Members of the University

The members of the University as defined on statute 2(1) are:

(a) The Officers of the University.

(b) The members of the Council.

(c) The members of the Senate.

(d) The members of the Academic Staff.

(e) The Graduates.

(f) The students; and such other persons as may by Statute be granted the status of members.

A person shall remain a member of the University only as long as he is qualified for such membership under any of the sub- paragraphs of paragraph (1) of this Statute.

The Officers of the University

The Officers of the University as contained in Statute 3 shall be:

(a) The Chancellor.

(b) The Pro-Chancellor.

(c) The Vice-Chancellor.

(d) The Deputy Vice-Chancellor (Academic).

(e) The Deputy Vice-Chancellor (Administration).

(f) The Registrar.

(g) The Librarian.

(h) The Bursar;

(i) Such other persons as may by Statute be granted the status of officers.

Establishment of the University Council

(a) Functions

The University Council to be known as the Council of the Obafemi Awolowo University, Ile-Ife was established by the Edict. The Edict states that Council shall be the governing authority of the University and shall have the custody, control and disposition of all the property and finances of the University and, except as may otherwise be provided in the Edict and the Statutes, shall manage and superintend generally the affairs of the University and, in any matter concerning the University not provided for or under this Edict, the Council may act in such manner as appears to it best calculated to promote the interests, objects and purposes of the University.

The Council, subject to the provision of the Edict and Statutes has the following functions among others:

*to determine, in consultation with Senate, all University fees;

*to establish, after considering the recommendation of the Senate on that behalf, Faculties, Institutes, Schoo1s, Boards, Departments and other units of learning and research.

*to prescribe the organization, constitution and functions of the afore mentioned and to modify or revise the same;

*to authorize, after considering the recommendations of the Senate in that behalf, the establishments for the academic in the University, and with approval of the Senate, to suspend or abolish any academic post except a post created by this Edict or the Statutes;

*to authorize the establishments for the administrative staff and other staff in the University and to suspend or abolish any such posts other than posts created by the Edict or the Statutes;

*to make the appointments authorized by this Edict and the Statutes;

*to exercise powers of removal from office and other disciplinary control over the academic staff, the administrative staff and all other staff in the University;

*to supervise and control the residence and discipline of students of the University and to make arrangements for their health and general welfare -

(b) Composition of the Members of Council

The Council as contained in Statute 10(1) as amended by Decree No. 11 of 1993 and Decree 25 of 1996 shall consist of the following members:

(i) Ex -Officio Members: Pro-Chancellor

The Vice-Chancellor

The Deputy Vice-Chancellors

(ii) 1 member from the Federal Ministry of Education

(iii) 4 members appointed by National Council of Ministers

(iv) 4 members of Senate appointed by Senate

(v) 2 members of the Congregation elected by the Congregation

(vi)1 member of Graduates Association -elected by Graduates Association

The Senate shall prescribe which Departments and subjects of study shall form part or be the responsibility of each of the Faculties. The next level of organization is the Faculty where the teaching and other activities of the Departments are co-ordinated. Proposals generally come from Departments to the Faculty Board although they can also be initiated at the Faculty level in which Departments normally have an opportunity to consider them before the Faculty Board takes a decision. The membership of the Faculty Board is stipulated in Statute 13(3) thus:

(a) The Vice-Chancellor

(b) The Deputy Vice-Chancellors

(c) The Dean of the Faculty

(d) The Professors and Heads of Departments comprising the Faculty;

(e) Such other full-time members of the academic staff of the Departments comprising the Faculty as the Senate may determine after considering the recommendation of the Faculty Board.

(f) Such other Professors and other Heads of Departments, as the Senate may determine after considering the recommendation of the Faculty Board;

(g) Such other persons within or outside the University as the Senate may appoint after considering the recommendation of the Faculty Board.

The next level is that of Departments which consist of groups of teachers and sometimes Research Fellows in a single subject with a Head who is usually although not always a Professor generally appointed by the Vice-Chancellor.

The Department is the normal basic unit of academic organization. It is at this level that the organization of teaching and the use of research facilities are primarily worked out. Senate may however recommend the creation of Institutes for groups of specialized subjects or discipline that require interdisciplinary research efforts and thus, cut across Faculties in scope.

THE UNIVERSITY LIBRARY

The University Library is made up of several units and offers several services.

African Special Collection

The African Special Collection is a collection of rare and other books primary interest to people whose fields of interest are in African Studies. Staff publications and theses submitted for higher degrees of the University as well as of other Universities are also housed there. The Collection is closed access.

Documents Collection

The Documents Collection includes official publications of the Federal Government of Nigeria, the old regional governments, the present state governments and the Federal Capital Territory. It also includes publications of other African governments and international organizations.

Reference Collection

Dictionaries, encyclopedia, handbooks, directories, atlases, University Calendars, etc. are shelved in the Reference Room.

Bibliographies, indexes and abstracts are available in the Bibliography Room. Reference books do not ordinarily circulate a newspaper clippings file (post-October; 1985) and a vertical file (reports and other pamphlet type material) kept in the Reference Room.

Reserve Collection

(i) Day reserve collection

Multiple copies of textbooks, particularly some of those recommended for specific courses, are shelved in the Reserve Books Room on Floor 3 North East Wing.

(ii) Two Hour Reserve

Some other materials, periodical articles in particular, a placed on 2-hour reserve. These may be obtained on request (signature and seat number required) and retained for a period of two hours at a time, subject to renewal provided other readers have not demanded the materials

Recent Accessions

A selection of books added to the Library stock is normally displayed for several days before being put in the main collection. The books may not be borrowed while on display but may be reserved at the loans Desk.

Catalogues

A library catalogue is a finding list of books and other materials available in the library. The following catalogues can be found in the Catalogue Hall:

(i) The Author/title Catalogue

(ii) The Subject Catalogue

(iii) The Shelf list

(iv) The Serials Catalogue

(v) The Documents Catalogue

How to Borrow a Book

When you have found the book you want to borrow, you will be required to sign your name and address on the book card provided in duplicate. You must surrender a Borrower's Ticket for each book borrowed.

When you return a book, you must ensure that you receive your Borrower's Ticket back immediately.

Reservation

Filling a reservation slip can reserve a book; in which case, it will not be renewed for the present borrower when returned, and, if it is already overdue, it will be recalled at once.

Inter-Library Loan

If the book you require is not in stock, it is often possible to borrow it from another library. This service is dependent on goodwill and cooperation between libraries, and readers who benefit from it are required to observe the regulations applying to each loan.

Photocopying Services

Within the limitations imposed by copyright, the library is able to supply readers with photocopies of periodical articles and parts of books at moderate charges.

Penalties for Overdue or Lost Books

Penalties for overdue books will be imposed as follows: -

(a) **₦5.00** per day for the first 30 days; thereafter all loan privileges will stop.

(b) Books specially recalled by the University Librarian would attract a fine of **₦10.00** per day after third day from the date of recall.

(c) Books lost or damaged will attract a fine five times the current cost of the books.

(d) No student will be allowed to attend the Graduation Ceremony or receive his/her certificate without a clearance certificate from the University Library to the effect that no book or fine is outstanding against him or her.

LIBRARY OPENING AND CLOSING HOURS

Monday – Friday	8.00 a.m. - 8.00 p.m.
Saturday	8.00 a.m. - 4.00 p.m.
Sunday	2.00 p.m. - 8.00 p.m.

Vacation Period

Monday – Friday	8.00 a.m. - 6.00 p.m.

DIVISION OF STUDENTS' AFFAIRS

Guidance and Counseling Unit:

The Division of Students' Affairs has Professional Counselors who are committed to helping students grow in self-understanding in the process of integrating their personal and academic experiences. The services are free to students and are confidential (i.e. not used as part of his/her other University records). The services include personal counseling, group counseling, study skills improvement, test anxiety reduction, personal crisis intervention, psychological testing, career and occupational counseling and settlement of grievance between students. Where necessary, consultations are made with campus organization, specialists and academic Departments, to ensure that students' problems are resolved satisfactory.

The Counselors can be contacted in Room 9 and 10 Division of Students' Affairs between 10.00 a.m. and 2.00 p.m. Monday to Friday.

Scholarships and Financial Assistance:

The Division of Students' Affairs serves as a link between students and sponsoring authorities both within and outside Nigeria. Students are advised to check the Notice Board in their respective faculties as well as those at the Division of Student Affairs Building for advertisement and other relevant information.

Liaison is also maintained between students and government at various levels of scholarships and bursaries.

ROLL OF HONOURS FOR STUDENTS

Senate at a Special Meeting held on Wednesday, 1st November, 2006 decided that Roll of honours for students be instituted in the University to enhance discipline and good performance among students.

All students are enjoined to strive to be on the Honours Roll. The details are as follows:

(i) The Honours Roll should be at three levels, namely:

(a) Departmental Honours Roll

(b) Provosts/Deans Honours Roll

(c) University Vice-Chancellor's Honours Roll

(ii) The beneficiaries must have a minimum CGPA of 4.0 for Departmental Honours Roll; 4.25 for Provost/Deans Honours Roll and 4.5 for Vice-Chancellor/University Honours Roll in all the Faculties except the Faculty of Pharmacy and College of Health Sciences where the candidates are expected to have a cumulative average of 60% and 62% respectively.

(iii) The beneficiary must maintain this grade annually to continue to enjoy the award.

(iv) The recommendations must be processed along with results of Rain Semester examinations.

(v) The student must be of good conduct.

(vi) He/she must not have outstanding or carry-over courses and must not be repeating the year.

(vii) No student on Leave of Absence shall enjoy the Annual Roll of Honours Award.

(viii) No student that has a disciplinary problem shall enjoy the award.

(ix) The award shall be based on the recommendation of the Departmental Board of Examiners and the Faculty Board of Examiners, while that pertaining to the Vice-Chancellor/University shall be processed through the Committee of Deans.

(x) Names of beneficiaries shall be displayed as follows:

Departmental Honours - Departmental Notice Board. Provost/Deans Honours - Faculty Notice Board

Vice-Chancellor University Honours

(xi) Each beneficiary shall be given a certificate.

UNIVERSITY EXAMINATION REGULATIONS

Some University Examination Regulations students should note as contained in University Examination Regulations for first Degrees, Diplomas and Certificates are: **Registration for University Examinations**

(a) A candidate for a University examination must have registered the courses in the prescribed format not later than the closing date prescribed for registration for such courses. Any candidate who fails to register for courses at the appropriate time as prescribed by Senate will not be allowed to take any examination in such courses. Any examination taken without course registration shall be null and void.

(b) Students who register for courses are committed to the number of units registered for and are expected to take examinations in such courses. If a student failed to take an examination be would be scored '00F' for the number of units he had registered for and in which he had failed to take the prescribed examination.

(c) Any student who does not have any course to offer in a particular semester should apply for leave of absence.

(d) A candidate who has less than 15 units in a particular semester to graduate should apply to his/her Faculty Board for permission to register for less than 15 Units. Failure to do so constitutes a breach of regulation which may result in the non-processing of the candidate results

(e) A candidate, who cannot register for courses during the prescribed period for registration because of an illness, must ensure that the medical report on his illness is forwarded by him or his parents/sponsors to reach the Dean of his Faculty not later than four weeks after the end of the normal registration period as scheduled in the University Calendar. Such a medical report should be forwarded for authentication by the Director of Medical and Health Services for it to be considered valid. Such a candidate shall be exempted from the penalties of late registration. All application should be routed through the Head of Department.

(f) Student must attend a minimum of 75% of course instructions including lectures tutorials and practical where requ1re to qualify to sit for examination m any course.

Absence from Examination

Candidates must present themselves at such University examination for which they have registered. Candidates who fail to do so for reason other than illness or accident shall be bound by the following regulations:

(a) Any student who fails to register for courses during one semester without permission should be deemed to have scored "OF' in the minimum number of units required for full time students (i.e. 15 Units).

(b) Candidate who registered for courses, attended classes regularly, did all practicals and test but did not take the required semester examinations should be given a continuous assessment grade n each of affected courses and a grade of '00F' in the examination which they should have taken, but which they did not take.

(c) Candidates who have less than 15 units to graduate but fail to take the required examination should be deemed to have scored "OF' in the outstanding courses only provided such candidates obtained permission to register for less than 15 Units.

(d) Any candidate who on account of illness, is absent from a University examination may be permitted by the Senate on the recommendation from the appropriate Faculty Board, to present himself for such examination at the next available opportunity provided that:

(i) A full-time student in the University shall report any case of illness to the University Health Centre at all times.

(ii) When a student falls ill during examination he should report to the Director, Medical and Health Service before attending any hospital outside the University. A report of sickness should be made to Registrar within a week and medical certificate of validation of his illness with three weeks.

(iii) When a student falls ill before an examination he shall be under an obligation to send a medical report countersigned by the Director, Medical and Health Services within one week of such illness. Any time outside this period, shall be considered on its merits.

(iv) The Director of Medical and Health Service should within 48 hours, submit a medical report on a candidate who is ill during an examination and is taken to Health Centre or referred by it to the hospital for treatment.

(v) A candidate applying for leave of absence on medical grounds must forward his application together with a medical report to the Dean of his Faculty through his Head of Department. The Director, Medical and Health Services must countersign the Medical Report. The appropriate Faculty Board must take all application for Leave of Absence.

SOURCES O1 INFORMATION AND TROUBLE-SHOOTING

When in secondary schools, information was usually brought to the assembly hall for dissemination, but in the university, students are required to scoop for necessary information. Seeking information is part of your training. Such information in usually pasted on information (notice) boards located around the campus and more often, students pass information to each other. Information obtained second hand should however be authenticated, for in the final analysis, ignorance is no excuse under the law and the university will not be responsible for any false or inaccurate information.

For information in courses being offered, a student should make it a duty to Visit the information boards at the various departments where the courses are being offered. All pieces of information on other issues could be obtained on the information board at The Senate building, the Student union building and in the Halls of Residence. It will therefore be necessary for students to visit such information boards on a regular basis in order to keep abreast of events.

Information on scholarship, employment and other opportunities can best be obtained at the office of the Dean of Students' Affairs (DSA). To afford oneself of such opportunities, it will be expedient for the students to visit the DSA also on regular basis.

What is the grading system in the university?

The grading system applicable to all Nigerian universities is based on the NUC recommendation as follows:

Score Range	Grades	Point(s)
70-100	A	5
60-69	B	4
50-59	C	3
45-49	D	2
40-44	E	1
<40	F	0

How do I calculate my GPA?

If your score is 70 in a 5 unit course such as CHM. 101, then you have 25 points; the summation of all the points in an examination then gives the Total Cumulative Point (TCP) while the addition of all units offered by the students for the semester gives the Total Number of Units (TNU). TCP divided by (TNU) gives the Grade Point Average (GPA). An example is given below: Let us assume that at the end of the Harmattan Semester, a student had the following grades.

Courses	Course unit	Candidate's Score/Grade	Points
CHM 101	5	70 A	5X5=25
MTH101	5	60 B	5X4=20
PHY 101	3	50 C	3X3=9
PHY 107	1	60 B	1X4=4
SER 001	2	P	-
Total	**TNU = 14**		**TCP=58**

GPA = TCP/TNU = 58/14 = 4.14

Note the following:

SER 001 is a (2 unit) special elective; a score of Pass (P) or Fail (F) is always returned and therefore carries no point.

The minimum work load of a student is 15 units per semester. In the example quoted above, the special elective is not used to calculate the GPA. The special elective is however a university requirement for graduation.

What is probation?

Probation is a warning to you that you need to be more serious in your studies. This occurs when your GPA falls below the mandatory 1.00 which is the minimum required to enable you remain as a student in the university. A student is therefore on probation if his/her GPA is below 1.00 at the end of a semester. If the cumulative GPA is still under 1.00 at the end of the following semester

then the student will be advised to withdraw from the university. This will be an anticlimax; every student should therefore be determined to make good his/her opportunity of a university education.

What do I do to make a first class?

All you have to do is work hard and make sure that your cumulative GPA is 4.50 and above by the time you graduate. Below is the classification of degrees and the CGPA necessary.

Class of degree	**GPA**
First class (Honours)	4.50 - 5.00
Second class (Honours) Upper division	3.50 -4.49
Second class (Honours) Lower division	2.40 - 3.49
Third class (Honours)	1.50 - 2.39
Pass degree	1.00-1.49

If you are not satisfied with the grade obtained in a course?

A student has the right to appeal grade(s) scored him/her in any course. A student who believes the Final grade was determined:

(a) on some basis other than performance in the course;
(b) through unreasonable standards different from those applied to the other students in the course.
(c) by standards that are substantial, unreasonable and unannounced departure from the instructor's previously articulated standards and
(d) without adequate instruction on the standard which would be applied;

Such students may appeal the final grade for a course following the steps below:

Before launching a formal appeal, every effort should be made to resolve the issue informally with the party/parties involved, if the issue cannot be resolved informally, then the student may appeal formally to the Director of Academic Affairs (DAA) in writing having paid the stipulated fee. The DAA will send the request for regrading through the Dean to the Head of Department, who in turn will constitute a panel to scrutinize the script and the appeal. The outcome of this panel will be communicated through the same channel to the student and the decision on the appeal should normally be final at this stage, but in rare circumstances when the student is still not satisfied with the panel's decision,

then such student may launch a formal appeal to the Vice Chancellor, who then may request the involvement of external examiners on the matter, and the outcome of such will be final and binding on the student and the university.

A BRIEF HISTORY OF THE DEPARTMENT

University education in Nigeria started with the establishment of the University of lbadan, Ibadan in 1948 and remained the only university in the country for 12 years until the establishment of the University of Nigeria, Nsukka in 1961 and the University of Ife at the temporary site in Ibadan in 1962. The University of Ife (now Obafemi Awolowo University) started with 214 students in five faculties including the Faculty of Science where the Department of Chemistry is a component part. Teaching in the university started with a total teaching, administrative and technical staff strength of about 80. The Department of Chemistry also started academic work in earnest in 1962, with about fifteen expatriate members of staff, only Drs. Oke and Ogunkoya were Nigerians. It is noteworthy that these two pioneering lecturers in Chemistry later became Vice-Chancellors - Professor Oke became the pioneer Vice-Chancellor of Ladoke Akintola University of Technology, Ogbomosho (1988-1995) and Professor Ogunkoya was Acting Vice Chancellor of Olabisi Onabanjo (Ogun State) University, Ago-Iwoye (1999-2001). The next set of indigenous members of staff recruited into the Department of Chemistry included Drs. Macaulay and Sanni who paved the way for the present Chemical Engineering Department. Also recruited during this period was Dr. Onajobi, who later became a foundation member of staff in the Department of Biochemistry.

The first set of graduates was produced in the 1965/66 academic session. A staff development programme initiated by Professor Oluwasanmi - the indefatigable Vice-Chancellor (1966-1975) soon produced a new crop of lecturers for the Department some of them trained in the best universities in Britain and America. A substantial number of the present members of staff trained under this programme are now Professors in the department.

The first comprehensive undergraduate degree programme based on the course unit system - the first of its kind in the university started in 1976/1977 session and graduate studies commenced in 1972/1973 session. The department produced her first PhD graduate in 1980 and has since produced several doctorate degree holders of which not less than 15 are among the teaching staff of the Department.

Although, a Nobel Prize might not have been won in the Department, research activities were quite intense, leading to publications in highly recognized international journals. Even at present, though “things are not what they used to be”, a considerable number of research activities is still going on in the

Department. A computerized infrared and ultraviolet spectrophotometer procured by the Department has brightened the horizon of research activities.

PRIZES WITHIN THE DEPARTMENT: A prize for academic excellence was instituted in the 1992/1993 session by the Student's Chemical Society, OAU chapter, for the best overall student in Chemistry with an overall grade of not less than a second class upper division. A Second Prize known as the Professor Olusegun Ayobami Olubuyide Prize in memory of one of the few first class honours graduate of our department and later a Professor of Chemistry in this university, is for the best student with a first class honours degree. Both prizes attract a cash award and a certificate of merit. Other prizes include those of Prof Layi Ogunkoya for the best students with scores not less than 60 in CHM 307 and CHM 408.

CULTISM is an anathema in modem day academic community and students are strongly warned against cult activities as **CULTISM IS BOTH CRIMINAL AND AGAINST ALL HUMAN DECENCY**. There are too many academic, social, cultural and religious activities to attract your attention on this campus without getting into cultism.

DEGREES OFFERED

The two degree programmes offered in the Department are:

(i) B.Sc. (Hons) Chemistry

(ii) B.Sc. (Hons) Industrial Chemistry

PHILOSOPHY AND OBJECTIVES OF B.Sc. (Hons) CHEMISTRY AND INDUSTRIAL CHEMISTRY DEGREE PROGRAMMES

The department aims at providing her graduates with a broad based knowledge of theoretical and practical chemistry leading to specialization in Chemistry. Prescribed courses cover the physical, inorganic, organic, analytical and applied/industrial area of chemistry. Industrial Chemistry students at the end of year III Harmattan Semester go for six months industrial attachment in chemical and allied industries. In the final year, the undergraduates carry out practical research projects under the supervision of members of academic staff, and present dissertations. This practice gives the students insight into the methods of planning and execution of research programmes.

Well qualified chemistry graduates may proceed to work for a higher degree, or may use the B.Sc. degree to obtain employment which would commonly be in

teaching, industry, commerce, government services and research institutes or be self-employed.

PHILOSOPHY AND OBJECTIVES OF INDUSTRIAL CHEMISTRY OPTION

The programme is designed to produce graduates who have sound basic knowledge of chemistry and its applications especially in industries. In particular, the programme will expose the students to the chemical and related manufacturing industries in the country with a view to their (students) acquiring adequate knowledge of the chemical raw materials requirements, their local sources, processing and production; quality control, economics and marketing of the industrial products.

(i) To prepare self-reliant graduates for self-employment.
(ii) To prepare well trained personnel for the growing chemical industries in the country.
(iii) To prepare graduates for teaching and research work industrial/applied chemistry in our higher institutions of learning in the country.

ADMISSION REQUIREMENTS

Students intending to graduate in Chemistry or Industrial Chemistry must satisfy the general university entrance requirements and should normally have obtained "O" Level credits in Chemistry, Physics Mathematics and any other two subjects. The B.Sc. Degree course normally takes four years of study and comprises a two-year Foundation Programme. University entrants, who have passed with a satisfactory grade at "A" level in Chemistry and in either Physics and/or Mathematics, may be admitted into year II of the programme.

LETTER COURSE CODE

The letter course code for Pure Chemistry Programme is CHM and that of Industrial Chemistry is ICH.

REQUIREMENTS FOR THE AWARD OF A DEGREE

To be eligible for the award of a B.Sc. (Hons) Degree in Chemistry (pure or industrial), the candidate must have satisfied:

(a) The approved University requirements of 12 units of special electives.
(b) The approved Faculty of Science requirement with respect to work-load, registration for courses, and programme duration;

(c) The Departmental requirements, by satisfactorily completing the compulsory courses together with the minimum number of units of the restricted and free elective courses.

To be eligible for the award of a B.Sc. (Hons) Industrial Chemistry degree, the candidate must satisfactorily complete 153 units including:

(i) **University Requirements**:
SER 001 (2); SER 002(2); SEA 001 (2), SEA 002 (2), SEO 001 (2), SEL 001 (2) and SEM 001(2).

Total Number of Units = 12 selected out of the above courses.

(ii) **Faculty Requirements**:

BIO 101 (3), CHM 101 (4), CHM 102 (4), CHM 103 (1), CHM 104 (1), MTH 101 (5), MTH 102 (5), MTH 201 (4), MTH 202 (4), PHY 101 (3), PHY 102 (3), PHY 107 (1) PHY 108 (1) and PHY 205 (3).

Total number of units = 42

(iii) **Departmental Requirements:**

a. ICH102 (2), CHM 201 (4), CHM 202 (4), CHM 203 (4), CHM 205 (1), CHM 206(1), CHM 208 (2); ICH 202 (2), ICH 204 (3); ICH 206(3), CHM 301 (2) CHM 304(3), CHM 305 (2); CHM 306 (2), CHM 307 (3), CHM 308 (2), CHM 309 (2),. CHM 311(2), ICH 301 (2) ICH 303 (2), ICH 305 (2); ICH 307 (2), ICH 309 (2),ICH 322 (2), CSC 201 (3), MAC 201 (3); CHM 408 (3) CHM 428(1); ICH 421 (3); ICH 422 (3); ICH 401 (3), ICH 403 (2), ICH 402(3), ICH 404 (2), ICH 405 (3) ICH 406 (2), ICH 407, ICH 409 PHY 205 (3), TPD 503 (2), ICH 421, ICH 422.

Total number of units = 89

b **Restricted Electives**: A minimum of 6 units from the following: CHM 423 (2) CHM 424 (2), CHM 411 (2), ICH 411, ICH 412 (2), ICH 413, ICH 415, ICH 439 (3), TPD 501(2), FST 303 (4), CHE 517 (3), PHY 202 (2) and FST 405(3).

c. **Free Electives**: A minimum of 4 units.

NOTE: The number in parenthesis indicates the Course Units.

OUTLINE OF PROGRAMMES PURE CHEMISTRY PROGRAMME
Schedule of Courses

HARMATTAN SEMESTER PART I

Course Codes	Course Title	L	T	P	U
CHM 101	Introductory Chemistry I	3	1	0	4
CHM 103	Experimental Chemistry I	0	0	3	1
MTH 101	Elementary Mathematics I	4	1	0	5
PHY 101	General Physic I	3	1	0	4
PHY 107	Experimental Physics I	0	0	3	1
	Special Elective	1	1	0	2
	Total:				**17**

RAIN SEMESTER PART I

Course Code	Course Title	L	T	P	U
CHM 102	Introductory Chemistry II	3	1	0	4
CHM 104	Experimental Chemistry II	0	0	3	1
MTH 102	Elementary Mathematic II	4	1	0	5
PHY 102	General Physic II	3	1	0	4
PHY 108	Experimental Physics II	0	0	1	1
	Special Elective	1	1	0	2
	Total:				**17**

HARMATTAN SEMESTER PART II

Course Code	**Course Title**	**L**	**T**	**P**	**U**
BIO 101	Biology for physical Science	2	1	0	3
CHM 201	Basic/organic Chemistry	3	1	0	4
CHM 203	Basic Physical chemistry	3	1	0	4
CHM 205	Experimental physical/inorganic Chemistry	0	0	3	1
MTH 201	Mathematical Methods I	3	1	0	4
PHY 203	Electric Circuit and Electronics	2	1	0	3
PHY 205	Introductory Modern Physics	2	1	0	3
	Total:				22

RAIN SEMESTER PART II

Course Code	Course Title	L	T	P	U
CHM 202	Basic Organic Chemistry	3	1	0	4
CHM 206	Experimental Organic Chemistry	0	0	3	1
CHM 208	Introductory Analytical Chemistry	1	1	0	2
MTH 202	Mathematical Method II	3	1	0	4
	Special elective	1	1	0	2
	Special elective	1	1	0	2
	Total:				15

HARMATTAN SEMESTER PART III

Course Code	Course Title	L	T	P	U
CHM 301	Instrumentation and Analytical Chemistry I	1	1	0	2
CHM 303	Quantum Chemistry	1	1	0	2
CHM 305	Chemical Kinetics	1	1	0	2
CHM 307	Application of spectroscopic Methods	2	1	0	3
CHM 309	Experimental Physical Chemistry	0	0	6	2
CHM 311	Instrumentation and Analytical Chemistry	0	0	6	2
CSC 201	Computer Application	2	1	0	3
	Special Elective	1	1	0	2
	Total:				18

RAIN SEMESTER PART III

Course Codes	Course Title	L	T	P	U
CHM 302	Structure and Main Group Inorganic Chemistry	3	1	0	4
CHM 304	Chemical Thermodynamics	2	1	0	3
CHM 306	Aromatic and Heterocyclic Chemistry	1	1	0	2
CHM 308	Natural and Synthetic Macromolecular	1	1	0	2
CHM 310	Group Theory and Quantum Mechanics	1	1	0	2
CHM 312	Experimental Organic Chemistry	0	0	6	2
CHM 314	Acyclic, Bifunctional Aliphatic and Terpenoid Compounds	1	1	0	2
CHM 316	Experimental Organic Chemistry	0	0	2	2
	Total:				19

HARMATTAN SEMESTER PART IV

Course Code	Course Title	L	T	P	U
CHM 401	Transition Metal Chemistry	3	1	0	4
CHM 403	Electrochemistry	1	1	0	2
CHM 405	Introduction to Industrial Chemistry	1	1	0	2
CHM 407	Fundamentals of Physical Organic Chemistry	2	1	0	3
CHM 421	Research Project	0	0	9	3
MAC 201	Principles of Management	2	1	0	3
	Restricted Elective	1	1	0	2
	Total:				19

RAIN SEMESTER PART IV

Course Code	Course Title	L	T	P	U
CHM 402	Organometallic Chemistry	2	1	0	3
CHM 404	Introduction to Environmental and Petroleum Chemistry	1	1	0	2
CHM 406	Molecular Spectroscopy	2	1	0	3
CHM 408	Organic Reactions and Syntheses	2	1	0	3
CHM 421	Research Project	0	0	9	3
CHM 428	Seminar	-	-	-	1
	Restricted elective	1	1	0	2
	Restricted elective	1	1	0	2
	Total:				**19**

RESTRICTED ELECTIVES

Courses Code	Course Title	L	T	P	Units
CHM 409	Topics in Advanced Inorganic Chemistry	1	1	0	2
CHM 410	Topics in Advanced Heterocyclic Nitrogen Compounds	1	1	0	2
CHM 411	Topics in Main Group Chemistry	1	1	0	2
CHM 412	Photochemistry	1	1	0	2
CHM 413	Mechanisms of Inorganic Reactions	1	1	0	2
CHM 414	Theoretical and Experimental Methods of Structure Determination	1	1	0	2
CHM 415	Topics in Biological and Industrial Chemistry	1	1	0	2
CHM 416	Advanced Chemical Kinetics	1	1	0	2
CHM 417	Polymer Chemistry	1	1	0	2
CHM 418	Radiochemistry and Nuclear Chemistry	1	1	0	2
CHM 419	Non-Aqueous Solvents	1	1	0	2
CHM 420	Topics in Advanced Oxygen containing Ring-compounds	1	1	0	2
CHM 422	Topics in Theoretical Chemistry	1	1	0	2
CHM 423	Topics in Analytical Chemistry and Instrumentation	1	1	0	2
CHM 424	Catalysis	1	1	0	2
CHM 425	Topics in Advanced Terpenoid and Steroidal Compounds	1	1	0	2
CHM 426	Surface and Colloid Chemistry	1	1	0	2
CHM 427	Topics in Advanced Organo-sulphur and Organo-phosphorus Compounds	1	1	0	2
CHM 429	Statistical Thermodynamics	1	1	0	2
	GRAND TOTAL				**146**

NOTE:

(i) The above-suggested combinations of courses are not rigid. Students are free to modify them as necessary and convenient whenever possible.

(ii) Students are strongly advised to discuss their proposed plan of study (with respect to combination of courses) with their Class Administrator at the beginning of each semester.

COURSE DESCRIPTION FOR THE HARMATTAN SEMESTER

CHM 101 – Introductory Chemistry I: 3 + 1+0 (4 units)

This course is divided into **9** sections and taught by 6 – 8 lecturers with 4 – 5 professors participating each session.

Emphasis is laid on fundamental chemical principles including detailed atomic structure and physical principles involved in chemical reactions. Topics include:

1. INTRODUCTION:
Methods of science: Measurement and precision. Significant figures: errors in quantitative measurements: nature of matter: elements and compounds. Types of chemical reactions.

2. ATOMIC THEORY AND NATURE OF ATOMS
Dalton atomic theory: Atomic weight, Avogadro's number: structure of the atom: Divisibility of atom. Cathode rays: mass spectrometer: contributions to atomic structure by Bohr, Thompson, Morseley and Rutherford: Discovery of nucleus: electronic energy levels and periodic table: atomic size: ionization potentials, electron affinity: ionic radii and electronic configuration.

3. STOICHIOMETRY I
Chemical Formulae and equations; simplest formulae; molecular formulae; mole concept; calculation of formulae and equations from gravimetric data and vice-versa; ionic equations for neutralization and precipitation reactions. Concentrations; molarity and volumetric calculations based on stoichiometric coefficients; Oxidation and reduction as electron transfer; oxidation number; balancing of equations including balancing of redox equations by electron transfer equality.

4. STOICHIOMETRY II
Volumetric analysis including relevant calculations. Preparation of standard solutions, morality and volumetric coefficients in neutralization, redox precipitation and complexation reactions.

5. CHEMICAL EQUILIBRIA
The equilibrium state; Mass action; equilibrium constant calculations; Equilibrium changes; Dissociation of water; pH of acids and bases; buffer solutions; Indicator theory; solubility of ionic solids; solubility products; precipitation reactions (using solubility products) calculations as applied to qualitative and quantitative analysis. Common ion effect.

6. THERMOCHEMISTRY

Balancing of intermolecular forces. Hydrogen bonding; order - disorder phenomenon; entropy; free energy; energy effect; exothermic and endothermic changes; enthalpy of reaction. Hess's law of enthalpy summation; relevant calculations; heats of neutralization; combination and formation; bond dissociation energies; relevant calculations; free energy and spontaneous change.

7. ELECTROCHEMISTRY

Electrical units; Ohm's law; Faraday's laws of electrolysis; Galvanic cells; Standard Half-Cell potentials and reactions. Concentration effects (Nernst equation). Redox reactions; oxidation potential treated in terms of free energy change; cells and batteries.

8. KINETICS

Introduction to chemical kinetics, Basic definitions of order of reaction, molecularity, reactions rates and simple reaction mechanism. Activation energy and kinetic theory.

9. RADIOACTIVITY

Types of radioactive disintegration; nuclear fission and nuclear fussion; Detection of radioactivity; Uses of radioisotope.

CHM 103 – Experimental Chemistry I: 0 + 0 + 3 (1 unit)

General laboratory instructions and regulations including safety in our laboratories, Measurements and recordings of data, basic techniques (weighing, solubility, dilution and preparation of solutions. Recrystallization and determination of melting point. Acid-Base titrations, Redox titrations and gravimetric analysis.

CHM 201 – Basic Inorganic Chemistry: 3 + 1 + 0 (4 units)

A quantitative introduction to the basic principles of inorganic chemistry, particularly atomic structure, periodicity of chemical properties, chemical bonding and reactivity. Sub-sections comprise: electronic structures of the elements; the covalent bond; the ionic bond; introductory symmetry; inorganic applications of standard reduction potentials; general properties of the elements in relation to the periodic table; introduction to complex-ions, including nomenclature and isomerism.

Pre-requisites: CHM 102 or A-level Chemistry

CHM 203 – Basic Physical Chemistry: 3 + 1 + 0 (4 units)

The aim of the course is to provide a firm foundation in basic thermodynamics and kinetic treated under the following headings: Kinetic theory; energetic; the first law of thermodynamics; free energy, entropy and the second law of thermodynamics; phase changes equilibrium; reaction kinetics; electrochemistry.

Pre-requisite: CHM 101 or "A" level Chemistry and Mathematics or Physics.

CHM 205 – Experimental Physical/Inorganic Chemistry: 0 + 0 + 1 (1 unit)

A basic practical chemistry course designed to:

(a) Develop good experimental expertise

(b) Illustrate the principles of the topics covered in the CHM 200 level courses;

(c) Demonstrate the empirical nature of chemistry.

Basic techniques to be developed are in physical and inorganic chemistry, and shall include:

(i) Estimation of errors, theoretical processing of experimental data to yield best curve or linear fits and error limits;

(ii) Quantitative inorganic analysis by volumetric and gravimetric methods including:
- (a) Measurement of pH and preparation of buffer solutions;
- (b) Oxidation reduction titrations;
- (c) Mixed base titrations requiring the use of more than one indicator;

(iii) Thermal analysis, including
- (a) Measurement of heat of reaction;
- (b) Measurement of heat of solution and mixing.

(iv) Analysis of intermolecular forces.

(v) Chemical kinetics
- (a) Measurement of reaction rates;
- (b) Measurement of activation energy

(vi) Electrochemistry

(vii) Simple inorganic synthesis

Pre-requisite: CHM 101 or A-level Chemistry,
Co-requisite: CHM 201 or 203 or 207

CHM 207 – Physical and Inorganic Chemistry (for non-chemistry majors) 3 + 1 + 0 (4 units)

A broad base course, covering much of the material in CHM 201 and 202, but less rigorously and in less detail. Topics include: development of modern chemistry; chemical bonding and the states of matter; buffer systems and pH – controlled precipitations complex ions in analysis; chemistry of representative metals, metalloids, non-metals, and transition elements; inorganic chemical production; basic chemical kinetics and thermodynamics; interfacial and surface properties, films, micelles and colloids; absorption at surfaces, with particular reference to heterogeneous catalysis.

Pre-requisite: CHM 101 and CHM 102 or A-level Chemistry.
Co-requisite: CHM 102

CHM 301 – Instrumentation and Analytical Chemistry I: 1 + 1 + 0 (2 units)

1. **Analytical Separations**
   Solvent extraction, pH effect, and extraction with metal chelator. Type of chromatography especially Ion-Exchange chromatography used in inorganic separations and resins.
2. **Molecular Spectroscopy and Flame Methods**
   Molecular spectra and regions of emr. Wavelength selectors, cells, detectors. Quantitative laws of absorption of radiation and use of absorbance measurements for quantitative analysis. Absorbance measurements and location of titration end points. Determination of ligand to metal ratio in a complex. Deviations from Beer's Law and use of UV radiation in qualitative work.
3. **Luminescence, Nephelometry and Turbidimetry, Instrumentation** and uses for quantitative work.
4. **Atomic Spectra and Spectra Line Widths**
   Apparatus, radiation sources, hollow cathode lamps, cells, flames and furnaces. Quantitative applications of atomic spectroscopy and interference studies in atomic spectra.
5. **Analytical Automation**
   Automatic titrators, pH-stat and process control.

Pre-requisite: CHM 205 and 208

CHM 303 – Quantum Chemistry: 1 + 1 + 0 (2 units)
An introduction to the methods of quantum mechanics and their application to the study of structures of atoms. This is considered in terms of historical development; the Schrodinger's equation; application to simple systems; the hydrogen atom; spectroscopic states and energy levels; many electrons atoms.

Pre-requisite: CHM 201

CHM 305 – Chemical Kinetics: 1 + 1 + 0 (2 units)
Topics covered include: review of reaction rates, rate equations, order of reactions and their determination calculations; experimental methods for studying slow and fast reactions; theories of reaction rates; reactions in solution; complex reactions; heterogeneous catalysis.

Pre-requisite: CHM 203

CHM 307 – Application of Spectroscopic Methods: 2 + 1 + 0 (3 units)
A survey of spectroscopic and optical methods with emphasis on their application in elucidation of structures of organic, inorganic and organometallic compounds. Principles and applications of ultraviolet, infrared, nuclear magnetic resonance and mass spectroscopy; of optical rotation and optical rotatory dispersion. The complementary nature of spectroscopic and chemical methods of structure elucidation exemplified by applications in natural product chemistry. Spectroscopy of inorganic compounds and organometallic complexes. Tutorial work involves the interpretation of spectra.

Pre-requisite: CHM 202 and CHM 201

CHM 309 – Experimental Physical Chemistry: 0 +0 + 2 (2 units)

A selection of experimental exercises, designed: to illustrate principles discussed in CHM 304/305 lectures; to provide practice in making measurements and analyzing data; and to inculcate a critical approach to laboratory work. Topics covered include: equilibria, colligative properties, surface phenomena, thermodynamic principles, gas- and liquid-phase kinetics, electrochemistry, molecular spectroscopy, properties of macromolecules.

Pre-requisites: CHM 203 and CHM 205

CHM 311 – Instrumentation and Analytical Chemistry II:0 + 0 + 2 (2 units)

Experiments will be along the following lines:

1. Determination of product yield
   i. Preparation of Hexamine Cobalt (III) Chloride
   ii. Purification of the product
   iii. Determination of the percentage yield
2. Determination of the acid content of different commercially available vinegar products
   i. Preparation of primary and secondary standards
   ii. Standardization of the acid and base needed in the experiment
   iii. Determination of the acid content of unknown vinegar samples
   iv. Identification of the Vinegar type
3. Vitamin C in commercially available tablets
   i. Preparation of reagents
   ii. Determination of vitamin C in tablets
   iii. Determination of the percentage weight of vitamin C in the tablets
4. Chloride contents of table salt
   i. Determination of chloride content of table salt using Mohr and Volhard methods
      a. Preparation of reagent solutions and standards
      b. Standardization of solutions
   ii. Comparison of the two methods
5. Gravimetric Determination of Nickel as Dimethylglyoximate
   Calculation of Ni content in the salt
   Co-requisite: CHM 301

CHM 401 – Transition Metal Chemistry: 3 + 1 + 0 (4 units)

Transition-metal (d-block) chemistry is discussed in terms of: electronic configuration; oxidation states; co-ordination chemistry and complex ions; the hard/soft, acid/base concept; ligand-field splitting crystal-field stabilization energy, and electronic spectra of octahedral and tetrahedral complexes. ACFT and MO theory; magnetochemistry. The group chemistry of these elements is briefly discussed, with comparison of 3d-, 4d-, and 5d- types. Lanthanide and actinide (f-block) chemistry is discussed in terms of: electronic configuration; characteristic oxidation states; spectroscopy; magnetic properties; complex formation; separation processes; comparison between actinides, lanthanides and d-block elements. Application of IR, Raman, NMR, NQR, ESR, and Mossbauer

spectroscopy to the study of transition metal complexes. The lanthanide shift reagents, and their use in interpreting complex spectra.

Pre-requisites: CHM 302 & CHM 307

CHM 403 – Electrochemistry: 1 + 1 + 0 (2 units)

Electrochemistry, previously presented as part of CHM 203, is extended under the headings of ionic and electronics. Under the former heading, the transport and thermodynamic properties of ionic solutions are considered; discussion includes methods of measurement of conductance and of activity coefficients. Topics under electronics include: measurement of cell potentials; standard cells and their construction; the nature of the electrode/solution interface; introduction to electrode kinetics; voltametric techniques.

Pre-requisite: CHM 304

CHM 405 – Introduction to Industrial Chemistry 1 + 1 + 0 (2 units)

Chemistry in the industrial environment. Basic raw materials and routes to products. Topics are selected to illustrate the industrial application of chemical principles in such areas as polymers, textiles, dyestuff, rubbers, paper, food technology, iron and steel, cement and soap.

Pre-requisites: CHM 302, 306, and 314

CHM 407 – Fundamentals of Physical Organic Chemistry: 2+1 + 0 (3 units)

Experimental methods for investigation reaction mechanisms; acid-base reaction; chemical kinetics and isotope effects structure-reactivity relationships; aromaticity; hyper conjugation and automatism; classes and mechanisms of organic reactions, *viz*, addition, substitution, elimination, rearrangements, reduction and oxidation, *etc*., medium effects on organic reactions; stereochemistry and conformational analysis.

Pre-requisites: CHM 306 and CHM 307

CHM 409 – Topics in Advance Inorganic Chemistry: 1 + 1 + 0 (2 units)

Topics are selected to illustrate recent developments in inorganic chemistry in the areas of structure, reactivity and synthesis.

Pre-requisite: CHM 302

CHM 411 – Topics in Main Group Chemistry: 1 + 1 + 0 (2 units)
Topics are selected to illustrate recent advances in the understanding of the bonding and properties of compounds of boron, and of the compounds of the elements in Groups IV, V, and VI.

Pre-requisite: CHM 302

CHM 413 – Mechanisms of Inorganic Reactions: 1 + 1 + 0 (2 units)
Classification of inorganic reactions; electron-transfer processes proton-transfer processes; ligand-exchange reactions; redox reactions; practical aspects of the subject, including techniques for studying fast reactions; biological implications.

Pre-requisite: CHM 305

CHM 415 – Topics in Biological and Industrial Chemistry: 1+1 + 0 (2 units)
Topics are presented from the following fields: biogenetic pathways; chemistry of a selected group of primary or secondary metabolites; applications of organic chemistry in chemotherapy, pest-control, dyestuffs, etc; thermodynamics, electrochemistry and kinetics of selected biological and industrial systems.

Pre-requisite: CHM 306

CHM 417 – Polymer Chemistry: 1 + 1 + 0 (2 units)
Survey, classification, and nomenclature of synthetic and naturally occurring macromolecules; their physical and chemical properties; synthesis, particularly by addition, condensation, and ring-opening processes; comparison of synthetic methods with biogenetic routes; characterization of polymers, particularly by molecular weight measurements; correlation of physical and chemical properties of macromolecules with structural features, including their stereochemistry.

Pre-requisites: CHM 202 and CHM 306

CHM 419 – Non-Aqueous Solvents: 1 + 1 + 0 (2 units)
Definition of solvents, general characteristics; solute solvent interactions. Classes of solvents to include liquid ammonia, halides (HF), dinitrogen tetraoxide, sulphur dioxide and sulphuric acid. Application of solvents.

Pre-requisite – CHM 302

CHM 421 – Research Project: 0 + 0 + 3 (6 units)
This is a research project course covering both Harmattan and Rain Semesters. Research projects in various areas of chemistry are given by academic staff to students and students are allowed to choose projects in the areas of their interests. Each academic staff can supervise more than one student's projects in a session.

CHM 423 – Topics in Analytical Chemistry and Instrumentation:
1 + 1 + 0 (2 units)
Topics will be chosen from the following sampling techniques; scope of EDTA titration flame spectra and interferences; fluorescence and phosphorescence in analysis; analytical methods in mineral exploration; proximate analysis; etc.
Pre-requisite: CHM 301 and 311

CHM 425 – Topics in Advanced Terpenoid and Steroidal Compounds:
1 + 1 + 0 (2 units)
Topics include chemistry, synthesis and biosynthesis of terpenoid and steroidal compounds, their isolation, purification and structural elucidation using spectroscopic techniques.
Pre-requisite: CHM 314

CHM 427 – Topics in Advanced Organo-sulphur and
Organo-phosphorus compounds 1 + 1 + 0 (2 units)
Topics include chemistry, synthesis, application and structural elucidation. Phosphoro-hydrozides and azides, sulfenes and sulfonamides.
Pre-requisite: CHM 314

CHM 429 – Statistical Thermodynamics 1 + 1 + 0 (2 units)
An introduction to the physical basis of statistical mechanics is followed by a consideration of the statistical equivalents of entropy, temperature, and free energy; the canonical ensemble and thermodynamic properties in terms of the partition function. Applications considered include: the partition function for non-interacting systems; translation, rotation and vibration in an ideal gas; the Einstein solid; theories of liquids; molecular dynamics and Monte-Carlo methods, briefly discussed.
Pre-requisites: CHM 303 and CHM 304

COURSE DESCRIPTIONS FOR THE RAIN SEMESTER

CHM 102 – Introductory Chemistry II: 3 + 1 + 0 (4 units)

1. **Qualitative Analysis (Inorganic)** – Test for simple cations and anions .
2. **Identification of Organic Compounds t**o include:
   (i) Isolation and purification
   (ii) Qualitative analysis: Test for common elements e.g. carbon, hydrogen, nitrogen, sulphur, halogens etc.
   (iii) Quantitative analysis using Dumas, Kjeldahl's and Carius methods
3. **(a) Chemical Bonding**

   Why and how do atoms combine**?** The molecule and chemical bonding; electrons in molecules; ionic, covalent, dative and complex bonding; polarity of bonds; co-ordinate bonds; metallic bonds; basic crystalline structure e.g. NaCl and metallic lattices. Hybridization and resonance in chemical bonding.

   (b) Chemistry of hydrogen, noble gases, Alkali metals (Group I) and the alkali earth metals (Group II)
4. **Introduction to Organic Chemistry;**

   Introduction to the term "Organic Chemistry"

   Hybridization in Carbon - sp^3, sp^2 and sp hyridization;

   Physical properties as related to structures – bond length, strength, rotation etc.;

   Electrophiles and Nucleophiles – Examples to include acids and bases;

   Homolytic and Heterolytic fission of bonds;

   Factors influencing organic reactions – inductive and mesomeric effects, steric factors etc.
5. (a) Homologous series and Functional groups' chemistry;
   (b) Types of Organic reactions;
   (c) Isomerism - Structural, Geometric and Optical Isomers;
   (d) Chemistry of Hydrocarbons (alkanes, alkenes, alkynes, alky halides and Grignard reagents) to include
   (i) Nomenclature (IUPAC rules to be treated under Alkanes);
   (ii) Preparation
   (iii) Physical properties;
   (iv) Chemical reactions with simple mechanisms where applicable.
   (v) Applications

   These subheadings are to be applied to each of the families above.
6. **MAIN GROUP CHEMISTRY (Groups III – V)**

   Trends in properties of elements (structures, ionization energy, physical and chemical properties);

   Properties of selected types of compounds – hydrides, oxides, acids and bases;

Chemistry of B and Al; C and Pb; N and Bi.

7. MAIN GROUP CHEMISTRY (Groups VI and VII) AND TRANSITION METAL CHEMISTRY

(a) MAIN GROUP CHEMISTRY (Groups VI and VII)

(i) Trend in properties of elements;

(ii) Properties of selected types of compounds;

(iii) Chemistry of O and S; F and Cl.

(b) TRANSITION SERIES

(i) Properties of elements and compounds of d-block elements, lanthanides and actinides.

(ii) Electronic configuration; Complexes and IUPAC nomenclature of complexes.

(iii) Chemistry of Cr, Fe, Co, Ni and Cu; particularly of the most common oxidation states.

8. CHEMISTRY OF ALCOHOLS, ETHERS, ALDEHYDES AND KETONES, CARBOXYLIC ACIDS, DERIVATIVES AND AMINES

Nomenclature (IUPAC);
Preparation, Structure, Physical properties and general reactions.
Introduction to Aromatic compounds.

9. CARBOHYDRATES, PROTEINS AND LIPIDS.

Simple treatment of carbohydrates – monosaccharides (e. g. glucose and fructose), disaccharides and polysaccharides;
Proteins – amino acids, peptide bonds etc
Lipids – Fats and Oils, Soap and Detergent.

CHM 104– Experimental Chemistry II: 0 + 0 + 3 (1 unit)

General laboratory instructions, Reactions of inorganic ions and Identification of the ions in some inorganic salts. Identification of anions and cations from unknown salt samples. Separation of a mixture of two salts using sublimation method. Introduction to organic chemistry practicals – qualitative analysis of organic compounds. Preparation of aspirin (acetylsalicylic acid) and soap.

CHM 202 – Basic Organic Chemistry: 3 + 1 + 0 (4 units)

Revision of chemistry of common functional groups covering the material of CHM 102. Extension of aliphatic chemistry, including hydrocarbons, alkenes, the carbonyl group, the hydroxyl group, the amino group, carboxylic acids and their derivatives. Survey of aromatic chemistry, topics including benzene and its monosubstitution products. Bifunctional compounds. Introduction to lipids, carbohydrates, amino-acids and proteins, and to chromatographic and

spectroscopic methods of investigating organic structures. Synthesis of some organic compounds.

Pre-requisite: CHM 102 or "A" level Chemistry

CHM 206 – Experimental Organic Chemistry I: 0 + 0 + 1 (1 unit)

A course designed to illustrate the principles covered in lecture course CHM 202. Topics include separation, purification and identification of organic compounds by solvent extraction, distillation, crystallization followed by determination of physical constants simple organic synthesis and qualitative analysis by chemical methods.

Pre-requisite: CHM 102 or A-level Chemistry

Co-requisite: CHM 202

CHM 208 – Introductory Analytical Chemistry: 2 + 0 + 0 (2 units)

1. **Review** of steps in and applications of quantitative chemical analysis. Expressions of concentrations, to include units used in instrumental work (ppm etc.).
2. **Statistics**: Data treatment, potential sources of error in chemical analyses. Sampling, and sample size, and sample collection.
3. **Laboratory Techniques**
   General operations and tools of the trade.
4. **Gravimetric Methods**: Applications of organic precipitating agents
   e.g. Oxime, 8-hydroxyquinoline, drug and sodium tetraphyenylborate (NaTPB) (-for K^+, NH_4^-)
5. **Volumetric Methods**
   (i) Acid-Base Titrations;
   (ii) Precipitation Titrations-Volhard, Mohr & Fajan
   (iii) Redox Titration's and Indicators, and
   (iv) Complexiometric Titrations – Equilibria and analytical uses of complexes
6. **Electroanalytical Techniques**
   Potentiometer and non-potentiometric electro analysis.
   Karl Fischer titrations as examples of amperometric titrations.
   Theory and applications of ion-selective electrodes.

Pre-requisite: CHM 101

CHM 302 – Structural and Main-Group Inorganic Chemistry: 3 + 1 + 0 (4 units)

Structural topics covered in the course include structures of metals and ionic crystals of types AB, AB_2, AB_3, A_2; introduction to diffraction methods: X-ray, neutron and electron diffraction; lattices and crystal defects; introduction to crystal growth; structures of covalent molecules and of complex ions of main-group elements; introduction to the structure of transition metal complexes. Main-group elements classified by anions, are surveyed in terms of preparative methods, general properties, reactions, and structures, with particular attention to hydrides, halides and pseudohalides, oxides, chalconides, and oxyanions. Properties and group trends are surveyed for elements of Groups I to V.

Pre-requisite: CHM 102

CHM 304 – Chemical Thermodynamics: 2 + 1 + 0 (3 units)

The first, second and third laws of thermodynamics are given a more rigorous treatment in CHM 203. Thermodynamic principles are considered in relation to: chemical potential; inter-relationships of the thermodynamic functions; phase equilibria; gaseous and liquid mixtures; colligative properties of solution; chemical equilibria; electrolyte solutions; thermodynamics of surfaces.

Pre-requisite: CHM 203

CHM 306 – Aromatic and Heterocyclic Chemistry: 1 + 1 + 0 (2 units)

This is a broad-based course in general organic chemistry. The topics to be covered include:

(a) Some leading features of benzenoid chemistry together with bifunctional benzene derivatives including examples of naturally occurring oxygen compounds;

(b) Polycyclic aromatic hydrocarbons such as naphthalene, phenanthrene and anthracene;

(c) Aromatic heterocyclics exemplified by pyrrole, furan, thiophene, pyrone, indole, quinoline and benzopyrone systems including introduction to alkaloid chemistry.

Pre-requisite: CHM 202

CHM 308 – Natural and Synthetic Macromolecules: 1 + 1 + 0 (2 units)

Natural Polymers

(a) Carbohydrates – glucose, starch-cellulose-structure, reactions, molecular weight determinations and various uses, Ligrin-structure and products of degradation;

(b) Amino acids and proteins; structures and reactions. Determination of protein structure, primary, secondary and tertiary structure. Peptide and protein synthesis.

(c) Nucleic acid: Classification, structures and functions, DNA & RNA. Synthesis of polynucleotides.

Synthetic Polymers

(i) Definitions and glossary terms. Classification according to use, origin and reaction to stress and temperature. Physical and chemical properties of common polymers including molecular structure. Fiber forming polymers, natural, synthetic regenerated. Principles of fibre making processes.

(ii) Brief over-view of other uses of polymers e.g. on paints, plastic ware etc.

Pre-requisite: CHM 202

CHM 310 – Group Theory and the Quantum Mechanics of Molecules: 1 + 1 + 0 (2 units)

Group theory, basic theory of groups: symmetry elements and symmetry operations; molecular symmetry and symmetry point groups; representation of groups; symmetry consideration in quantum mechanical calculations; applications of group theory in spectroscopy; symmetry classifications of vibrational modes.

(i) Molecular orbitals; H_2^+ ion molecule and H_2 molecule; molecular spectroscopic states, review of electronic configuration of homo-and hetero-nuclear diatomic molecules; spectroscopic states and correlation diagrams.

(ii) Valence bond theory: H_2 molecule; other simple diatomic molecules (Li_2, N_2, O_2); introduction of ionic character into VB wave functions; comparison of MO and VB theories of diatomic molecules.

(iii) Bonding in polyatomic molecules; hybridization and resonance MO and VB theories for polyatomic molecules.

(iv) Electron theory of organic molecules: Huckel MO theory; symmetry and MO theory for polyatomic molecules.

Pre-requisite: CHM 303

CHM 312 – Experimental Organic Chemistry II: 0 + 0 + 6 (2 units)
A more advanced course in experimental-organic chemistry, designed to provide experience in single- and multi-stage synthesis, in separation and purification procedures, and in the identification of organic compounds with the aid of spectra in conjunction with chemical tests. The exercises are designed to involve deductive reasoning, based upon principles discussed in lecture.

Pre-requisite: CHM 202

CHM 314 – Alicyclic, Bi-functional Aliphatic and Terpenoid Compounds: 1 + 1 + 0 (2 units)

(a) Chemistry, stereochemistry and synthetic application of bi-functional organic diols, hydroxyl-acids, keto-acids, keto-esters and amino acids;
(b) Alicyclic chemistry, including the reactions and stereochemistry of small and large ring compounds and important naturally occurring derivatives like steroids and terpenes;
(c) Introduction to the chemistry of organo-phosphorus and organo-sulphur compounds.

Pre-requisite: CHM 202

CHM 316 – Experimental Inorganic Chemistry: 0 + 0 + 2 (2units)
A more advanced course in experimental inorganic chemistry, designed to illustrate preparative methods and the use of physical methods, such as chromatography, infrared and electronic spectroscopy, and magneto-chemistry, for the characterization of inorganic compounds.

Pre-requisites: CHM 201 and CHM 205
Co-requisite: CHM 302

CHM 402 – Organometallic Chemistry: 2 + 1 + 0 (3 units)
Classification of organometallic compounds. Preparation, structure and reactions of organometallic compounds. Classification of ligands, 18-electron rule bonding in transition metal organometallic compounds. Metal-metal bonds and transition metal clusters. Organometallic catalysis and applications of organometallic compounds to organic synthesis.

Pre-requisites: CHM 201 and CHM 302

CHM 404 – Introduction to Environmental and Petroleum Chemistry: 1 + 1 + 0 (2 units)

Pollution – Concepts of elementary cycle. Characteristics of the atmosphere. Sources, types and effects of environmental pollution. Waste-water treatment. Composition of domestic waters. Water chemistry and analysis. Recycling and uses of waste products.

Petroleum – Petroleum in the contemporary energy scene. Nature, classification and composition of crude petroleum and natural gases. Distribution of petroleum and natural gas resources (the global and Nigerian situations). Petroleum technology. Survey of refinery products and process. Petrochemicals in industrial raw materials. Prospects for the petrochemical industry in Nigeria.

Pre-requisites: CHM 301 and CHM 311

CHM 406 – Spectroscopy: 2 + 1 + 0 (3 units)

The aim is to provide a concise and clear essential theoretical background in terms of underlying phenomena, basic principles and fundamental processes by which the macroscopic effects resulting from the interaction between molecules and electromagnetic radiation can be grasped most concretely. Topics covered include: the electromagnetic spectrum, the nature of electromagnetic waves, and the mechanisms of their interaction with matter; spectroscopy in the microwave region – rotational spectroscopy; vibrational spectroscopy – IR and Raman spectroscopy; spectroscopy in the visible and ultraviolet region – electronic spectra; photoelectron spectroscopy (PES) and X-ray photoelectron spectroscopy (XPES) in the far – U.V. and X-ray regions; magnetic resonance spectroscopy; particularly NMR and ESR, and the application of double resonance techniques.

Pre-requisites: CHM 303 and CHM 307

CHM 408 – Organic Reactions and Synthesis: 2 + 1 + 0 (3 units)

Selected types of reactions are discussed in relation to mechanistic concepts and to the utility of the processes in modern organic chemical practice. Discussion includes: alkylation and acylation processes, aldol-type condensations; synthesis with organometallic compounds. Applications of those operations are exemplified by reference to syntheses in the literature.

Pre-requisite: CHM 306

Co-requisite: CHM 307

CHM 410 – Topic in Advanced Heterocyclic Nitrogen Compounds: 1 + 1 + 0 (2 units)

Topics include isolation, purification, chemistry, synthesis and biosynthesis of alkaloids. Examples to be selected from various types; indole, urine, pyridine, pyrrole and qunoline alkaloids.

Pre-requisite: CHM 306

CHM 412 – Photochemistry: 1 + 1 + 0 (2 units) Rain Semester:

Topics will include general description of excited electronic states; photophysical processes, and experimental methods for their study; photochemistry of simple systems; organic photochemistry; inorganic photochemistry.

Pre-requisite: CHM 202 and CHM 203

CHM 414 – Theoretical and Experimental Method of Structure Determination: 1 + 1 + 0 (2 units) Rain Semester

Theoretical and experimental aspects of spectroscopic diffraction and other physical method will be considered, and it will be shown how those can be applied to the determination of molecular structure.

Pre-requisite: CHM 302

CHM 416 – Advanced Chemical Kinetics: 1 + 1 + 0 (2 units)

Topics will be selected to illustrate recent advances in the areas of homogenous and heterogenous catalysis, thermo chemical kinetics, ion-molecule reactions, and other areas of advanced kinetics.

Pre-requisite: CHM 305

CHM 418 – Radiochemistry and Nuclear Chemistry: 1 + 1 + 0 (2 units)

Topics will be selected from the following: the structure of the nucleus and nuclear forces, nuclear reactions, radioactivity and radioactive decay processes, uses and applications of radioisotopes, radiation chemistry.

Pre-requisite: CHM 203 and PHY 101

CHM 420 – Topics in Advanced Oxygen containing Ring-Compounds: 1 + 1+ 0 (2 units)

Topics include chemistry, uses, structural elucidation, and properties of flavonoid compounds *viz*, coumarins, chromones, flavenes and flavonols.

Pre-requisite 306

CHM 422 – Topics in Theoretical Chemistry: 1 + 1 + 0 (2 units)
Topics may be chosen from among the following: theories of liquids; computer methods in statistical mechanics non-equilibrium thermodynamics; molecular beam reaction; quantum mechanics of small molecules, molecular orbital calculations and electron spectroscopy: electron transfer at electrode surfaces. Emphasis is placed more upon qualitative understanding of the models, and of the approximations involved than upon mathematical rigor.

Pre-requisites: CHM 304 and CHM 309

CHM 424 – Catalysis: 1 + 1 + 0 (2 units)
Homogeneous catalysis, including acid-base catalysis and catalysis involving metal complexes; enzymic catalysis; heterogeneous catalysis on solid surfaces.

Pre-requisite: CHM 305

CHM 426- Surface and Colloid Chemistry: 1 + 1 + 0 (2 units)
Introduction to surface chemistry and the colloidal state; adsorption isotherms; the liquid-liquid and liquid-gas interfaces soaps, detergents, and the structure of micelles; colloidal solutions; the solid-liquid and solid-gas interfaces; electrical phenomena at interfaces emulsions, foams, gels and aerosols.

Pre-requisites: CHM 202 and CHM 304

CHM 428 – Seminar 0 + 1 + 0 (1 unit)
Students choose from a list of topics suggested by members of staff, do a literature survey on the chosen topic and present a one hour seminar in the Rain Semester.

INDUSTRIAL CHEMISTRY PROGRAMME
SCHEDULE OF COURSES

HARMATTAN SEMESTER PART I

Course Code	Course Title	L	T	P	UNITS
CHM 101	Introductory Chemistry I	3	1	0	4
CHM 103	Experimental Chemistry	0	0	3	1
MTH 101	Elementary Mathematics I	4	1	0	5
PHY 101	General Physics I	3	1	0	4
PHY 107	Experimental Physics I	0	0	3	1
BIO 101	Biology for Physical Sciences	2	1	0	3
	Special Elective	2	0	0	2
	Total:				**20**

RAIN SEMESTER PART I

Course Code	**Course Title**	**L**	**T**	**P**	**U**
CHM 102	Introductory Chemistry II	3	1	0	4
CHM 104	Experimental Chemistry II	0	0	3	1
MTH 102	Elementary Mathematics II	4	1	0	5
PHY 102	General Physics II	3	1	0	4
PHY 108	Experimental Physics II	0	0	3	1
ICH 102	Introduction to Industrial Chemistry	1	1	0	2
	Special Elective	1	1	0	2
	Special Elective	1	1	0	2
	Total:				**21**

HARMATTAN SEMESTER PART II

Course Code	**Course Title**	**L**	**T**	**P**	**U**
CHM 201	Basic Inorganic Chemistry	3	1	0	4
CHM 203	Basic Physical Chemistry	3	1	0	4
CHM 205	Experimental Physical/Inorganic Chemistry	0	0	3	1
MTH 201	Mathematical Methods I	3	1	0	4
PHY 205	Introduction to Modern Physics	2	1	0	3
MAC 201	Principle of Management	2	1	0	3
	Special Elective	1	1	0	2
	Total:				**21**

RAIN SEMESTER PART II

Course Code	Course Title	L	T	P	U
CHM 202	Basic Organic Chemistry	3	1	0	4
CHM 206	Experimental Organic Chemistry	0	0	3	1
CHM 208	Introductory Analytical Chemistry	1	1	0	2
ICH 202	Environmental and Petroleum Chemistry	1	1	0	2
ICH 204	Chemistry of Plastics and Elastomers	2	1	0	3
MTH 202	Mathematical Methods II	3	1	0	4
ICH 206	Chemistry of Dyestuff and Pigment	1	1	0	2
	Free Elective	1	1	0	2
	Special Elective	1	1	0	2
	Total:				**22**

HARMATTAN SEMESTER PART III

Course Code	Course Title	L	T	P	U
CHM 301:	Instrumentation and Analytical Chemistry	1	1	0	2
ICH 301:	Industrial Application of Chemical Principles	1	1	0	2
ICH 303:	Experimental Industrial Chemistry	0	0	6	2
CHM 305:	Chemical Kinetics	1	1	0	2
ICH 305:	Industrial Inorganic Chemistry	1	1	0	2
ICH 307:	Detergents and Cosmetic Chemistry	1	1	0	2
ICH 309:	Nutritional Chemistry	1	1	0	2
CHM 307:	Application of Spectroscopic Methods	2	1	0	3
CHM 311	Instrumentation and Analytical Chemistry II	0	0	6	2
	Special Elective	1	1	0	2
	Total:				**21**

RAIN SEMESTER PART III

Course Code	Course Title	L	T	P	U
ICH 322:	Industrial Attachment	-	-	-	6
	Total:				**6**

HARMATTAN SEMESTER PART IV

Course Code	Course Title	L	T	P	U
ICH 401	Industrial Heat Exchange Process and Mass Transfer	2	1	0	3
ICH 403	Fertilizer and Agrochemicals	1	1	0	2
ICH 405	Polymer Processing and Technology of Fibres	2	1	0	3
ICH 407	Corrosion Chemistry	1	1	0	2
ICH 409	Chemistry and Production of Pulp land Paper	1	1	0	2
ICH 421	Research Project	0	0	9	3
TDP 503	Industrial Law and Management	1	1	0	2
	Restricted Elective	1	1	0	2
	Restricted Elective	1	1	0	2
	Total:				**21**

RAIN SEMESTER PART IV

Course Code	Course Title	L	T	P	U
CHM 304	Thermodynamics	2	1	0	3
ICH 402	Ceramics and Composite Material	1	1	0	2
ICH 404	Quality Control and Assurance	1	1	0	2
CHM 406	Molecular Spectroscopy	2	1	0	3
CHM 408	Polymer Processing and Technology of Fibres	2	1	0	3
ICH 422	Research Project	0	0	9	3
CHM 428	Seminar and Report Writing	-	-	-	1
	Restricted Elective	1	1	0	2
	Free Elective	1	1	0	2
	Total:				**21**

N. RESTRICTED ELECTIVES TO BE TAKEN FROM THE FOLLOWING

Course Code	Course Title	L	T	P	U
ICH 411	Nanochemistry	1	1	0	2
ICH 412	Chemistry and Technology of Paints	1	1	0	2
ICH 413	Radiochemical Methods of Analysis	1	1	0	2
ICH 415	Chemistry and Technology of Leather	1	1	0	2
FSE 303	Introduction to Food Engineering	3	1	0	4
CHM 403	Electrochemistry	1	1	0	2

CHM 423	Topics in Analytical Chemistry and Instrumentation	1	1	0	2
CHM 424	Catalysis	1	1	0	2
TPD 501	Industrial Economics	1	1	0	2

SUMMARY OF UNITS

LEVEL	UNITS			
	UTME		DE	
	HARMATTAN	RAIN	HARMATTAN	RAIN
100	18	17		
200	19	20	19	20
300	19	6	19	6
400	21	21	21	21
TOTAL:	**141**		**106**	
Electives	12		12	
Grand Total	**153**		**118**	

NOTE: The total number of units from the course structure is 153. This includes 4 units of free electives which are not compulsory for graduation.

INDUSTRIAL CHEMISTRY COURSE CONTENT

ICH 102– Introduction to Industrial Chemistry: 1 + 1 + 0 (2 Units)
General introduction to industrial chemistry, Food chemistry, color and dye, medicinal chemistry and paper chemistry. Simple industrial processes such as metal extraction, Haber process, Solvay process, extraction and fermentation. Fine and heavy chemicals. rubber, coal, fuel and gases.

ICH 202– Environmental and Petroleum Chemistry: 1 + 1 + 0 (2 Units)
Characteristics of the atmosphere and photochemistry. Chemical interaction between the atmosphere and the hydrosphere. Effect on living things. Sources, types and effect of environmental pollution. Waste water treatment. Solid wastes and their treatment. Water chemistry and analysis. Energy sources and their pollution effects. Sources, composition, classification and properties of crude petroleum and natural gases, survey of refinery products, processing of petroleum, preparation and chemical transformation of petrochemicals.

Pre-requisite: ICH102 and CHM102

ICH 204– Chemistry of Plastics and Elastomers: 2 + 1 + 0 (3 Units)
Polymerization process - addition, condensation, ring - opening polymerization, vinyl polymerization with complex catalyst, poly-electrolytes and ionomers characterization, structure and properties of polymers; kinetics and mechanisms of polymerization. Copolymerization-types, properties and importance of copolymers elastomers-structure, synthesis, properties, characterization and applications of common elastomers. Some specialty polymers Application and industrial importance of polymers.

Pre-requisite: ICH 102 and CHM 102

ICH 206– Chemistry of Dyestuff and Pigments: 2 + 1 + 0 (3 Units)
General survey of dyestuffs and pigments. Synthesis of dyestuff and intermediates. Specific references to selected heterocyclic compounds relevant to dyes and pigments e.g. pyrazolones, indole, thiazoles etc. Classification according to chemical properties and applications e.g. Azo, disperse, reactive and vat dyestuff and pigments. Theory of colour: colour constitution; relationship between colour and fastness properties.

Pre-requisite: ICH 102

ICH 301– Industrial Application of Chemical Principles:1 + 1 + 0 (2 Units)
The purpose of the course is to demonstrate the interdependence of basic science and technology in the chemical and allied industries. Topics covered will include: basic chemical processes exemplified by the manufacture of dye intermediates and detergents, synthetic fibres, plastics and resins, finishing agents, food preservatives and other selected industrial and fine chemicals.

Pre-requisite: ICH 204 or ICH 206

ICH 303– Experimental Industrial Chemistry: 0 + 0 + 6 (2 Units)
Three main areas will be covered- Polymer synthesis and characterization, dye synthesis and applications and methods in nutritional chemistry. Isolation and spectroscopic characterization of organic compounds, synthesis, chemical and spectroscopic characterization of coordination compounds, double-salts etc.

Pre-requisite: ICH 204 and CHM 206

ICH 305– Industrial Inorganic Chemistry: 1 + 1 + 0 (2 Units)
The chemistry of some selected elements e.g. Fe, Al, Si and Pb. Chemistry of some inorganic compounds and complexes of industrial interest. Chemistry of

metals: occurrence, extraction, refining and uses. Reaction Mechanism in Inorganic Chemistry- Ligand substitution reaction – thermodynamic consideration with emphasis on formation constants and factors that affect the formation constant; the Irving-William series; Kinetic consideration with emphasis on lability and factors that affect lability. Types of substitution mechanisms and the rate determining steps. Substitution in square planar complexes: determination of rate law based on the effect of solvent concentration; trans-effect. Substitution in octahedral complexes: types of substitution; deriving rate law and it significance; deriving the rate law for base-catalyzed hydrolysis; factors that affect rate of substitution, stereochemistry of substitution

Pre-requisite: CHM 201

ICH 307– Detergents and Cosmetics Chemistry: 1 + 1 + 0 (2 Units)

Preparation of soaps and specific types of detergent (foaming and non-foaming). Use of fillers, advantages and disadvantages of fillers in detergents, and the link with pollution and the BOD (biochemical oxygen demand). Domestic and industrial applications of detergents. Sources of local raw materials for detergent preparation. Relative potency of detergents.

Pre-requisite: ICH 202 and CHM 202

ICH 309– Nutritional Chemistry: 1 + 1 + 0 (2 Units)

Topics include: food and its functions, types of nutrients, food as a source of energy. Enzyme and life, chemical nature of enzymes, classification, selectivity and sensitivity. Chemistry of oils, fats, colloids and carbohydrates. Rancidity and uses of emulsifying agents. Production of raw sugar from sugar cane. Amino acids and proteins, water and mineral elements, trace elements; vitamins; food spoilage, microbial spoilage, food preservation, nutritive value of' canned foods, food poisoning; chemicals in food, chemical contaminants, food additives and flavouring agents.

Pre-requisite: CHM 202

ICH 401– Polymer Processing and Technology of Fibres: 2 + 1 + 0 (3 Units)

Structure, characterization and physical properties of polymers. Manufacture, processing (injection, extrusion, compression, transfer moulding) and properties of major thermosetting resins, thermoplastics, elastomers and fibre forming polymers e.g. wool, cotton, flax, hemp, lute etc. Modified natural fibres e.g. viscose, cellulose acetate, arnel. Synthetic fibres e.g. nylon, dacron. polyacrylic and poly-olefinic e.g. orion, modacrylic, saran, vinyonn and spendex.

Pre-requisite: ICH 301

ICH 402– Ceramics and composite material: 1 + 1 + 0 (2 units)
Chemistry, structure and properties of soils containing useful clays. Ceramics: Definition, structure, production, chemical and physical properties and applications. Composites: Definitions, types of production. properties and applications of some commercial composites - glass, cement, paints, alloys for specific uses and introduction to nanochemisty

Pre-requisite: ICH 301

ICH 403– Fertilizers and Agrochemicals: 1 + 1 + 0 (2 Units)
Introductory chemistry of fertilizers. Applications of fertilizer. Chemistry and application of physically mixed and complex NPK fertilizers. Chemistry of organochlorine and organophosphorous insecticides, fungicides, herbicides and growth regulators. The effects of fertilizers and pesticides on the environment. Synthesis and structural elucidation of commercial fertilizers and pesticides.

Pre-requisite: ICH 301

ICH 404– Quality Control and Assurance: 1 + 1 + 0 (2 Units)
Chemical and technical quality control of texture, food dyes, soaps and detergents, cosmetics, ceramics etc. Basic chemical and instrumental procedures for the determination of physical and chemical characteristics of raw materials. Auditing of raw materials and finished products of selected industries for quality assurance.

Pre-requisite: CHM 301

ICH 405– Industrial Heat Exchange Process and Mass Transfer: 2 + 1 + 0 (3 Units)
Introduction to heat transfer principles and applications in chemical industries, forced and natural convections, steady-state conduction, radiation, boiling and condensation, boilers and heat exchangers. Introductory fluid mechanics and fluid handling processes: grinding, size-reduction. Theories of mass transfer. Extractive and azeotropic distillation. Liquid-liquid extraction.

Pre-requisite: CHM 203

ICH 407– Corrosion Chemistry: 1+1+0 (2 units)
Introduction: Corrosion rate expression. Hectrochemical mechanism of corrosion. Passivity. Factors affecting corrosion - oxygen and oxidizers, temperature, velocity, corrosive concentration, galvanic coupling. Types of

corrosion and methods of control uniform or general attack, crevice, pitting, galvanic, selective leaching or parting. intergranular, stress, erosion. Grain boundaries in metals and corrosion. Ringworm corrosion. Economic effect of corrosion, advantages and disadvantages. Hydrogen damage.

Pre-requisite: CHM 305

ICH 409– Chemistry and Production of Pulp and Paper: 1 + 1 + 0 (2 Units)
Raw materials include rags, soft and hard wood, non-wood (fibre crops such as bamboo, cereal straw, bagasse) and other agricultural residues. Knowledge of the simplest units involved such as the cellulose, hemicellulose, polysaccharides and the other additives as necessary. Major pulping methods, mechanical and chemical, as well as the others such as the thermo-mechanical, chemo-thermomechanical and the semi-chemical methods. Pulping processes such as the Kraft (basic) and Sulphite (acidic) processes. Bleaching of the pulp and the agents which include: chlorine, hypochlorite, chlorine dioxide, hydrogen peroxide, peroxyacetic acid, polyformic acid, etc. and the roles of enzymes such as "Xylanaze" in bleaching. Significance and effect of the methods used to immediate environment. Pulp varieties and their properties. Paper making and finishes, type of finishes such as the coated and the uncoated.

Pre-requisite: ICH 301

ICH 421– Research Project: 0 + 0 + 9 (3 Units)
This is a research project course covering both Harmattan and Rain Semesters. Research projects in various areas of chemistry are given by academic staff to students and students are allowed to choose projects in the areas of their interests. Each academic staff can supervise more than one student's projects in a session.

Pre-requisite: ICH 303 and CHM 311

ICH 422– Research Project: 0 + 0 + 9 (3 Units)
This is a research project course is a continuation of ICH 421 that started in the Harmattan Semesters. Research projects in various areas of chemistry are given by academic staff to students and students are allowed to choose projects in the areas of their interests. Each academic staff can supervise more than one student's projects in a session.

Pre-requisite: ICH 303 and CHM 311

RESTRICTED ELECTIVES

ICH 411– Nanochemistry: 1 + 1 + 0 (2 Units)
Introduction to the science and technology of materials in nanorange. Areas of synthetic materials, physical and electronic properties of nanomaterials. Specific nanochemical processes. Examples of current and future as of application of nanotubes, nanowires, nanosensors, nanotransislors, etc.

Pre-requisite: ICH 305

ICH412– Chemistry and Technology of Paints: 1 + 1 + 0 (2 Units)
Definitions of terms in paint making. Types of paints based on resin types: lacquers, thermosetting, akyds, polyesters, acrylics amino, epoxies, polyurethanes, etc. Pigments: structures, properties and importance (uses) in coatings. Primary and secondary colors. Solvents and non-solvent. Water - borne coatings. Paint additives. Primers and finishes. Drying chemistry and dryers. Treatment of substrate and applications of paints. Coating defects and remedies. Paint making.

Pre-requisite: ICH 301

ICH 413– Radiochemical Methods of Analysis: 1 + 1 + 0 (2 Units)
Introduction to Nuclear and Radiochemistry. Radioactivity, mass-energy relationship. Transmutation. Types of radioactivity decay. Half-life and decay equations. Nuclear cross-section and reaction yield. Decay chain and estimation of decay products. Detection and quantification of radiation-G.M tubes. Si(Li) and- Ge(Li) detectors, P/N junction. NAA, PIXE, dispersive X-ray analysis etc. Dating. Radiometric methods.

Pre-requisite: CHM 301

ICH 414– Petroleum Chemistry: 1 + 1 + 0 (2 units)
Processing of petroleum (separation processes, discussion of distillation methods, conversion processes- reforming, cracking (catalytic, thermal and hydrocracking), alkylation, isomerization, polymerisation, purification process- hydrotreating and sulphur recovery. Petroleum technology- methods of extraction of petroleum resources from the reservoir, refinery process units-crude distillation unit, vacuum distillation unit, thermal cracker, hydrotreater, separators, reformer etc. preparation and chemical transformation of petrochemicals.

Pre-requisite: ICH 202

ICH 415– Chemistry and Technology of Leather: 1 + 1 + 0 (2 units)
Hides and skin: structure and general characteristics. Preparatory steps prior to tanning: skinning and curing, beam house involving (i) use of milk of lime and addition of sharpening agents e.g Na_2S, NaCN and amines (ii) unhairing: use of Na_2S, NaOH, $NaHSO_3$, $Ca(HS)_2$, dimethylamine (iii) deliming: use of enzymes and bating (iv) pickling: use of common salt and H_2SO_4. Tanning e.g. vegetable tanning, chemistry of chrome tanning and alum tanning.

Pre-requisite: ICH 301

ICH 416: Environmental Chemistry 1 + 1 + 0 (2 units)
Air pollutants- natural and man-made and their effects on living things, water pollution and waste water analysis and treatments, solid waste management, environmental impact assessment of pollutants- sampling, analysis and report writing including executive summary, treatment and disposal of hazardous wastes.

Pre-requisite: ICH 202