New

National Universities Commission

Core Curriculum and Minimum Academic Standards for the Nigerian University System (CCMAS)

Pharmaceutical Science

2022

Ten Unique Features

1. The mix and quality of courses have been compiled to produce pharmacists for pharmaceutical services in the 21st century.
2. Supply Chain Management and Logistics for Health commodities have been given more enriched prominence to ensure continued availability of quality drugs and enhance employability
3. Emphasis placed on better understanding of pathophysiology of diseases, pharmacogenomics, and pharmaceutical care, to optimize patient care outcomes.
4. Acquisition of soft skills such as: leadership skills, communication skills to produce pharmacists for the 21st century.
5. .Inclusion of Emergency Preparedness for integration of pharmacists in National and International response to Public Health emergencies as is obtained in many countries
6. Addition of more hospital, community and primary healthcare practical experience for an all-round service to the community.
7. The rich mix of courses prepares graduates for practice in all areas of pharmaceutical sciences as against the bias towards clinical practice alone found with PharmD programmes from other countries.
8. Clinical Pharmacognosy included because of increasing use of herbal remedies and other complementary and alternative medicines by many communities the world over.
9. Emphasis on entrepreneurial and business creation for self-employment and employment creation.
10. Minimum Academic Standards to produce graduates that can compete favourably globally with life skills for flexibility and competitiveness in a rapidly changing world.

Executive Secretary: Abubakar Adamu Rasheed

New

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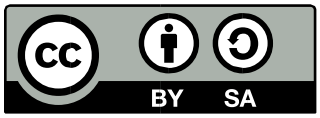

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Foreword

In furtherance of the "change" mantra of the present administration, I published a roadmap to guide my Ministry on ways of addressing the multiple problems that faced the education sector of the country shortly after my assumption of office in 2016. Known as "***Education for Change: Ministerial Strategic Plan – 2016-2019"*** (updated to 2018-2022), the content of the document reaffirms government's commitment to strengthening institutional structures and establishing innovative approaches that would quickly revamp the education sector.

The nations' universities hold a pride of place in the execution of such a strategy, being at the peak of the educational system and charged in an overall manner, with the responsibility of catalysing the sustainable and inclusive growth and prosperity that the "change" mantra envisions. Thus, a "rapid revitalization of the Nigerian university system", which is proceeding apace, became imperative. Improvement in research, teaching and learning facilities, deepening ICT penetration and the provision of enhanced power supply in our university campuses are some of the areas receiving stringent attention. In the same vein, the need was felt to radically review the curricula which universities had used for more than a decade so as to put in place one that would more directly address local issues, meet international standards and is fit for purpose for the training of 21st century graduates.

The National Universities Commission has concluded the review of the former *Benchmark Minimum Academic Standards (BMAS)* of 14 disciplines into those of Core *Curriculum and Minimum Academic Standards (CCMAS)* of 17 disciplines. I am therefore pleased to present these documents to the universities, the general public and the international community as I am sure that their application would tremendously uplift scholarship in our universities. I thank all and sundry who worked assiduously to bring this seminal enterprise to fruition.

Malam Adamu Adamu
Honourable Minister of Education

Preface

Section 10 (1) of the Education (National Minimum Standards and Establishment of Institutions) Act, Cap E3, Laws of the Federation of Nigeria 2004, empowers the National Universities Commission to lay down minimum standards for all universities and other degree awarding institutions of higher learning in the Federation and the accreditation of their degrees and other academic awards. The earliest efforts at giving effect to this legal framework in the Nigerian University System (NUS) started in 1989 following the collaboration between the Commission and Nigerian Universities, which led to the development of the Minimum Academic Standards (MAS) for all programmes in Nigerian universities. The MAS documents were subsequently approved by the Federal Government for use as a major instrument for quality assurance in the Nigerian University System (NUS). The documents were employed in the accreditation of programmes in the NUS for over a decade.

In 2001, the Commission initiated a process to revise the documents because the said MAS documents were essentially content-based and merely prescriptive. In 2004, the Commission developed outcome-based benchmark statements for all the programmes through a workshop that allowed for exhaustive deliberations by relevant stakeholders. Following comments and feedback from the universities to the effect that the Benchmark-style Statements were too sketchy to meaningfully guide the development of curriculum and inadequate for the purpose of accreditation, the Commission, in 2007 put in place a mechanism for the merger of the Benchmark-style Statements and the revised Minimum Academic Standards, which birthed the Benchmark Minimum Academic Standards (BMAS). The resultant BMAS, an amalgam of the outcome-based Benchmark statements and the content-based MAS clearly articulated the Learning Outcomes and competencies expected of graduates of each academic programme in Nigerian Universities without being overly prescriptive while at the same time providing the requisite flexibility and innovativeness consistent with institutional autonomy. In all, the BMAS documents were developed for the thirteen existing disciplines namely, **Administration and Management, Agriculture, Arts, Basic Medical Sciences, Education, Engineering and Technology, Environmental Sciences, Law, Medicine and Dentistry, Pharmaceutical Science, Sciences, Social Sciences and Veterinary Medicine.**

The Commission, in 2016, in its sustained commitment to make the NUS adaptable to global trends in higher education, constituted a group of relevant academic experts to develop a BMAS in **Computing**, thus increasing the number of disciplines in Nigerian Universities to fourteen.

In keeping with its mandate of making university education in Nigeria more responsive to the needs of the society, the National Universities Commission commenced the journey to restructure the BMAS in 2018, introducing in its place, the **Core Curriculum and Minimum Academic Standards (CCMAS),** to reflect the 21st Century realities, in the existing and new disciplines and programmes in the Nigerian University System.

The new CCMAS is a product of sustained stakeholder interactions over two years. The composition of each panel took into consideration, the triple helix model, as a unique feature. This involved a blend of academic experts, academies, government (represented by NUC), professional bodies and of course, the private sector represented by the Nigerian Economic Summit Group (NESG). In order to enrich the draft documents, copies of each discipline were

forwarded to all critical stakeholders including the relevant academic units in Nigerian Universities, the private sector, professional bodies and the academies for their comments and input. These inputs along with the curriculum of programmes obtained from some foreign and renowned universities served as major working materials for the various panels constituted for that purpose.

Bearing in mind the need to adhere to covid-19 protocol as prescribed by the National Centre for Disease Control (NCDC), the Commission was compelled by prevailing circumstances to finalize the curriculum virtually. General Assemblies were also held via Zoom, comprising, the NUC Strategic Advisory Committee (STRADVCOM), Chairpersons/Co-Chairpersons of the various disciplines and Panel Members of the respective programmes. Each Discipline and Programme had NUC representatives who assisted panellists with all the tools and working materials. Several online meetings were held at programmes level, where the real business of developing the CCMAS took place. The products of the various programme-based virtual meetings were submitted to the corresponding discipline group and then to the National Universities Commission. These documents were further scrutinized and fine-tuned by a smaller group of versatile subject matter specialists and relevant private sector practitioners.

In line with the dynamism in higher education provisioning, the Commission took cognizance of complaints by the universities on the high number of General Studies (GST) courses in the BMAS, and was subsequently streamlined. Entrepreneurship courses such as Venture Creation and Entrepreneurship, and innovation found generous space. In addition, the new curriculum unbundled the Bachelor of Agriculture, Bachelor of Science in Mass Communication and the Bachelor of Architecture Programmes, while establishing some emerging specializations in these fields as obtained globally. This is in furtherance of the goal of producing fit for purpose graduates. The Allied Health Sciences was also carved out as a new Discipline from the existing Basic Medical Sciences discipline.

Preceding the completion of the curriculum review content and language editing, a 3-day validation workshop (face-to-face mode) involving critical stakeholders, including STRADVCOM, Vice-Chancellors and Directors of Academic Planning of Nigerian Universities, as well as the Nigerian Economic Summit Group (NESG) was organized by the Commission to validate the CCMAS documents, and to engender ownership for ease of implementation.

Consequent upon the afore-mentioned processes, seventeen CCMAS documents were produced for the following academic disciplines in the NUS:

1. Administration and Management
2. Agriculture
3. Allied Health Sciences
4. Architecture
5. Arts
6. Basic Medical Sciences
7. Computing
8. Communication and Media Studies
9. Education
10. Engineering and Technology
11. Environmental Sciences
12. Law

13. Medicine and Dentistry
14. Pharmaceutical Science
15. Sciences
16. Social Sciences
17. Veterinary Medicine

The CCMAS documents are uniquely structured to provide for 70% of core courses for each programme, while allowing universities to utilise the remaining 30% for other innovative courses in their peculiar areas of focus. In addition to the overall Learning Outcomes for each discipline, there are also Learning Outcomes for each programme and course. In general, programmes are typically structured such that a student does not carry less than 30 credit units or more than 48 credit units per session.

Consequently, the Commission is optimistic that the 2022 CCMAS documents will serve as a guide to Nigerian Universities in the design of curriculum for their programmes with regards to the minimum acceptable standards of input and process, as well as, measurable benchmark of knowledge, 21st century skills and competences expected to be acquired by an average graduate of each of the academic programmes, for self, national and global relevance.

Professor Abubakar Adamu Rasheed, *mni, MFR, FNAL, HLR*
Executive Secretary

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Introduction

Two Acts provide the legal framework for the quality assurance and regulatory mandates of the National Universities Commission. The first is the **National Universities Commission Act No. N81 Laws of Federation Nigeria (L.F.N.) 2004**.

This Act sets up the National Universities Commission as a body corporate charged with the responsibility of advising the Federal and State Governments of all aspects of university education and the general development of universities in Nigeria. The second, **Education (National Minimum Standard and Establishment of Institutions) Act No. E3 L.F.N. 2004**, *empowers the National Universities Commission to lay down minimum standards for all universities and other institutions of higher learning in the Federation and the accreditation of their degrees and other academic awards in formal consultation with the universities for that purpose, after obtaining prior approval therefor through the Minister, from the President.*

Following the enactment of NUC Act No. E3 L.F.N. 2004, the National Universities Commission developed the first set of Minimum Academic Standards (MAS) in 1989 for all the academic programmes existing in the Nigerian University System (NUS) at that time under the 13 major disciplines of Administration, Agriculture, Arts, Education, Engineering and Technology, Environmental Sciences, Law, Medicine and Dentistry, Management Sciences, Pharmaceutical Science , Science, Social Sciences and Veterinary Medicine. The Minimum Academic Standard served as the reference documents for the first accreditation of programmes conducted in NUS in 1990.

In its bid to review the Minimum Academic Standard documents, which was predicated on the fact that they were prescriptive, the Commission decided to develop the outcome-based Benchmark Statements for all programmes in the Nigerian University System in line with contemporary global practice in 1999. In the first comprehensive review of the Minimum Academic Standards by NUC, which was in 2004, the Commission decided to merge the Benchmark Statements and the revised Minimum Academic Standards into a new document called Benchmark Minimum Academic Standards (BMAS). These documents were approved for use in Nigerian universities in 2007. A second attempt at reviewing the BMAS was in 2011. It must however be noted that stand alone BMAS for new programmes were at different times developed by the Commission on request from some Nigerian universities.

The Current Review of the BMAS

The journey of the current curriculum review efforts commenced in 2018, when the National Universities Commission circulated the 2018 draft BMAS to all Nigerian universities and other stakeholders for their comments. In addition to the harvested comments, the curriculum of different programmes of some world-class universities were downloaded. The draft 2018 BMAS, compiled comments of Nigerian universities and other stakeholders and the downloaded curriculum of some foreign universities served as the working documents for the curriculum review panels. A multi-stakeholder approach was deployed in constituting the panels for the curriculum review exercise. The constituted panels included:

i. Academic staff of Nigerian universities;
ii. Representatives of the Academies;

iii. Representatives of Professional bodies/associations
iv. Representatives of the private sector

In addition to the reviewers working individually and in consultation with their subject area peers, over 512 cumulative online meetings of the general assembly (Vice-Chancellors, Discipline Chairmen/Chairpersons, programme-specific reviewers and Heads/representatives of international quality assurance agencies and institutions); Discipline groups; and programme groups were held between March and November, 2021. Physical meetings were also held to finalize the curriculum review exercise.

The reviewers carried out their assignments with a view to producing a curriculum for their respective programmes that will reflect both national and international expectations. Specifically, the reviewers focused on ensuring that the emerging curriculum will be adequate to train Nigerian university students in the 21st Century. By implication and in addition to current trends in the various programmatic areas, the curriculum will be ICT oriented, promote Artificial Intelligence, enhance skills acquisition (including soft skills), inculcate and sharpen entrepreneurship mindset of students and capable of steering the deployment of evolving technologies to deliver its content.

The Core Curriculum and Minimum Academic Standards (CCMAS)
The major highlights of the new curriculum are:

1. Change of nomenclature from **Benchmarks Minimum Academic Standards (BMAS)** to **Core Curriculum and Minimum Academic Standards (CCMAS);**
2. The curriculum provides for 70% minimum core courses requirements for graduation. Nigerian universities are expected to provide the remaining 30%;
3. In consonance with global best practice, the curriculum is to stimulate blended learning in its delivery;
4. Mass Communication has been unbundled to create a distinct discipline of Communications comprising degree programmes in Advertising, Broadcasting, Development Communication Studies, Film and Multimedia, Information and Media Studies, Journalism and Media Studies, Mass Communication, Public Relations and Strategic Communication;
5. Agriculture has been unbundled into programmes in its contributing components of B.Sc Agricultural Economics, B.Sc. Animal Science, B.Sc. Crop Science and B.Sc. Soil Science;
6. The unbundling of Architecture and introduction of Architecture as a new discipline with programmes like Architecture, Architectural Technology, Furniture Design, Interior Architecture Design, Landscape Architecture and Naval architecture;
7. The split of the Basic Medical Sciences discipline into two – Basic Medical Sciences and Allied Health Sciences;
8. Reduction of the General Studies (GST) course from 36 credit units to 12 credit units of 6 courses as follows:
    i. Communication in English;
    ii. Nigerian People and Culture;
    iii. Philosophy, Logic and Human Existence;
    iv. Entrepreneurship and Innovation;
    v. Venture creation; and
    vi. Peace and Conflict resolution.

9. Entrepreneurship has been repackaged with the introduction of programme-specific entrepreneurship;
10. The number of academic disciplines has been increased from 14 to 17 as follows:

    i. Administration and Management
    ii. Agriculture
    iii. Allied Health Sciences
    iv. Architecture
    v. Arts
    vi. Basic Medical Sciences
    vii. Communications and Media Studies
    viii. Computing
    ix. Education
    x. Engineering and Technology
    xi. Environmental Sciences
    xii. Law
    xiii. Medicine and Dentistry
    xiv. Pharmaceutical Science
    xv. Sciences
    xvi. Social Sciences
    xvii. Veterinary Medicine

Having reviewed the curriculum of Nigerian universities, the next steps will include training and retraining of academic staff of Nigerian universities to effectively deliver the content of the curriculum.

Bachelor of Pharmacy (B. Pharm.)

Overview

The Bachelor of Pharmacy (B. Pharm.) programme has been operational in Nigerian universities for over 30 years, with reviews every 2 to 5 years. This is another cycle of review. The B. Pharm. programme is intended to produce pharmacists with adequate education and skills, as well as flexibility, to meet the 21st century challenges of pharmaceutical healthcare in a global setting. This programme has been designed knowing that the global trend is to offer pharmaceutical care. The pharmacy profession is such that has expanded over time to incorporate pharmaceutical care and, in accommodating this clinical demand, it is pertinent that a segment, which is purely clinical, be instituted within the Nigerian educational system.

These Core Curriculum Minimum Academic Standards (CCMAS) are designed for the education and training of undergraduate students wishing to obtain first degree in Pharmacy in the Nigerian university system. It is pertinent to note that this CCMAS document is expected to guide institutions in the design of curricula for their Bachelor of Pharmacy programme by stipulating the minimum requirements. As such, institutions are encouraged to take due cognizance of the CCMAS while bringing necessary innovation into the content and delivery of their programme, towards achieving the overall goals of pharmacy education and training in the country.

This Core Curriculum and Minimum Academic Standards (CCMAS) of the National Universities Commission (NUC) is for use by all Nigerian universities offering Pharmacy. Pharmacy has evolved from a product-oriented practice to a patient-oriented practice. Accordingly, this B. Pharm. curriculum has been reviewed to include: pharmaceutical care concepts, limited clerkship, administrative skills, veterinary pharmacy for animal care and, most importantly, entrepreneurship skills.

Philosophy

The general philosophy of pharmacy education is to produce graduates knowledgeable in the practice of pharmacy, worthy in character, and capable of critical thinking and life-long learning, as a means of achieving optimal patient outcomes.

Objectives

The ultimate aim of the programme is to produce pharmacy practitioners with the knowledge, skills and motivation to provide good pharmaceutical services. To this end, the objectives of the B. Pharm. degree programme are to:

1. instil in the students a sense of appreciation of the pharmacy profession and to involve them in an intellectually stimulating and satisfying experience of learning and study;
2. develop students who demonstrate proficiency in the knowledge, skills and attitudes of basic and applied pharmaceutical sciences;
3. produce graduates who are capable of independent, analytical thinking and problem solving, with respect to drugs and drug-related problems, both in human and animals;
4. provide students with the ability to communicate effectively with patients and caregivers, thereby promoting healthcare and optimal use of drugs;
5. empower the graduates with adequate knowledge and skills to function confidently as integral members of the multidisciplinary healthcare team;

6. produce graduates who will function in a manner consistent with the professional and ethical standards of practice in the country;
7. provide students with adequate knowledge in the manufacture, quality control and distribution of quality pharmaceutical products;
8. produce graduates empowered with leadership and management skills;
9. instil in the students the dynamic value of the profession, which makes life-long learning a necessity; and
10. provide students with adequate knowledge and appropriate skill base, from which they can proceed for further studies in specialised areas of Pharmacy.

Employability Skills

The Bachelor of Pharmacy (B. Pharm.) graduate will be equipped with the following employability skills:

1. relevant skills in hospital pharmacy practice (oncology, paediatrics, psychiatry, veterinary medicine, nuclear medicine, emergency medicine and many others);
2. clinical pharmacy skills (pharmaceutical care/patient care);
3. community pharmacy skills;
4. complementary and alternative medicine practice (herbal medicine);
5. teaching and research skills in tertiary institutions;
6. drug manufacturing skills;
7. drug logistics and supply chain management; and
8. drug development and regulatory control.

21st Century Skills

The B. Pharm. graduate will have the following 21st century skills:

1. learning skills, which include critical thinking, creativity, collaboration and communication
2. literacy skills, such as information technology and use of media
3. life skills for flexibility, leadership, productivity, and social interaction
4. key competencies, such as teamwork, problem solving, sense of responsibility, trustworthiness, ethics, and organisational skills

Unique Features of the Programme

1. The mix and quality of courses are structured to produce pharmacists for the 21st century.
2. New or expanded core courses to fill gaps in the old B. Pharm. curriculum.
3. All courses are to enhance employability of B. Pharm graduates in all aspects of Pharmacy practice and beyond.
4. More time was allocated to clinical experience at orthodox and traditional medicine practice centres for better patient outcome and because of increasing use of herbal remedies and other complementary and alternative medicines by many communities the world over.
5. Acquired entrepreneurial skills are to broaden the horizon of employment of pharmacy graduates.
6. Core courses are designed to equip pharmacy graduates to practise globally.
7. Introduced acquisition of Soft Skills such as: Leadership Skills, Communication Skills to make Pharmacy graduates excel and diversify easily.

Admission and Graduation Requirements

Admission Requirements

Candidates are admitted into the degree programme in any of the following ways:

- Unified Tertiary Matriculation Examination (UTME) Mode (5-year Degree Programme)
- Direct entry

Unified Tertiary Matriculation Examination (UTME) Mode (5-year Degree Programme)

In addition to UTME score, the candidate should possess five credit passes in Senior School Certificate (SSC) to include English Language, Mathematics, Chemistry, Physics, and Biology, at not more than two sittings. This is in addition to an acceptable pass in the UTME and university screening.

Direct Entry

For the four-year programme: five SSC credit passes, two of which must be at Advanced Level and to include Chemistry, Physics/Mathematics and Zoology/Botany/Biology, in addition to UTME requirements.

Candidates with relevant first degree, having not less than Second Class Lower degree in addition to UTME requirements may be considered, in line with the university policy.

Duration

The minimum duration of the Bachelor of Pharmacy programme is five academic sessions for candidates who enter through the UTME mode. Direct Entry candidates admitted to the 200 Level of the programme will spend a minimum of four academic sessions.

The maximum length of time allowed for obtaining an honours degree in the Faculty shall be 14 semesters for the 5–year degree programme and 12 semesters for students admitted directly into the 200 Level. Students requiring more than the normal period of graduation (not more than 150% of the normal course duration) should also be awarded degrees.

Students who transfer from other universities should have sat and passed all courses transferred from the previous university and should have attained the minimum CGPA of 3.50. Such students shall however be required to spend not less than three sessions (6 semesters) in order to earn a degree. Appropriate decisions on transfer cases shall be subject to the approval of Senate on the recommendation of the Faculty.

Graduation Requirements

To graduate with B. Pharm degree, a student must have undergone five (5) academic sessions for UTME or four (4) academic sessions for Direct Entry. A student shall qualify for the award of a B.Pharm degree when he/she has completed and passed all the prescribed number of courses, with **a score of not less than 50% in the professional courses, except Dispensing Practical and Pharmacy Jurisprudence, which require 60% pass mark.** The student must have obtained a minimum CGPA of not less than 2.50 and earned the minimum credit units of not less than 150 for UTME and 120 for Direct Entry candidates.

Course System

The Pharmaceutical Sciences programme shall be run on a modularised system, commonly referred to as Course Unit System. All courses should therefore be sub-divided into self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that particular semester. Credit weights in form of units should be attached to each course. One unit is equivalent to one hour per week per semester of 15 weeks of lectures or 3 hours per week of laboratory work per semester of 15 weeks. It is assumed that the Nigerian university system shall continue to operate the academic year of two semesters with a minimum of 15 weeks of lectures/practical per semester.

The courses are arranged in levels of academic progress. There shall be five levels of courses numbered 101-199, 201-299, 301-399, 401-499 and 501-599. For ease of identification, course numbers can be prefixed by a three-character programme/subject code. Thus, the course code is in the form: DEP LNJ (where the three letters DEP identify the course, 'L' in LNJ, which represents the level of the course (1 or 2 or 3 or 4 or 5 for all undergraduate courses) and NJ is a two-digit numbering of courses. Thus, for example, PCH 203 is a 200-Level course with number 03 offered in the Pharmaceutical Chemistry Department.

Grading of Courses

Grading of courses shall be done by a combination of percentage marks and letter grades translated into a graduated system of Grade Point as shown in Table 1.1.

Table 1. 1 Grade Point System

Mark %	Letter Grade	Grade Point
70 – 100	A	5
60 – 69	B	4
50 – 59	C	3
45 – 49	D	2
40 – 44	E	1
0- 39	F	0

Grade Point Average and Cumulative Grade Point Average

For the purpose of determining a student's standing at the end of every semester, the Grade Point Average (GPA) system shall be used. The GPA is computed by dividing the total number of Units x Grade Point (TUGP) by the total number of units (TNU) for all the courses taken in the semester as illustrated in Table 1.2

The Cumulative Grade Point Average (CGPA) over a period of semesters is calculated in the same manner as the GPA by using the grade points of all the courses taken during the period.

Even when a student repeats the same course once or more before passing it, grades scored at each, and all attempts shall be included in the computation of the GPA.

Table 1:2 Calculation of GPA or CGPA

Course	Units	Grade Point	Units x Grade Point (UGP)
C_1	U_1	GP_1	U_1 x GP_1
C_2	U_2	GP_2	U_2 x GP_2
-	-	-	-
-	-	-	-
C_i	U_i	GP_i	U_i x GP_i
-	-	-	-
-	-	-	-
C_N	U_N	GP_N	U_N x GP_N
TOTAL	**TNU**		**TUGP**

$$TNU = \sum_{i=1}^{N} U_i \qquad TUGP = \sum_{i=1}^{N} U_i * GP_i \qquad CGPA = \frac{TUGP}{TNU}$$

Degree Classifications

A minimum CGPA of 2.50 is required for graduation. Candidates can earn either PASS or PASS WITH DISTINCTION. Candidates with CGPA of 4.50 to 5.0 shall qualify for Pass with Distinction as a way of encouraging healthy competition and excellence (Table 1.3). Others outside this category will receive Pass degrees. The Cumulative Grade Point Average (CGPA) over a period of semesters is calculated in the same manner as the GPA by using the grade points of all the courses taken during the period.

Cumulative Grade Point Average and Class of Degree

A Pass degree is awarded as follows:

Table 1.3: Degree Classification

Pass Degree	Cumulative Grade Point Average (CGPA)
Pass with Distinction	4.50–5.00
Pass	2.5-4.49

Probation

Probation is a status granted to a student whose academic performance falls below acceptable standard at the end of the session. Generally, a student whose Cumulative Grade Point Average (CGPA) is below 1.00 at the end of a particular year of study, earns a period of probation for one academic session. For Pharmacy, CGPA of 2.50 at the end of a particular session of study earns a period of probation for one academic session and may be withdrawn from the programme after two consecutive probation periods.

Withdrawal

A candidate whose Cumulative Grade Point Average is below 2.50 at the end of a particular year should be on probation. But a candidate whose cumulative GPA is below 2.50 at the end of a particular year of probation should be required to withdraw from the programme.

Resit Examinations
Because of the professional nature of the programme, during the professional years (from 200 Level) candidates may not proceed to higher levels until they have passed all relevant courses and fulfilled the credit requirements in the preceding year. Candidates are expected to complete each year by passing all compulsory and prescribed courses in various subject areas. However, candidates who obtain a set minimum credit pass may be permitted by the Senate on the recommendation of the Faculty Board to be referred in the courses (Resit examination) before another session begins. Candidates who pass less than the set minimum credit units shall be required to repeat the session. Candidates who still fail to fulfil the set requirements above after a resit examination may be asked to repeat the session, while those who still fail after a repeat may be asked to withdraw from the programme. Resit examinations will help students who are not able to cope with all the credit load during examination to have a better grasp of their weak subject areas before proceeding to more advanced courses.

Evaluation

Student Assessment
Practicals
By the nature of the pharmacy profession, laboratory practicals are very important in the training of students. To reflect the importance of practical work, a minimum of 9 hours per week or 135 hours per semester (equivalent to 3 units) should be spent on students' laboratory practicals. Consequently, some of the courses have both theory and practical components. Thus, in the description of courses to be taken in this programme, as will be presented, the number of hours of lectures (LH) and the number of hours of practicals (PH) per semester are indicated. The overall performance of students in such courses is to be based on the evaluation of the performance in written examination (which tests the theory) and also the performance in the laboratory work (based on actual conduct of experiments and the reports).

The experiments to achieve the practical components of the courses must be designed in quality and quantity to enrich the grasp of the theoretical foundations of the courses. It is left for the department to organise all the experiments in the best way possible. Another way to achieve this is to lump the entire laboratory practicals under a course, which the student must pass.

Tutorials
The timetable for courses shall be designed to make provision for tutorials of at least one hour for every four hours of lecture. Thus a 3-unit course of 45 hours per semester should attract about 10 hours of tutorials.

Continuous Assessment
Continuous assessment of students should be by means of term paper, frequent tests (formal and informal) and practical exercises.
The general pattern approved is as follows:
1. scores from continuous assessment shall normally constitute 30 percent of the full marks for courses which are primarily theoretical;
2. for courses which are partly practical and partly theoretical, scores from continuous assessment and practical shall constitute 40 percent of the final marks; and

3. for courses that are entirely practical, continuous assessment shall be based on a student's practical work or reports, as well as practical examination, and both shall constitute 100 percent of the final marks.

Examinations
In addition to continuous assessment, a final examination should normally be given for every course at the end of each semester. All courses shall be graded out of a maximum of 100 marks comprising:
Final Examination: 60% - 70%
Continuous assessment (Quizzes, Homework, Tests, Practicals): 30% - 40%
Each course shall normally be completed and examined at the end of the semester in which it is offered.

External Examiner System
There shall be external examiners to vet and moderate the courses and examination for the various subject areas to cover the professional years. This system should be used to assess courses and projects, and to certify the overall performance of students, as well as the quality of facilities and teaching in the faculty. The use of different external examiners for major subject areas in the professional programme is recommended.

It is believed that effective use of external examiners will bring out the desirable assurance in achieving the set goals of the programme.

The external examiner's reports should be sent to the Vice-Chancellor and be made available to the departments for appropriate action.

Industrial Experience
Students Industrial Work Experience Scheme (SIWES)
There should be a mandatory 6-month SIWES training of 12 weeks each at the 300- and 400-Levels, respectively, during which students can gain work experience. Adequate monitoring of such activities must be built into the administration of the programme.

Externship/Clerkship
Pharmacy students will participate in both externship and clerkship programmes. These are built into the curriculum that runs during the session. For externship/clerkship, students are rotated among hospital and community pharmacies and Primary Healthcare Centres (PHC). Periods of at least 3 hours are to be spent, with the aim of the students acquiring clinical experience. Details are as specified in the course content.

Attainment Level
the minimum pass mark for any pharmacy course taken in the professional years shall be fifty percent (50%) and sixty percent (60%) for Dispensing Practical and Pharmacy Jurisprudence. Evidence on which assessment is based shall include:
1. Informal/written examination;
2. Continuous assessment;
3. Laboratory reports;
4. Oral presentation; and
5. Conduct and reporting of project work.

Students' Evaluation of Courses

There should be an established mechanism to enable students to evaluate courses delivered to them at the end of each semester. This should be an integral component of the course credit system, serving as feedback mechanism for achieving the following:

1. Improvement in the effectiveness of course delivery;
2. Continual update of lecture materials to incorporate emerging new concepts;
3. Effective usage of teaching aids and tools to maximise impact of knowledge on students; and
4. Improvement in students' performance through effective delivery of tutorials, timely presentation of continuous assessment and high-quality examination.

The evaluation should be conducted preferably before the final semester examinations. It is very important that students' evaluation of courses be administered fairly and transparently, using well-designed questionnaires. The completed questionnaires should be professionally analysed and results discussed with the course lecturer(s) towards improvement in course delivery in all its ramifications.

Global Course Structure

100 Level

Course Code	Course Title	Units	Status	LH	PH
GST 111	Communication in English I	2	C	30	-
GST 112	Nigerian Peoples and Culture	2	C	30	-
BIO 101	General Biology I	2	C	30	-
BIO 102	General Biology II	2	C	30	-
BIO 107	General Biology Practical I	1	C	-	45
BIO 108	General Biology Practical II	1	C	-	45
CHM 101	General Chemistry I	2	C	30	-
CHM 102	General Chemistry II	2	C	30	-
CHM 107	General Chemistry Practical I	1	C	-	45
CHM 108	General Chemistry Practical II	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 102	General Physics II	2	C	30	-
PHY 107	General Physics Practical I	1	C	-	45
PHY 108	General Physics Practical II	1	C	-	45
PCY 101	Introduction to Pharmacy	1	C	15	-
	Total	**27**			

200 Level

Course Code	Course Title	Units	Status	LH	PH
GST 212	Philosophy, Logic, Environment and Sustainable Development	2	C	30	-
ENT 211	Entrepreneurship and Innovation	2	C	30	-
ANA 201	Basic Anatomy	2	C	30	-
ANA 202	Neuroanatomy	3	C	30	45
ANA 203	Histology	1	C	15	-
BCH 201	Biochemistry	3	C	30	45
BCH 202	Introductory Molecular Biology	3	C	30	45
PIO 201	Introductory and Blood Physiology	3	C	30	45
PIO 202	Neurophysiology and Special Senses	3	C	30	45
ICT 201	Information and Communication Technology in Pharmacy I	2	C	15	45
PCG 201	Organised Vegetable Drugs	3	C	30	45
PCG 202	Unorganised Vegetable Drugs	1	C	15	-
PCH 201	Inorganic Pharmaceutical Chemistry	3	C	30	45
PCH 202	Physical Pharmaceutical Chemistry I	3	C	30	45
PCH 203	Organic Pharmaceutical Chemistry I	3	C	30	45
PCT 201	Introductory Pharmaceutics	2	C	30	-
PCT 202	Unit Operations	2	C	30	-
PCT 203	Dispensing Practical I	1	C	-	45
PCT 204	Dispensing Practical II	1	C	-	45
PHM 201	Introductory Pharmaceutical Microbiology	3	C	30	45
	Total	46			

300 Level

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	30	-
PAA 399	SIWES	3	C	-	12 wks
CLI 301	Clinical Pharmacy I	2	C	30	-
PAT 301	Pathology	2	C	30	-
PCG 301	Separation Techniques in Pharmacognosy	2	C	15	45
PCG 302	Drugs of Biological Origin	3	C	30	45
PCH 301	Physical Pharmaceutical Chemistry II	3	C	30	45
PCH 302	Organic Pharmaceutical Chemistry II	3	C	30	45
PCT 301	Drug Dosage Forms	2	C	30	-
PCT 302	Physical Pharmaceutics I	2	C	30	-
PCT 303	Dispensing Practical III	1	C	-	45
PCT 304	Dispensing Practical IV	1	C	-	45

PHA 301	Introductory Pharmacology	2	C	30	-
PHA 302	Pharmacology of the Autonomic Nervous System	3	C	30	45
PHA 304	Pharmacology of the Haemopoietic System and Gastrointestinal Tract	2	C	30	-
PHM 301	Applied Pharmaceutical Microbiology I	3	C	30	45
PSM 301	Biostatistics	1	C	15	-
SAP 301	Pharmacoeconomics	2	C	30	-
	Total	41			

400 Level

Course Code	Course Title	Units	Status	LH	PH
PAA 499	SIWES	3	C	-	12 wks
BTG 401	Biotechnology	3	C	30	45
CLI 401	Clinical Pharmacy II	3	C	45	-
CLI 402	Clinical Pharmacy Externship	2	C	-	90
ICT 401	Information and Communication Technology in Pharmacy II	2	C	15	45
PCG 401	Phytochemistry and Biosynthesis of Natural Products	2	C	30	-
PCG 402	Medicinal Plants/Traditional Medicine	3	C	30	45
PCH 401	Pharmaceutical Analysis I	3	C	30	45
PCH 402	Medicinal Chemistry I	3	C	45	-
PCT 401	Pharmaceutical Technology	3	C	45	-
PCT 402	Physical Pharmaceutics II	3	C	45	-
PCT 403	Industrial Pharmacy	3	C	-	135
PHA 401	Pharmacology of Cardiovascular System	3	C	30	45
PHA 402	Pharmacology of Central Nervous System	3	C	30	45
PHM 401	Applied Pharmaceutical Microbiology II	3	C	30	45
SAP 401	Pharmacy Management I	2	C	30	-
SAP 402	Forensic Pharmacy and Pharmacy Ethics	2	C	30	-
	Total	46			

500 Level

Course Code	Course Title	Units	Status	LH	PH
PAA 501	Veterinary Pharmacy	3	C	45	-
PAA 502	Project	6	C	-	270
CLI 501	Clinical Pharmacy III	2	C	30	-
CLI 502	Literature Evaluation and Communication Skill	2	C	30	-
CLI 503	Public Health Pharmacy	2	C	30	-
CLI 504	Clinical Pharmacy Clerkship II	2	C	-	90
CLI 505	Clinical Pharmacy Clerkship I	2	C	-	90
PCG 501	Evaluation of Phyto-pharmaceuticals	1	C	15	-
PCG 502	Clinical Pharmacognosy: Traditional Medicine Practice (TMP)	2	C	15	45
PCH 501	Pharmaceutical Analysis II and Drug Quality Assurance	3	C	30	45
PCH 502	Medicinal Chemistry II	2	C	30	-
PCH 503	Principles of Drug Design	2	C	30	-
PCT 501	Formulation Processes and Process Validation	3	C	30	45
PCT 502	Production and Quality Control of Cosmetics	2	C	30	-
PHA 501	Chemotherapy	2	C	30	-
PHM 501	Pharmaceutical Microbiology III	2	C	30	-
SAP 502	Pharmaceutical Marketing	1	C	15	-
	Total	39			
	TOTAL CREDIT UNITS B. Pharm	199			

Course Contents and Learning Outcomes

100 Level

GST 111: Communication in English I (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. identify possible sound patterns in English Language;
2. list notable language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents
Sound patterns in English Language (vowels and consonants, phonetics and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple and complex). Grammar and usage (tense, mood, modality and concord, aspects of language use in everyday life). Logical and critical thinking and reasoning methods (Logic and syllogism, inductive and deductive argument and reasoning methods, analogy, generalisation and explanations). Ethical considerations, copyright rules and infringements. Writing activities (Pre-writing, writing, post-writing, editing and proofreading; brainstorming, outlining, paragraphing). Types of writing: Summary, essays, letter, curriculum vitae, report writing and note making. Mechanics of writing. Comprehension strategies (Reading and types of reading, comprehension skills, 3RSQ). Information and communication technology in modern language learning. Language skills for effective communication. Major word formation processes. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening.

GST 112: Nigerian Peoples and Culture (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. analyse the historical foundation of the Nigerian culture and arts in pre-colonial times;
2. list and identify the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political unit;
4. analyse the concepts of trade, economic and self-reliance status of the Nigerian peoples towards national development;
5. enumerate the challenges of the Nigerian State towards nation-building;
6. analyse the role of the Judiciary in upholding people's fundamental rights;
7. identify acceptable norms and values of the major ethnic groups in Nigeria; and
8. list and suggest possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents
Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and culture; peoples and culture of the ethnic minority groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation-building (military intervention in Nigerian politics; Nigerian Civil War). Concept of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigeria peoples; trade, skill acquisition and self-reliance). Social justices and national development (law definition and classification). The Judiciary and fundamental rights. Individual norms and values (basic Nigerian norms and values). Patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts. Cultism, kidnapping and other related social vices. Re-orientation, moral and national values. The 3Rs – Reconstruction, Rehabilitation and Re-orientation. Re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline (WAI), War Against Indiscipline and Corruption (WAIC), Mass Mobilisation for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

BIO 101: General Biology I **(2 Units C: LH 30)**

Learning Outcomes
At the end of the course, students should be able to:
1. explain cell structure and organisation;
2. summarise functions of cellular organelles;
3. characterise living organisms and state their general reproduction;
4. describe the interrelationship that exists between organisms;
5. discuss the concept of heredity and evolution; and
6. enumerate habitat types and their characteristics.

Course Contents
Cell structure and organisation, functions of cellular organelles, characteristics and classification of living things, chromosomes, genes - their relationships and importance, general reproduction, interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism). Heredity and evolution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms), elements of ecology and types of habitats.

BIO102: General Biology II **(2 Units C: LH 30)**

Learning Outcomes
At the end of the course, students should be able to:
1. state the unique characteristics of plant and animal kingdoms;
2. describe ecological adaptations in the plant and animal kingdoms;
3. give a summary of the physiology of plants and animals;
4. explain nutrition, respiration, excretion and reproduction in plants and animals; and
5. describe growth and development in plants and animals.

Course Contents
A generalised survey of the plant and animal kingdoms, based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory system, excretion, reproduction, growth and development.

BIO 107: General Biology Practical I **(1 Unit C: PH 45)**

Learning Outcomes
At the end of the course, students should be able to:
1. outline common laboratory hazards;
2. provide precautions on laboratory hazards;
3. state the functions of the different parts of the microscope;
4. use the microscope and describe its maintenance;
5. draw biological diagrams and illustrations; and
6. apply scaling and proportion to biological diagrams.

Course Contents
Common laboratory hazards: prevention and first aid; measurements in biology; uses and care of microscope: compound and dissecting microscope. Biological drawings and illustration, scaling,

accuracy and proportion. Use of common laboratory apparatus and laboratory experiments designed to illustrate the topics covered in BIO 101.

BIO 108: General Biology Practical II (1 Unit C: PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. describe the anatomy of flowering plants;
2. differentiate types of fruit and seeds;
3. state ways of handling and caring for biological wares;
4. describe the basic histology of animal tissues; and
5. identify various groups in the animal kingdom.

Course Contents

Anatomy of flowering plants; primary vegetative body: stem, leaf and root to show the mature tissues, namely parenchyma, collenchyma, sclerenchyma, xylem and phloem. Types of fruits and seeds. Care and use of dissecting kits and other biological wares. Dissection and general histology of animal tissues based on vertebrate forms. Morphology and functions of epithelial, muscular, nervous and connective tissues. Examination of various groups of lower invertebrates under microscopes. Identification of various groups of organisms in the animal kingdom and any experiment designed to emphasise the practical aspects of topics in BIO 102.

CHM 101: General Chemistry I (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. define atom, molecules and chemical reactions;
2. discuss the modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. justify the trends of atomic radii, ionization energies, electronegativity of the elements based on their position in the periodic table;
5. identify and balance oxidation – reduction equation and solve redox titration problems;
6. illustrate shapes of simple molecules and hybridized orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. the principles of equilibrium to aqueous systems using LeChatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

Course Contents

Atoms, molecules, elements and compounds and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence Forces; Structure of solids. Chemical equations and stoichiometry; Chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 102: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. state the importance and development of organic chemistry;
2. define fullerenes and its applications;
3. discuss electronic theory;
4. determine structures of organic compounds; qualitative and quantitative analysis in organic chemistry;
5. describe rules guiding nomenclature and functional group classes of organic chemistry;
6. determine rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group IA, IIA and IVA elements; and
9. describe basic properties of transition metals.

Course Contents

Historical survey of the development and importance of organic chemistry; fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

CHM 107: General Chemistry Practical I (1 Unit C: PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. describe the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out Chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. differentiate between primary and secondary standards;
5. perform redox titrations;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

Course Contents

Laboratory experiments designed to reflect topics presented in course CHM 101. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CHM 108: General Chemistry Practical II (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. identify the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests, which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. execute solubility tests on known and unknown organic compounds;
6. execute elemental tests on known and unknown compounds; and
7. conduct functional group/confirmatory test on known and unknown compounds which could be acidic / basic / neutral organic compounds.

Course Contents
Laboratory experiments designed to reflect topics presented in course CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

MTH 101: Elementary Mathematics I (2 UNITS C: LH 30)
(Algebra and Trigonometry)

Learning Outcomes
At the end of the course, students should be able to:
1. understand basic definition of set, subset, union, intersection, complements and use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. understand various types of numbers; and
5. solve some problems using binomial theorem.

Course Contents
Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers; integers, rational and irrational numbers, mathematical induction, real sequences and series. Theory of quadratic equations, binomial theorem. Complex numbers; algebra of complex numbers; the Argand diagram. De-Moivre's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 102: Elementary Mathematics II (2 UNITS C: LH 30)
(Calculus)

Learning Outcomes
At the end of the course, students should be able to:
1. recall types of rules in differentiation and integration;
2. recall the meaning of function of a real variable, graphs, limits and continuity; and
3. solve some applications of definite integrals in areas and volumes.

Course Contents
Function of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation. Extreme curve sketching. Integration as an inverse of differentiation. Methods of integration. Definite integrals. Application to areas, volumes.

PHY 101: General Physics I (2 Units C: LH 30)
(Mechanics)

Learning Outcomes
At the end of the course, students should be able to:
1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents
Space and time; units and dimension, vectors and scalars. Differentiation of vectors: displacement, velocity and acceleration. Kinematics. Newton laws of motion (inertial frames, impulse, force and action at a distance, momentum conservation). Relative motion. Application of Newtonian mechanics; equations of motion. Conservation principles in physics. Conservative forces, conservation of linear momentum. Kinetic energy and work. Potential energy. System of particles. Centre of mass, rotational motion; torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; circular motion; moments of inertia, gyroscopes and precession. Gravitation: Newton's law of gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits.

PHY 102: General Physics II (2 Units C: LH 30)
(Electricity & Magnetism)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the electric field and potential, and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law and electric potential;
3. describe and determine the magnetic field for steady and moving charges;
4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. describe electromagnetic induction and related concepts, and make calculations using Faraday's and Lenz's laws;
6. explain the basic physical of Maxwell's equations in integral form;
7. evaluate DC circuits to determine the electrical parameters; and

8. determine the characteristics of AC voltages and currents in resistors, capacitors, and inductors.

Course Contents
Forces in nature; electrostatics; electric charge and its properties, methods of charging; Coulomb's law and superposition; electric field and potential; Gauss's law; capacitance; electric dipoles; energy in electric fields; conductors and insulators, current, voltage and resistance; Ohm's law and analysis of DC circuits; magnetic fields; Lorentz force; Biot-Savart and Ampère's laws; magnetic dipoles; dielectrics; energy in magnetic fields; electromotive force; electromagnetic induction; self and mutual inductances; Faraday's and Lenz's laws; step up and step down transformers: Maxwell's equations; electromagnetic oscillations and waves; AC voltages and currents applied to inductors, capacitors, resistance and combinations.

PHY 107: General Physics Practical I (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents
This introductory course emphasises quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques should be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity and many others covered in PHY 101 and PHY 102. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

PHY 108: General Physics Practical II (1 Unit C: PH 45)
This is a continuation of the experiments designed for PHY 101 and PHY 102, some of which have been covered under PHY 107.

PCY 101: Introduction to Pharmacy (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, the student should be able to:
1. define the role of Pharmacists in health services;
2. identify opportunities in various practice areas of Pharmacy;
3. identify various disciplines of Pharmacy;
4. interpret prescriptions; and
5. identify different dosage forms.

Course Contents
Orientation to Pharmacy - the role of a pharmacist in the health services. Opportunities in Pharmacy. History of Pharmacy. Evolution of the pharmacy profession. Various disciplines of Pharmacy. Stages in the development of a new drug. Concept of dosage forms. The prescription.

200 Level

GST 212: Philosophy, Logic, Environment and Sustainable Development
(2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. analyse the concept of humanity, its origin, philosophy and cosmic environment;
2. improve their logical and critical thinking skills;
3. identify the basic roles of science and technology in human society;
4. describe renewable and non-renewable environmental resources available in the Nigerian society;
5. identify resource conservation tools and techniques for sustainable environment;
6. analyse environmental effects of plastics, and other wastes;
7. suggest possible management techniques and solutions to identifiable environmental challenges faced in different areas of the Nigerian society;
8. list and describe unethical behaviour patterns that can hinder human societal growth and development.

Course Contents
Concept of humanity, its origin, philosophy and cosmic environment. Concepts and techniques in logic and critical thinking. Science and technology in human society and services. Renewable and non-renewable environmental resources. Climate change and the principle of sustainable development. Environmental effects of plastics, and other waste products. Elements of environmental studies for productive, safe and healthy living. Environmental Challenges – urbanisation, environmental pollution and degradation, soil erosion, desert encroachment, soil degradation and flooding. National Development Plans towards sustainable environment. Trends in global action towards environmental sustainability.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation, and risk taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment, and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe stages in enterprise formation, partnership and networking, including business planning;

7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. state the basic principles of e-commerce.

Course Contents
Concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship). Theories, rationale and relevance of entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship and creative destruction). Characteristics of entrepreneurs (Opportunity seeker, risk-taker, natural and nurtured, problem-solver and change agent, innovator and creative thinker). Entrepreneurial thinking (critical thinking, reflective thinking, and creative thinking). Innovation (concept of innovation, dimensions of innovation, change and innovation, knowledge and innovation). Enterprise formation, partnership and networking (basics of business plan, forms of business ownership, business registration and forming alliances and joint ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office, networking). Entrepreneurship in Nigeria (biographies of inspirational entrepreneurs, youth and women entrepreneurship, entrepreneurship support institutions, youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

ANA 201: Basic Anatomy (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to describe the:
1. basic organisation of the human body;
2. gross and microscopic structure of different organ systems; and
3. structure-function correlation.

Course Contents
Basic organisation of the human body: A study of human biological structure at various levels of complexity, from sub-cellular to gross and microscopic structure of individual organ systems. Structure-function correlations. Integumentary system. Circulatory system. Lymphoid system. Alimentary system. Musculoskeletal system. Respiratory system. Urinary system. Genital system. Endocrine system. Organs of special senses.

ANA 202: Neuroanatomy (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to describe the:
1. structural organisation of the nervous system;
2. spinal cord and the brain;
3. peripheral nervous system;
4. general embryology, teratology and genetic anatomy; and
5. influence of drugs on foetal development.

Course Contents
Basic structural organisation of the nervous system: The neuron (Soma and neurites). Centralisation and Telencephalisation. Neural Circuitry (receptors, effectors and the synapse). Fate of the neural crest. Spinal Cord: general topography, grey matter, ascending and descending pathways. Brain: general topography; brainstem, cerebellum, diencephalon, cerebrum. Meninges

and ventricular system. Pia, arachnoid & duramater. Secretion and circulation of cerebrospinal fluid. Blood-brain barrier. Peripheral nervous system; basic plan, afferent and efferent cerebrospinal peripheral nerve endings, ganglia. Autonomic nervous system; Basic plan; sympathetic system, parasympathetic system, autonomic effector endings. General embryology, teratology and genetic anatomy. General embryology - Male gamete, female gamete, fertilisation (gametogenesis). Development of early embryo and developmental malformations.

Systemic embryology - musculoskeletal system, respiratory system, cardiovascular system, nervous system, urogenital system, and developmental malformations.
Genetic anatomy - genetic apparatus, and genetically related malformations. Influence of drugs on development.

ANA 203: Histology (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, students should be able to explain the:
1. histology of lymphatic and alimentary system and reproductive systems; and
2. histology of the exocrine glands and organs of special senses.

Course Contents
The tissues. The lymphatic system. The alimentary system. The exocrine glands. The urinary glands. The reproductive system. Organs of special senses.
Practicals – This will involve the use of plastic models and slides for histology and class demonstrations.

BCH 201: Biochemistry (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. list the importance of Biochemistry in health sciences;
2. explain the structure and function of proteins;
3. describe digestion, absorption and transport across membranes; and
4. describe metabolism of carbohydrates, lipids, and amino acids.

Course Contents
Importance of Biochemistry to the health sciences - levels of medical care and biochemistry. Membranes and cell structure techniques used in Biochemistry and Medicine. Protein structure and function- primary, secondary and tertiary structure of proteins in blood. Digestion, absorption and transport across membranes. Protein calorie malnutrition. Metabolism - introduction of the study of intermediary metabolism. Carbohydrate chemistry, digestion, absorption and metabolism. Lipid chemistry, digestion, and metabolism, including phospholipids and prostaglandins. Lipidoses. Metabolism of amino acids. Amino acid degradation and biosynthesis. Essential and non-essential amino acids. Ketogenic and glucogenic amino acids.
Practicals: Relevant experiments to demonstrate absorption and transport across membranes.

BCH 202: Introductory Molecular Biology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe nucleic acids and their structure;
2. explain genes and heredity, DNA replication and cell division;
3. define recombinant DNA technology and list its uses;
4. describe protein synthesis, hormones and their actions; and
5. name significant biochemical transformations of medical importance.

Course Contents
Nucleic acids - DNA, RNA and elementary treatment of their structure. Biochemistry of heredity. Discovery and properties of the genetic materials, DNA replication and cell division. Cloning and recombinant DNA Technology. Mutagens and mutation. Mechanism of protein synthesis. Biochemistry of hormones and hormonal action to include actions of cyclic-AMP, cyclic-GMP, adrenaline, glucagon and insulin. Detoxification mechanisms including cytochrome P_{450} and other isoforms. Haem degradation and other significant biochemical transformation of medical importance.
Practicals: Relevant experiments to demonstrate protein and nucleic acid synthesis.

PIO 201: Introductory and Blood Physiology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to describe:
1. cell physiology and transport system; and
2. physiology of the cardiovascular, respiratory, renal, gastrointestinal and endocrine systems.

Course Contents
Body fluids. Cell Physiology. Transport System. Excitable cells. Contractile tissues. Homoestasis. Control systems. Blood. Introductory autonomic nervous system. Cardiovascular and Respiratory Physiology: Cardiovascular physiology. Cardiac muscle. E.C.G., Haemodynamics. Systemic circulation. Events in cardiac cycle. Heart rate and its control. Blood pressure. Cardiac output. Introduction to mechanics of respiration. Lung volumes. Gas tensions. Oxygen transport. Oxygen dissociation curve. Carbon dioxide transport. Carbon dioxide dissociation curve. Nervous regulation of respiration. Chemoreceptors. Hypoxia, hyperpnoea, apnoea. Periodic respiration. Dyspnoea. Cyanosis.
Renal, Gastrointestinal and Endocrine Physiology: Introductory renal anatomy. Glomerular filtration and clearance. Tubular reabsorption, T_m. Countercurrent mechanism. E.C.F. Regulation. Dilute and concentrated urine output. Micturition. Renal hormones. Renin-Angiotension system. Mastication. Deglutition. Salivation. Stomach and its emptying. Small intestine. Large intestine. Salivary, gastric and pancreatic juices. Reflexes. Digestion, absorption and assimilation. Bile. Thyroid, parathyroid and calcium metabolism. Pituitary gland. Adenohypophysis, neurohypophysis, adrenal cortex and medulla. Pancreas, thymus, pineal gland. Male and female reproductive systems.

PIO 202: Neurophysiology and Special Senses (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the organisation of the CNS and its control systems;
2. describe sleep, memory and learning;
3. describe autonomic nervous system; and
4. explain special senses.

Course Contents
Neurophysiology: Organisation of the CNS and CNS control systems. Spinal reflexes. Excitation and inhibition. Localisation of functions in the cortex. Motor system. Pyramidal and extrapyramidal sensory systems. Reticular formation. Cerebellum: Control of posture. Neurobiology rhythms. Sleep and unconscious states. Memory, learning.
Autonomic Nervous System: Parasympathetic and sympathetic neuroeffectors. Cholinergic mechanisms. Adrenergic mechanisms. Autonomic reflexes. Adrenal medulla. Autonomic drugs.
Special Senses: Eyeball: retina, sight, accommodation. Photochemical mechanism. Receptor potential. Light reflexes and adaptation. Ear: sound waves, hearing. Taste. Smell.
Practicals: Special exercises to illustrate various aspects of physiology treated above.

ICT 201: Information and Communication Technology in Pharmacy I
(2 Units C: LH 15; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. explain an overview of computer technology;
2. describe applications of ICT in Pharmacy and society;
3. perform practical, hands-on exercises; and
4. identify available software, statistical packages, databases and management information systems.

Course Contents
Overview of information and communication technology and their applications in contemporary society. Computer types (Mainframe, minicomputers, microcomputers). Computer parts and terminologies (hardware, software). Computer hardware. Components affecting the performance of a computer. Computer software. Application software. Database management systems.
Practicals: Perform hands-on practicals using relevant softwares, statistical packages and other databases.

PCG 201: Organised Vegetable Drugs (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. recognise the relevance of plant morphology, using microscopical technique to identify how organised plant-based drugs are;
2. classify, cultivate, collect, prepare, substitute, and store crude drugs (leaf, bark, root, rhizome, flower, seeds);

3. describe their mode of preservation for commerce; and
4. identify adulteration of crude drugs.

Course Contents
Introduction to pharmacognosy – definitions, scope and application. Classification of natural drugs of vegetable origin. The microscope - optical principles and techniques. Macroscopy, microscopy and chemo-microscopy. Basic histology, micromorphology and anatomy of medicinal roots, rhizomes, herbs, leaves, wood, fruits, seeds and flowers. Examples from Nigerian flora. Official monographs. Field trips.

PCG 202: Unorganised Vegetable Drugs (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, students should be able to:
1. identify crude drugs and their forms of occurrences; and
2. evaluate crude drugs.

Course Contents
Introduction to plant products of primary metabolism. Photosynthesis and its significance to the production of natural products. Natural sources, processing, identification and uses of saccharides, commercial starches, pharmaceutical gums, resins, balsams, and mucilage.

PCH 201: Inorganic Pharmaceutical Chemistry (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. explain Atomic and molecular structures;
2. explain chemical and physical properties of inorganic elements and compounds and their uses in Pharmacy and Medicine;
3. differentiate between normality and molarity; and
4. conduct qualitative analysis of inorganic pharmaceuticals.

Course Contents
Introduction to inorganic pharmaceutical chemistry. Occurrence, sources, control and removal of impurities in pharmaceuticals and their limit tests. Atomic and molecular structure and bonding. Periodic table and electronic configuration of the elements. Inorganic substance pharmaceuticals and medicinal agents. Principles and applications of volumetric and gravimetric analysis.
Practical: Relevant practicals to demonstrate qualitative analysis of inorganic pharmaceuticals.

PCH 202: Physical Pharmaceutical Chemistry I (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the theory and practical classes, students should be able to:
1. Describe various physicochemical properties of drug molecules as a guide to how to design dosage forms
2. Carry out assays of wet analyses, using basic laboratory equipment

Course Contents
Basic knowledge of the physical non-electrolyte solutions. Colligative properties and solubility of pharmaceuticals. Osmotic pressure and isotonic solutions. Chemical and ionic equilibria. General concepts; acid-base equilibria, buffer solutions and pharmaceutical applications. Electrochemical methods of analysis of pharmaceuticals. Electrolyte solutions and electrochemistry. Conductimetry. Potentiometry - principles, instrumentation and applications in pharmaceutical analysis. Amperiometric and dead-stop titration. Polarography.
Practicals: Relevant experiments to demonstrate assays of wet analyses and the use of basic laboratory equipment.

PCH 203: Organic Pharmaceutical Chemistry I (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. classify organic substances into groups;
2. predict chemical and physical properties of organic pharmaceuticals;
3. explain the use of organic compounds in Pharmacy and Medicine; and
4. conduct synthesis and analysis of simple organic functional groups.

Course Contents
Fundamental concepts and techniques of organic chemistry. Functional group chemistry (alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids and many others). Strengths of acids and bases. Introduction of stereochemistry of compounds. Molecular dissymmetry, racemisation and resolution methods.
Practicals: Relevant experiments for synthesis and analysis of simple organic functional groups.

PCT 201: Introductory Pharmaceutics (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. explain the principles and requirements of dispensing in Pharmacy;
2. describe various types of pharmaceutical calculations needed for formulations; and
3. describe preparation and dispensing of pharmaceutical dosage forms.

Course Contents
Introduction to dispensing. Sources of information for dispensing. Official compendia and formularies. Principles of dispensing. Prescriptions. Procedures and ethics of dispensing. Pharmaceutical incompatibilities. Pharmaceutical calculations including use of software applications.

PCT 202: Unit Operations (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the principles and scientific basis of unit operations employed in Pharmacy;
2. identify various types of simple dosage forms; and
3. describe methods of preparation, packaging, labelling and storage of dosage forms.

Course Contents
Milling and size reduction. Mixing of solids and liquids. Separation of solids from liquids. Clarification and filtration. Mass and heat transfer. Drying principles and methods. Evaporation and distillation. The phase rule: solution and solubility. Solutions as a dosage form. Stability of solutions. Surface and interfacial phenomena. Surface active agents, solubilisation, micelles. Introduction to dispersed systems.

PCT 203: Dispensing Practical I (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. use simple dispensing techniques;
2. prepare simple solutions; and
3. use appropriate packaging and labeling requirements for simple solutions.

Course Contents
Introduction to dispensing, packaging and labeling requirements for dispensing, containers and closures. Weighing techniques, measurement of volumes, techniques in unit operations, trituration and mixing of solids. Preparation of simple solutions. Dilution of simple solutions, syrup and aromatic waters.

PCT 204: Dispensing Practical II (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. carry out measurements using aliquot methods;
2. prepare different types of pharmaceutical powders; and
3. prepare elixirs, syrups, mixtures, suspensions and many others.

Course Contents
Preparation of liquid dosage forms. Compounding and dispensing of drugs. Extemporaneous and bulk preparation of mixtures of liquids and solid drug ingredients. Preparation of collodions and paints, gargles, inhalants and drops (nasal and eye). Preparation of pharmaceutical powders (bulk, compound and divided powders). Prescription reading.

PHM 201: Introductory Pharmaceutical Microbiology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe terms and concepts of turbidity, range, versatility, nutrition needs of micro-organisms;
2. describe basic techniques of culturing and isolation of micro-organisms; and
3. describe identification and counting of bacteria and parasites.

Course Contents
Historical development of microbiology and the effects on health. Morphology of bacteria and fungi. Nutritional needs of microorganisms. Cultivation and isolation methods for microorganisms.

Diagnostic techniques in relation to culture determination. Bacteria growth in culture and respective phases including death. Formation of colonies. Metabolism in microbial systems. Introductory Genetics. Introductory Parasitology.
Practicals: Relevant experiments to demonstrate cultivation, isolation, identification and counting of microorganisms.

300 Level

GST 312 – Peace and Conflict Resolution (2 Units C: LH 30)

At the end of the course, students should be able to:
1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe roles of international organisations, media and traditional institutions in peace building.

Course Contents

Concepts of Peace, Conflict and Security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political conflicts. Structural conflict theory, realist theory of conflict, frustration-aggression conflict theory. Root causes of conflict and violence in Africa: Indigene and settlers phenomenon, boundaries/border disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations. Selected conflict case studies – Tiv-Junkun, Zangon Kataf, chieftaincy and land disputes. Peace building, management of conflicts and security. Peace and human development. Approaches to peace & conflict management (religious, government and community leaders). Elements of peace studies and conflict resolution. Conflict dynamics assessment Scales: Constructive &destructive. Justice and legal framework: Concepts of social justice; the Nigeria legal system. Insurgency and terrorism. Peace mediation and peace-keeping. Peace & security council (International, national and local levels). Agents of conflict resolution – Conventions, treaties community policing: Evolution and Imperatives. Alternative dispute resolution, ADR. a) dialogue b). arbitration, c). negotiation d). collaboration. Roles of international organisations in conflict resolution. (a). The United Nations (UN) and its conflict resolution organs. (b). The African Union and Peace Security Council (c). ECOWAS in peace-keeping. Media and traditional institutions in peace building. Managing post-conflict situations/crisis: Refugees. Internally Displaced Persons, IDPs. The role of NGOs in post-conflict situations/crisis.

ENT 312 Venture Creation (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students, through case studies and practical approaches, should be able to:
1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. state how original products, ideas, and concepts are developed;
4. develop business concepts for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;

6. implement the requirements for establishing and managing micro and small enterprises;
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. understand why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity identification (Sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, micro finance, personal savings, small business investment organisations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, e-commerce business models and successful e-commerce companies). Small business management/family business: Leadership &management, basic book-keeping, nature of family business and family business growth model. Negotiation and business communication (strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (Business idea generation presentations, Business idea contest, brainstorming sessions, idea pitching). Technological solutions (the concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies - Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoTs), Blockchain, cloud computing, renewable energy and many others. Digital business and e-commerce strategies).

PAA 399: Students Industrial Work Experience (SIWES) (3 Units C: PH 12 weeks)

Learning Outcomes

At the end of the course, students should be able to:

1. prepare to handle industrial work they will likely meet after graduation;
2. learn methods and techniques in handling equipment and machinery that may not be available in their institutions; and
3. transit from school to workplace easily.

Course Contents

This is a supervised work-experience. During the programme, students are attached to pharmaceutical establishments, including drug manufacturing units, hospital pharmacies, community pharmacies and many others. Each student keeps a record of his/her training and experience during the programme in a logbook and is visited for supervisory purposes by an academic staff member from the Faculty. In addition, an experienced pharmacist located in the pharmaceutical establishment to which the student is attached provides day-to-day supervision.

CLI 301 Clinical Pharmacy I (2 Units C: LH 30)

Learning outcomes

At the end of the course, students should be able to:

1. describe the concept of clinical pharmacy;
2. appraise self-care and safe use of medication; and

3. describe patient assessment and management of common medical conditions in the community.

Course Contents
Introduction to clinical pharmacy. General medical terms and abbreviations. Definition of self-care and self-medication. Role of the pharmacist in ensuring safe and rational use of medicines. Patient assessment and how to manage selected common medical conditions within the community such as acne and other skin conditions. Others include eye conditions; vaginal infections; pain, diarrhoea and constipation, nausea and vomiting, anaphylaxis and drug allergies.

PAT 301: Pathology (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the aetiology, pathology and clinical manifestations of the diseases studied.

Course Contents
Principles of disease and pathology. The normal cell and the adopted cell. Diseases of immunity. Systemic diseases - diabetes mellitus, iron storage disorders, gout, and urate deposits in the kidneys. Fluid and haemodynamic derangements. Infectious diseases. Deficiency diseases - protein-calorie malnutrition, vitamins and minerals deficiency. Blood vessels and the heart, lymph nodes and spleen.

PCG 301: Separation Techniques in Pharmacognosy (2 Units C: LH 15; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the principles and applications of separation techniques;
2. understand paper, thin layer, column, gel and liquid chromatographies; and
3. conduct relevant experiments.

Course Contents
Separation techniques: Extraction, principles & application of non-chromatographic separations in Pharmacy such as sedimentation, fractional liberation, crystallization, acid-base shake outs, etc. Principles and application of chromatography in Pharmacy. Principles of adsorption and partition. Factors affecting resolution of solutes. Paper, thin layer, gel filtrations and high-performance liquid chromatography. Quantitative and qualitative chromatography.
Practicals: Conduct relevant experiments pertaining to separation techniques.

PCG 302: Drugs of Biological Origin (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe chemical classes, nature of plants constituents and their applications in surgical dressings, as herbal remedies.

Course Contents
Introduction to medicinal plant constituents and drugs from natural sources. Concept of secondary metabolism. Importance of secondary metabolites as drugs. Major drugs of biological origin (alkaloids, carbohydrates, fats and oils, amino acids, proteins, vitamins, minerals and many others). Fibres and surgical dressings. Cultivation of medicinal plants. Collection and preparation of crude drugs. Evaluation of crude drugs.
Practicals: Conduct relevant experiments pertaining to cultivation, collection, preparation and evaluation of crude drugs. Identification of fibres and surgical dressings.

PCH 301: Physical Pharmaceutical Chemistry II (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. explain production of radioisotopes, hazards and biological effects of radiation;
2. describe rate processes and basic methods of pharmaceutical analysis; and
3. perform relevant practicals.

Course Contents
Radio-pharmacy. Production of radioisotopes. Detection, measurement, hazards and biological effects of radiation. Applications and quality control of physicochemical properties of drugs. Rate processes and reaction kinetics. Introduction to physical and physicochemical methods of pharmaceutical analysis. Basic methods of analysis. Limit tests.
Practicals: Conduct relevant experiments pertaining to physical and physicochemical methods of pharmaceutical analysis. Limit tests.

PCH 302: Organic Pharmaceutical Chemistry II (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. Synthesize and relate functional groups of compounds to physical and chemical properties and the application of these groups in Pharmacy;
2. Write the structure and discuss the chemistry of heterocyclic compounds especially those found in drugs and pharmaceuticals; and
3. Perform relevant practicals.

Course Contents
Fundamental concepts in organic chemistry. Concepts of functional group and nomenclature of organic compounds. General review of organic reactions and inter-conversion of functional groups. Synthetic methods in medicinal chemistry. Functional group reactions and applications to synthesis of organic compounds with examples from biologically active compounds. Chemistry of heterocyclic compounds.
Practicals: Conduct relevant experiments pertaining to synthetic methods in organic and medicinal chemistry.

PCT 301: Drug Dosage Forms (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:

1. describe dosage forms and their properties;
2. appraise factors affecting dosage form design; and
3. discuss properties of emulsions.

Course Contents
Introduction to dosage forms. Definition and presentation of single dosage forms. Factors affecting dosage form design. Detailed consideration of selected dosage forms. Aromatic waters and mucilages. Solutions and syrups. Suspensions, mixtures, lotions. Emulsions. Viscosity and other physical properties of emulsions. Emulsifying agents. Divided and bulk powders.

PCT 302: Physical Pharmaceutics I (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe technologies behind preparation of simple mixtures, suspensions, emulsions, creams and ointments;
2. describe tableting technologies; and
3. describe different types of pharmaceutical disperse systems and tablets.

Course Contents
Dispersed Systems - surface chemistry of dispersed systems. Stability of dispersed systems. Emulsions and emulsifying agents. Creams and ointments. Rheology. Tableting technology fundamentals. Formulation of tablets. Standardisation, control, and production of tablets.

PCT 303: Dispensing Practical III (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. prepare mixtures, suspensions and different types of pharmaceutical powders; and
2. carry out measurements using aliquot methods.

Course Contents
Preparation of liquid dosage forms, mixtures, suspensions, compounding, and dispensing of drugs, extemporaneous and bulk preparation of mixtures of liquids and solid drug ingredients. Prescription reading.

PCT 304: Dispensing Practical IV (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. prepare emulsions, semi-solid dosage forms, suppositories and dispense these preparations to Out-patients and In-patients; and
2. read prescriptions, compound and dispense drugs.

Course Contents
Emulsions, lotions, liniments, semi-solid dosage forms, suppositories, pastes. Prescription reading, compounding, and dispensing of drugs.

PHA 301: Introductory Pharmacology (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the basic principles and concepts in pharmacology;
2. explain neurophysiological mechanisms in drug action;
3. determine the effects and fate of drugs in the body; and
4. describe stages of clinical trials.

Course Contents
General pharmacology. Passage of drugs across cell membrane. Routes of drug administration. ADME - Absorption, Distribution, Metabolism/Biotransformation and Excretion of drugs. Dose-response relationships. Bioassays and screening of drugs. Clinical trials. Pharmacodynamics – mechanisms of drug action. Adverse drug reactions.

PHA 302: Pharmacology of the Autonomic Nervous System
(3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. identify the mechanisms of actions of drugs on the ANS;
2. describe the synthesis, release and degradation of acetylcholine, the structure – activity relationship for cholinergic agonists and antagonists;
3. describe mechanism of action, pharmacological actions, indications and adverse effects of cholinergic agonists and antagonists;
4. describe synthesis, release, uptake and metabolism of noradrenaline;
5. classify different adrenergic receptors and identify their locations; and
6. explain the mechanism of action, pharmacological actions, indications and adverse effects of adrenergic agonists and antagonists.

Course Contents
Basic anatomy and physiology of the autonomic nervous system. Criteria for neurotransmitter status. Cholinergic transmission. Acetylcholine synthesis, release and metabolism. Acetylcholine-like drugs. Structure-activity-relationship for cholinergic agonists and antagonists. Cholinesterases, anticholinesterases and mechanism of action. Adrenergic transmission. Mechanism of synthesis, storage, release, uptake and metabolism of noradrenaline. Structure-activity-relationship for adrenergic agonists and antagonists. Pharmacodynamic basis of sub-classification of adrenergic receptors. Pharmacological properties of adrenaline, noradrenaline and isoprenaline. Alpha and beta adrenoceptor blockers and sympathomimetics amines. Outline of other non-adrenergic, non-cholinergic central and peripheral neurotransmitters: their actions and their antagonism.
Practicals: Conduct relevant experiments pertaining to cholinergic and adrenergic drugs.

PHA 304: Pharmacology of the Haemopoietic System and Gastrointestinal Tract (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:
1. describe drugs used to manage blood and blood cells disorders; and
2. describe drugs used to manage gastrointestinal tract disorders.

Course Contents

Drugs acting on the haematopoetic system-anticoagulants, fibrinolytics, antiplatelets. Drugs used in anaemias (iron deficiency, megaloblastic, sickle cell), haematinics, and vitamins. Drugs acting on the gastrointestinal tract -drugs used in treatment of peptic ulcers, antacids. Laxatives and purgatives, anti-diarrhoeal agents.

PHM 301: Applied Pharmaceutical Microbiology I (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, students should be able to:
1. Explain factors affecting microbial death;
2. Describe production and storage of water;
3. Identify sources of microbial contamination of pharmaceuticals; and
4. Perform relevant experiments.

Course Contents

Factors affecting microbial death. Sterilisation (description; methods such as moist heat, dry heat, ionisation and non-ionisation radiations, applications). Asepsis (techniques and processes). Sterility tests. Water as a vehicle (production, storage and quality determination). Parenteral products. Pyrogens and pyrogen testing. Evaluation of microbial contents of pharmaceutical preparations and products. Microbial spoilage. Sources of microbial contamination of pharmaceuticals. Evaluation of microbial quality of pharmaceutical products.
Practicals: Selected exercises for practicals pertaining to sterilization, pyrogens and pyrogen testing, evaluation of microbial contents of pharmaceutical preparations and products. Determination of water quality.

PSM 301: Biostatistics (1 Unit C: LH 15)

Learning Outcomes

At the end of the course, students should be able to:
1. identify the role of statistics in biological systems; and
2. outline the processes involved in sampling and health survey techniques.

Course Contents

Introduction to the role of statistics in human biology and medicine. Frequency distribution. Principles and methods of sampling. Measurement of health. Health survey techniques.

SAP 301: Pharmacoeconomics (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. compare values of pharmaceuticals and drug therapies;
2. evaluate cost and effects of pharmaceutical products; and
3. appraise Health Management Organisations (HMOS) and National Health Insurance Scheme (NHIS).

Course Contents
Definitions. Overview of basic economics. Pharmacoeconomic techniques i.e. cost minimisation, cost effectiveness, cost utility, cost benefits. Pharmacoeconomic methods (objectives, study design, comparison of alternatives and cost assessment). Pharmaceutical outcomes. Health Maintenance Organisations (HMOs). National Health Insurance Scheme (NHIS).

400 Level

PAA 499: Students Industrial Work Experience (SIWES) (3 Units C: PH 12 weeks)

Learning Outcomes
At the end of the course, students should be able to:
1. prepare to handle industrial work they will likely meet after graduation;
2. familiarise themselves with methods and techniques in handling equipment and machinery that may not be available in their institutions; and
3. transit from school to workplace easily.

Course Contents
This is a supervised work-experience. During the programme, students are attached to pharmaceutical establishments, including drug manufacturing units, hospital pharmacies, community pharmacies and many others. Each student keeps a record of his/her training and experience during the programme in a log book and is visited for supervisory purposes by an academic staff member from the Faculty. In addition, an experienced pharmacist located in the pharmaceutical establishment to which the student is attached provides day-to-day supervision.

BTG 401: Biotechnology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. appraise basic techniques in biotechnology;
2. describe clinical importance of recombinant proteins; and
3. appraise importance of biotechnology in vaccine development.

Course Contents
Basic techniques in biotechnology – cutting and joining of DNA molecules, cloning techniques and gene manipulation. Plant biotechnology. Polymerase Chain Reaction (PCR). Clinical importance of recombinant proteins. Gene therapy. Biotechnology in vaccines development. Identification of potential biotechnological products. Plants and transgenic animals as potential sources of recombinant biotechnological products.

Practicals: Conduct relevant practicals pertaining to basic techniques in Biotechnology.

CLI 401: Clinical Pharmacy II (3 Units C: LH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the fate of drug after administration;
2. discuss pharmacokinetics and the associate parameters; and
3. apply knowledge of pathophysiology to develop skills in planning rational therapeutic and non-drug therapy management of selected diseases.

Course Contents
Biopharmaceutics - Fate of drug after administration. Physicochemical properties and pharmaceutical (formulation) factors affecting the processes of absorption, distribution, metabolism and excretion of drugs. Routes of drug administration and influence of route of administration on drug bioavailability. Drug-protein binding. Enzymology and enzyme kinetics. Drug-receptor and bioenergetics. Consideration of the processes of drug disposition.
Pharmacokinetics - Definition of terminology and symbols used in pharmacokinetics. Compartment models - single and multiple compartmental models. Bioavailability and bioequivalence. Drug clearance - hepatic elimination of drugs. Non-linear pharmacokinetics. Relationship between pharmacokinetic parameters and pharmacologic response. Pharmacogenetics
Pharmacotherapeutics- Epidemiology, pathophysiology, diagnosis, and treatment modalities (including goals, drug and non-drug treatment options, and medication options) of each disease, using standard indicators/prescribing guidelines as approaches to developing rational drug therapy. Actions, uses, adverse events, precautions/contraindications, drug-interactions. Monitoring drug therapy and patient education for each class of drugs for each disease. Case studies in rational use of drugs. Diseases affecting the following systems: Cardiovascular and renal systems, GIT/nutrition, infectious diseases and the respiratory system.

CLI 402: Clinical Pharmacy Externship (2 Units C: PH 90)

Learning Outcomes
At the end of the course, students should be able to:
1. familiarise themselves with patient/pharmacist interaction;
2. understand physician /pharmacist interaction; and
3. acquire professional communication skills as regards accurate drug therapy.

Course Contents
Externship in clinical practice – posting of students to reputable pharmaceutical establishments, especially community and hospital pharmacies, familiarising with patient/pharmacist and physician/pharmacist interactions. Developing professional communication skills, as regards accurate drug therapy and pharmaceutical care concept. Review of simple cases of drug prescriptions in the pharmacy, with a view to detecting and correcting (if any) prescription errors.

ICT 401: Information Communication Technology in Pharmacy II
(2 Units C: LH 15; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. determine the statistical analysis to be applied to a set of data; and
2. apply ICT in all areas of pharmacy practice, such as drug manufacturing, hospital and community pharmacies.

Course Contents
Word processing. Statistical analysis, regression analysis, analysis tool pack such as WIN NONLIN. Social sciences statistics package like SPSS. Database skills. Internet skills. Internet concepts, intranet and extranet. Application of ICT in drug manufacturing. Electronic records management systems. Application of ICT in hospital & community pharmacy. Drug information services.
Practicals: Have a hands-on experience on word processing, statistical analysis, regression analysis and other analysis using the relevant tool packs.

PCG 401: Phytochemistry and Biosynthesis of Natural Products (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. outline the phytochemistry and biosynthesis of drugs of natural origin; and
2. describe therapeutic importance of secondary metabolites.

Course Contents
Significance of study of biogenetic pathways. Unit transformation in biogenesis. Sources of energy and enzymes. Evolutionary relationships. Introduction to the natural origin of the isoprene unit and pathways, leading to the production of terpenoids. Interrelationship of various terpenoids. The shikimic-acid pathway and selected pathways leading to the formation of natural aromatic drugs. Therapeutic importance of secondary metabolites.

PCG 402: Medicinal Plants/Traditional Medicine (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. list some of the Nigerian medicinal plants and items used in traditional medicine; and
2. discuss and proffer solutions to the problems associated with medicinal and non-medicinal plants use and abuse.

Course Contents
Introduction to traditional medicine. Definitions. Incantations. Medicinal plants, herbalist, and traditional medical practitioner. Advantages and limitations of traditional medicine. Traditional medicine as a source of new drugs and new treatment methods. Role of traditional healing methods in healthcare delivery in Africa. Integration or co-recognition of traditional and modern medicine. Medicinal plants of local importance. Identification of poisonous plants and toxic principles. Mechanism of action. Plants and plant products under legal control.
Practicals: Conduct relevant experiments in selected areas of theory such as identification of Nigerian medicinal plants and other natural sources of new drugs.

PCH 401: Pharmaceutical Analysis I (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. apply the principles of spectroscopic, chromatographic and other analytical techniques to the assay and identification of drugs and other pharmaceuticals.

Course Contents
Drug quality control/assurance systems. Monographs and specifications for drugs and drug products. Applications of chemical, biopharmaceutical and physicochemical analytical methods in purity determinations, identification and quantification of pharmaceuticals. Applications of Ultraviolet/visible (UV/Visible) spectrophotometry, Fourier Transform Infra-Red (FTIR) spectroscopy, fluorimetry, Atomic Absorption Spectroscopy (AAS), NMR, Mass Spectrometry (MS), Gas Chromatography (GC), Liquid Chromatography (HPLC, TLC-densitometry, electrophoresis; other methods, potentiometry, polarimetry. Radiopharmaceuticals as medicinal products. Basic tests for essential drugs.
Practicals: Conduct relevant practicals in identification and quantification of pharmaceuticals using different assay methods.

PCH 402: Medicinal Chemistry I (3 Units C: LH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe physical approaches in drug design;
2. explain concepts of isosterism; and
3. describe usefulness of enzymes in biotransformation.

Course Contents
Drug design. Physicochemical approaches to drug design. Historical, Free-Wilson and Hansch approaches. The concept of isosterism. Bio-isosterism as a tool in drug design. Structure-Activity Relationship in drug design. Antimetabolite and pro-drug approach to design of new drugs. Drug metabolism. Enzymes in biotransformation.

PCT 401: Pharmaceutical Technology (3 Units C: LH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe types and properties of capsules;
2. describe types and properties of tablets;
3. enumerate the excipients used in formulation and compression of tablets;
4. identify problems associated with compression processes; and
5. outline the steps involved in large scale production and the machinery used.

Course Contents
Capsules- types and properties, preparation of capsules. Tableting technology – definition, types and properties of tablets. Preparation of tablets. Formulation of excipients, granulation and compression process. Problems of processing. Quality evaluation. Large scale production and machinery.

PCT 402: Physical Pharmaceutics II (3 Units C: LH 45)

Learning Outcomes
At the end the course, students should be able to:
1. explain the fundamental principles and factors involved in the formulation of dispersed systems, including suspensions and gels; and
2. discuss the choice and influence of solvents on the activity of components.

Course Contents
Dispersed system – properties of materials used in formulation of dispersed systems (polymers, surfactants and other adjuncts). Suspensions: coarse dispersions, pharmaceutical dispersions, flocculation, deflocculation, salting out. Formulation and pharmaceutical applications of suspensions. Gels. Pharmaceutical solutions. Measurement of solubility. Choice and influence of solvents on the activity of components. Precipitation, salts of drugs, toxicity and adjustments of toxicity in injectables.

PCT 403: Industrial Pharmacy (3 Units C: PH 135)

Learning Outcomes
At the end of the course, students should be able to:
1. give detailed discussion on drug formulations- tablet and capsule formulations;
2. list additives used in formulations;
3. discuss controlled drug delivery system and instrumentation of tablet press and its usefulness;
4. formulate tablets and capsules; and
5. conduct in-vitro bio-equivalence and stability studies.

Course Contents
Tableting. Capsule production. Drug formulation. Selection of additives. Pre-formulation studies. Controlled drug delivery system. Instrumented tablet press. Drug stability. Dissolution and absorption. In-vitro, in-vivo correlation. Biopharmaceutical consideration in dosage form design. Parenteral products. Packaging science.

PHA 401: Pharmacology of Cardiovascular System (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe drugs used in cardiovascular disorders and their therapeutic applications; and
2. describe drugs acting on the kidney and their uses.

Course Contents
Drugs acting on the heart and blood vessels, including cardiac glycosides, anti-arrhythmic drugs and antihypertensive drugs, anti-hypotensives, coronary vasodilators, anti-lipidemics. Drugs acting on the kidney, including diuretics, antidiuretics, hormones and aldosterone.
Practicals: Conduct relevant practicals using drugs acting on the cardiovascular and renal systems.

PHA 402: Pharmacology of Central Nervous System (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. discuss narcotic analgesics, including drugs of abuse and dependence;
2. describe non-narcotic analgesics, sedatives and hypnotics; and
3. describe anti-convulsants, anti-psychotics, CNS stimulants and anaesthetics.

Course Contents
Narcotic analgesics, including drugs of abuse and drug dependence. Non-Narcotic: non-steroidal anti-inflammatory drugs, antipyretic and analgesic drugs. Sedative-hypnotics. Anticonvulsants. Central nervous system stimulants. Local anaesthetics and general anaesthetics.

PHM 401: Applied Pharmaceutical Microbiology II (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe types of antimicrobial agents and their different uses;
2. explain the evaluation of antimicrobial activities and antibiotic assays;
3. explain the correlation between bacterial genetics and drug resistance; and
4. conduct experiments relevant to this course.

Course Contents
Antimicrobial agents as preservatives, antibiotics, disinfectants, antiseptics, and chemotherapeutic agents. The evaluation of antimicrobial activities and antibiotic assays. Industrial uses of microorganisms. Media and fermenters. Bacterial genetics and drug resistance. Practicals: Conduct relevant practicals on the evaluation of antimicrobial activities and antibiotic assays.

SAP 401: Pharmacy Management I (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. explain the layout and design of a model pharmacy (community and hospital); and
2. explain fundamentals of marketing drugs in the community.

Course Contents
Principles and methods of marketing. Fundamentals of marketing drugs in community. Layout, design and modernisation of pharmacies. Fundamentals of accounting – specially adapted to pharmaceutical operations. Principles of organisation. Organisation control and management principles. Patterns and methods of drug distribution. Advertising, pharmacy finance and administration. Record systems. Human and material resources management.

SAP 402: Forensic Pharmacy and Pharmacy Ethics (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. discuss the history of Pharmacy;
2. outline the various arms of the pharmacy profession and know the role of the pharmacist in each of these practice sectors, with the attendant legal and ethical codes guiding the practice of Pharmacy in Nigeria and globally; and
3. recall the laws and ethics guiding the practice of Pharmacy with respect to the profession, pharmacists and patients.

Course Contents
Study of various laws and regulations governing the practice of Pharmacy, sale of drugs and pharmaceuticals. Pharmacy laws, public law and civil codes. Relevant case histories. History of Pharmacy and the Pharmacists Council Act. Professional Ethics.

500 Level

PAA 501: Veterinary Pharmacy (3 Units C: LH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. appraise veterinary pharmacy laws;
2. describe common diseases in selected animals; and
3. manage common diseases in selected animals.

Course Contents
Common diseases in animals (ruminants, pigs, horses, dogs, cats, poultry & fish). Legislation on animal health products. Veterinary Compendia. Routes of drug administration and dosage forms in veterinary practice. Essentials of veterinary pharmacology. Marketing of animal healthcare products.

PAA 502: Project (6 Units C: PH 270)
Each student at the level of final year (fourth professional year) to carry out independently a project encompassing a written research dissertation as well as a specific amount of laboratory or field work in some fields under a capable academic supervisor. The period spent on such projects will have to be carefully guided. Seminars and oral defence.

CLI 501: Clinical Pharmacy III (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. relate specific dosage prescribing requirements to the paediatric and geriatric populations;
2. appraise the pharmacokinetics in disease states; and
3. appraise prescription for renal and liver impaired patients, pregnant and lactating mothers.

Course Contents
Specific dosage prescribing requirements/guidelines under certain conditions. Prescribing for the paediatric and elderly populations. Prescribing for renal and liver impaired patients and prescribing for pregnant and lactating mothers. Pharmacokinetics in disease states modifying body perfusion. Pharmacotherapeutics: The epidemiology, pathophysiology, diagnosis, and treatment modalities (including goals, drug and non-drug treatment options, and medications options) of each disease, using standard indicators/prescribing guidelines as approaches to developing rational drug therapy. Actions, uses, adverse events, precautions/contraindications, drug-interactions, monitoring drug therapy and patient education for each class of drugs for each disease will be discussed. Case studies will be used for better understanding of rational drug use of drugs. Selected disease states affecting the following systems will be considered: haematology, oncology, endocrine, reproductive, musculoskeletal and neuropsychiatry systems.

CLI 502: Literature Evaluation and Communication Skills (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. rapidly retrieve, evaluate and effectively disseminate information on drug therapy;
2. communicate effectively with other healthcare professionals and the patient; and
3. plan a protocol for conducting research using health informatics.

Course Contents
Drug information centre. Drug information retrieval and literature evaluation. Health informatics. Pharmacist's clinical role – dispensing, administration of medications, monitoring of adverse drug effects. Communication skills (verbal and non-verbal).

CLI 503: Public Health Pharmacy (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. clearly outline the roles of pharmacist in public health; and
2. determine the roles of the pharmacist as a member of the healthcare delivery team in prevention and control of diseases in the community.

Course Contents
Overview of epidemiological methods. Concept of Primary Health Care (PHC). Drug use and management in PHC. Drug use in infertility and family planning management. Role of pharmaceutical care in promoting public health. Maternal and Child health. Nutrition and health, measurement of BMI. Preventive health-care and immunisation.

CLI 504: Clinical Pharmacy Clerkship II (2 Units C: PH 90)

Learning Outcomes
At the end of the clerkship, students should be able to:
1. evaluate a prescription for completeness, eliminating therapeutic duplication, drug interactions, adverse drug reactions and contraindicated therapy;
2. dispense medicines and counsel patients;
3. take medication histories to monitor patients' compliance;

4. keep medication profiles and report drug-drug and drug-food interactions, and adverse reactions;
5. review patient's medications and identify drug therapy problems;
6. interpret laboratory results to monitor patient's therapy; and
7. provide healthcare professionals with drug information.

Course Contents
Involves ward rotations, conferences and case studies in an affiliated University Teaching Hospital and community health sector. Experiences in hospital wards under supervision: ward rotation in the different departments. On-site preceptors serve as supervisors together with clinical instructors from the Faculty. Dispensing to In-patients and Out-patients. Scrutinising of prescriptions and dispensing. Patient counselling/education. Hospital or community pharmacy environment. Drug Information Centre/Services.

Student's experience will include:
1. participation in the medical and clinical pharmacist teams to observe patients and review their therapeutic progress;
2. assignments to monitor selected In-patients' medication, charts and profiles;
3. assignments to participate in education/counselling of patients about the rational use of their medication after discharge; and
4. assignments to monitor selected patients for development of signs of possible adverse drug reactions, side effects and therapeutic failures.

NOTE: During the clinical clerkship, students are expected to:
5. be able to discuss the drug therapeutic regimens, such as available options, suitable alternatives, dosage modifications with age and disease states and many others; and
6. be able to make brief presentations to supervisors and fellow students on the above experiences. Explain the rationale for chosen drug therapies and suggestions for the alternatives. Participate in primary health care activities in selected communities.

CLI 505: Clinical Pharmacy Clerkship I (2 Units C: PH 90)

Learning Outcomes
At the end of the clerkship, the students should be able to:
1. evaluate a prescription for completeness, eliminating therapeutic duplication, drug interactions, adverse drug reactions and contraindicated therapy;
2. dispense medicines and counsel patients;
3. take medication histories to monitor patients' compliance;
4. keep medication profiles and report drug-drug and drug-food interactions, and adverse reactions;
5. review patient's medications and identify drug therapy problems;
6. interpret laboratory results to monitor patient's therapy; and
7. provide healthcare professionals with drug information.

Course Contents
Involves ward rotations, conferences and case studies in an affiliated University Teaching Hospital and community health sector. Experiences in hospital wards under supervision: ward rotation in the different departments. On-site preceptors serve as supervisors together with clinical

instructors from the Faculty. Dispensing to In-patients and Out-patients. Scrutinising of prescriptions and dispensing. Patient counselling/education. Hospital or community pharmacy environment. Drug Information Centre/Services.

Student's experience will include:

1. participation in the medical and clinical pharmacist teams to observe patients and review their therapeutic progress;
2. assignments to monitor selected In-patients' medication, charts and profiles;
3. assignments to participate in education/counselling of patients about the rational use of their medication after discharge; and
4. assignments to monitor selected patients for development of signs of possible adverse drug reactions, side effects and therapeutic failures.

NOTE: During the clinical clerkship, students are expected to:

1. be able to discuss the drug therapeutic regimens, such as available options, suitable alternatives, dosage modifications with age and disease states; and
2. be able to make brief presentations to supervisors and fellow students on the above experiences. Explain the rationale for chosen drug therapies and suggestions for the alternatives. Participate in primary healthcare activities in selected communities.

PCG 501: Evaluation of Phyto-pharmaceuticals (1 Unit C: LH 15)

Learning Outcomes

At the end of the course, students should be able to:

1. identify plant-derived or natural herbicides, pesticides and molluscicides in higher plants as well as in proprietary products;
2. differentiate the mechanism of action of natural herbicides, pesticides and molluscicides;
3. evaluate surgical dressings, commercial dressings and fibres; and
4. discuss plant-derived veterinary products used in management/treatment of animal diseases.

Course Contents

Study of higher plants used traditionally in Nigeria as herbicides, pesticides as well as molluscicide, emphasising plants that may be cited in tropical diseases research (TDR) compendia. Preparation of monographs of selected Nigerian medicinal plants for potential inclusion in Nigerian Herbal Pharmacopoeia. Bioassay techniques of plant extracts to determine their pharmacological and toxicological effects. Evaluation of surgical dressings, Commercial dressing fibres – Vegetable (cotton, flax, hemp, jute); Animal (wool and milk); Minerals (asbestos, glass); Synthetic (nylon, terylene). Fibres generated from carbohydrate and protein substances. Determination of approximate analysis for nutraceuticals of higher plants

PCG 502: Clinical Pharmacognosy: Traditional Medicine Practice (TMP) (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. describe the concept of clinical pharmacognosy;
2. appraise the various traditional healthcare practices in Nigeria in comparison to the rest of Africa and other regions of the world (such as India, China, Asia and the Americas);
3. appreciate the increasing popularity of various healing methods with regards to safety and efficacy issues;
4. describe biodiversity and sustainability of the ecosystem; and
5. experience traditional healthcare practices in Nigeria through scheduled visits to herbal and bone setting clinics/homes.

Course Contents

Concept of clinical pharmacognosy. Clinical application of herbs and natural products as well as pharmaceutical raw materials of biological origin. Contributions of plants and plant products in the management/treatment of diseases with emphasis on some diseases (such as anti-cancer, antimalaria, anti-trypanosomiasis and many others. Formulations/preparations used in traditional medicine practice (TMP). Sanitation and Hygiene in TMP. Documentation of TMP (treatment design, treatment protocol, written prescriptions, estimated doses, route of administration, frequency of administration, duration of treatment, and outcome of treatment). Recognised herbal–drug interactions, herbal-herbal and herbal-food interactions in patients' care.

Practicals: Carry out scheduled and supervised visits to selected herbal and bone setting clinics/homes to acquire evidence-based practice in the use of natural and complementary and alternative medicines (CAM) health products.

PCH 501: Pharmaceutical Analysis II and Drug Quality Assurance (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. explain drug quality assurance systems, monographs and specifications of drugs and medicinal products; and
2. discuss various analytical methods in purity determination, qualitative and quantification.

Course Contents

Definitions. Drug quality assurance systems. Monographs and specifications of drugs and medicinal products. The pharmacopoeias. Microbiological evaluations and assays of various preparations and antimicrobial agents. Biological tests for drugs and medicines. Review of principles and applications of various analytical methods in purity determination, identification and quantification.

Practicals: Conduct relevant experiments pertaining to analytical methods, impurity determination, identification and quantification.

PCH 502: Medicinal Chemistry II (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1 appreciate the chemistry of the listed classes of drugs to their physicochemical properties, structural features, stability, structure activity relationships; and
2. describe the synthesis, stereochemistry, assay, modes of action and uses of the selected drugs.

Course Contents
The chemistry, nomenclature, physicochemical properties, stereochemistry, synthesis (where necessary), structure-activity relationship, metabolism and uses of the following groups: antihypertensives, diuretics, steroids and steroid hormones. Chemotherapeutic agents - sulphonamides, antimalarials, antibiotics, anthelmintics; trypanocides, schistosomicides, ameobicides, anticancer and antiviral agents. Photochemistry.

PCH 503: Principles of Drug Design (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe procedures in drug design;
2. design drugs, using bioinformatic principles;
3. appreciate the role of molecular modification in drug design; and
4. describe correlation between chemical structure and bioactivity.

Course Contents
Introduction to drug design. Procedures for search for 'leads'. Sources of leads (natural products - plants, animals, micro-organisms, serendipity, side effects of existing drugs, drug metabolites, screening of natural and synthetic banks of compounds for activity, analogue design – molecular modification of existing drugs, rational drug design including computer-aided drug design, computerised search of structural databases: virtual screening). Molecular modification and correlation of chemical structure and bioactivity. Qualitative structure-activity relationships (QSAR) and drug design. Bioinformatics.

PCT 501: Formulation Processes and Process Validation (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. explain the importance of particle size analysis in formulation processes;
2. discuss nanotechnology;
3. describe the technological aspects of GMP in the production of good quality tablets and capsules; and
4. perform relevant experiments.

Course Contents
Micrometrics -The science of small particles. Particle size distribution. Methods of measuring particle size. Importance of particle size in formulation of dosage forms. Nanotechnology – liposomal drug delivery. Detailed consideration of specific dosage forms: Aerosols, microcapsules,

film coated drugs. Multiple emulsions in drug delivery preparations. Topical preparations. Large scale drug production. Good Manufacturing Practices (GMP) guidelines. Planning a pharmaceutical industry.
Practicals: Conduct relevant experiments pertaining to particle size analysis and industrial visit.

PCT 502: Production and Quality Control of Cosmetics (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the skin, its functions and percutaneous absorption;
2. appraise the use and safety of cosmetic products;
3. explain skin bleaching/lightening effects and processes; and
4. identify raw materials, production processes, and quality control methods of cosmetic products.

Course Contents
Skin and percutaneous absorption. Uses and safety of selected cosmetic products, such as deodorants/antiperspirants, lipsticks, artificial nails and hair products, creams, face powder, mascara and eyelashes. Skin bleaching/lightening agents and processes, and their effects on health. Equipment. Raw materials. Standard formulation/composition. Production. Quality Control and evaluation of selected products.

PHA 501: Chemotherapy (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the basis for use of antimicrobial agents in the management of infections, mechanisms of action;
2. describe the consequences of abuse and misuse of chemotherapeutic drugs;
3. appraise the emergence of microbial drug resistance; and
4. discuss biostatistical calculations of LD_{50}, $ED_{50,}$ student t-test, toxicology.

Course Content
Chemotherapy of bacterial, parasitic, fungal and viral infections. Chemotherapy of neoplastic diseases. Biochemical pharmacology. Biostatistics - statistical calculations of LD_{50}, ED_{50}, student t-test. Toxicology.

PHM 501: Applied Pharmaceutical Microbiology III (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. explain immunology, immunological products, blood and blood products; and
2. discuss allergy, allergic reactions and veterinary parasites.

Course Contents
Infection: host/parasite relationship, transmission of infection, pathogenesis, virulence, aggressiveness of infectiousness, Koch's and Rivers postulate. Immunity: natural and acquired, antigen (AG) and antibodies (AB), their properties, types of AG-AB reactions. Theories of AB production, hypersensitivity and allergy. Immunology and blood products: production and quality

control. Types of bacterial and viral vaccines. Immunosera. Diagnostic reagents such as Schick Dick and tuberculin testing reagents. Blood and blood products: allergy and allergic reactions. Veterinary parasites and control system.

SAP 502: Pharmaceutical Marketing (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, students should be able to:
1. discuss medico-marketing; and
2. explain marketing of prescription and non-prescription drugs.

Course Contents
Pharmaceutical marketing/medico-marketing. Pharmaceutical representatives, new pharma codes, guidelines to pharmaceutical marketing, marketing of prescription and non-prescription drugs, marketing to healthcare providers (gifting, detailing, drug samples and sponsorship of pharmacy/medical programmes), visits to hospitals, doctors' offices, hospital pharmacists, community pharmacists; handling of advertisements and free samples.

Minimum Academic Standards

Equipment

Laboratory and Equipment Requirements for B.Pharm. Degree Programmes

Presented below are requirements for a centralised laboratory and facilities for the following subject areas:
1. Pharmaceutical Chemistry
2. Pharmacology including Animal House
3. Pharmaceutics including Dispensing Laboratory
4. Pharmaceutical Microbiology
5. Pharmacognosy including Medicinal Plant Garden
6. Drug Information Unit
7. Information & Communication Technology
8. Pharmaceutical Technology including Pilot Drug Production
9. Herbarium
10. Clinical Pharmacy
11. Model Community Pharmacy

Centralised Facilities

Computer Laboratory
Students of Pharmacy are to be exposed to computing in all its facets so that they can utilise the expertise in the practical and analytical aspects of their training. The computer laboratory should be adequately equipped to ensure reasonable contact hours by students. Students are to have first-hand experience in the use of pharmaceutical software for analysis of data and for drug information search such as WINOLIN, SPSS, HapMap database and many others.

Central laboratory Equipment

Certain equipment necessary for training of students will be centrally located. The recommended high degree of centralisation is dictated by the generally high cost of modern laboratory equipment and the need to utilise this equipment optimally.

1. High performance liquid chromatography (HPLC)
2. Gas chromatography (GC)
3. Gel imaging apparatus

Subject-Based Facilities
Pharmacology

1. Thermocirculators
2. Avery balances
3. Small animal respirators
4. Jacketed baths (5ml, 10ml, 25ml and 50ml capacities)
5. Assorted organ baths
6. Langendoffs
7. Refrigerators
8. Deep freezers
9. Brown-Schastermyograph stand
10. Aerator (organ bath)
11. Infusion pump
12. Peristaltic pump
13. Bench centrifuge
14. Hot plates
15. Water baths
16. Syringes of various sizes (1ml, 2ml, 5ml, 10ml and 20ml)
17. Smoking burners
18. Assorted sizes of white glazed paper
19. Assorted levers
20. Stop watch
21. Stop clock
22. Upright clamping rods
23. Clamps
24. Angle poise lamp
25. pH meters
26. Autoclave
27. Assorted surgical instruments
28. All glass water distiller
29. Automatic ice flake machine
30. Cell homogenizers
31. Kymograph/Microdynamometer/Data capsule

Pharmaceutics

1. Dispensing balances with weights
2. Analytical balances
3. Top loading balances
4. Beam balances with flat pan for weighing ointment

5. Refrigerator
6. Hot air ovens
7. Suppository moulds
8. pH meters
9. Thermostat controlled water baths
10. Viscometers
11. Bench centrifuges
12. Counting machine
13. Fluid energy mill (Jet mill)
14. Sets of test sieves
15. Sieve shaker
16. Fluidised bed dryer (5kg capacity)
17. Single station table press
18. Punches
19. Multipurpose motor units (Erweka AR 400)
20. Table hardness tester
21. Roche friabilator
22. Dissolution apparatus
23. Disintegration tester
24. Bowl mixer
25. Hygrometer
26. Coulter counter
27. Millers
28. Food processors
29. Oven

Pharmaceutical Microbiology and Biotechnology

1. Vertical autoclave (giant size)
2. Portable autoclaves
3. Sterilising ovens
4. Drying ovens
5. Incubators (37^{o}C)
6. Cool Incubators (5^{o}C)
7. Distilled Water still
8. Refrigerators (4^{o}C, -20^{o}C and -80^{o}C)
9. Centrifuges (bench)
10. Cooled centrifuges
11. Water baths/water baths with shakers
12. Laminar flow cabinets
13. Microscopes (binocular and inverted)
14. Turbidometers
15. Nephlometers
16. pH meters
17. Vacuum pumps
18. Spin mixer
19. Weighing balances (analytical and top loading)
20. Air conditioner

21. Gel electrophoresis apparatus
22. Thermal cycler (PCR machine)
23. ELISA micro plate reader
24. Colony counter
25. Ampoule sealing machine
26. UV/Visible spectrophotometer
27. Vortexer
28. Deioniser
29. CO_2 incubators for cell culture
30. Complete apparatus for protein gel (western blot) analysis

Pharmacognosy

1. Assorted heating mantles
2. Microscopes
3. Drying oven
4. Refractometer
5. Colorimeter
6. pH meters
7. Water Distiller
8. Ultra-microtome
9. Mortars and pestles (glass)
10. Centrifuge (bench)
11. Melting point apparatus
12. Freeze dryer
13. Hot plates
14. Fridge
15. Combined hot plate magnetic stirrer
16. TLC adjustable spreader
17. TLC Chromatanks (20 x 20)
18. Microscopes
19. UV Spectrophotometer
20. Assorted soxhlet apparatus
21. Fractional distiller
22. Museum equipment and furniture
23. Glassware of all sizes
24. Rotary evaporator
25. Fume cupboards

Pharmaceutical Chemistry

1. Complete TLC units – tanks with covers, UV lamp 254 & 360nm, TLC spreader
2. Refractometer
3. Polarimeter
4. Colorimeter
5. pH meter
6. Centrifuge
7. Conductivity bridge
8. Thermostirrers

9. Hot plates
10. Heating mantles
11. Heating mantles
12. Magnetic stirrer
13. Laboratory shakers
14. Thermostat Water baths
15. Balances: Top loading and Analytical (adequate number and of various precisions)
16. Ultraviolet Visible Spectrophotometer
17. Infrared Spectrometer
18. Vacuum pumps
19. Water pumps
20. Air pumps
21. Rotary evaporators
22. Ice-making machine
23. Ovens
24. Functioning fume cupboards
25. Molecular model
26. Refrigerators/Freezers (4^0C, -20^0C and -80^0C)
27. Appropriate assorted apparatus and glassware for:
    a. Synthesis
    b. Analysis
    c. Purification and extraction process
28. Fully equipped first aid box
29. Fire extinguishers
30. Gloves and safety spectacle
31. Glassware of various sizes
32. Dissolution apparatus
33. Disintegration tester
34. Friabilator
35. Hardness tester
36. Sonicators
37. Spray guns
38. Soxhlet extractors
39. Water baths
40. Sand bucket

Pharmaceutical Technology Laboratories

Unit Operations Laboratory

Laboratory models of the following must be provided

1. Hammer mill
2. Ball mill
3. Triple rollmill
4. Cube mixer
5. Bowl mixer
6. Sigma-blade mixer
7. Homogenizer/blender

8. Top Loading balance electronic
9. Filter press
10 Tray dryer
11 Fluidised bed Dryer 5kg

Liquid Processing Laboratory

The models to be provided here will serve as teaching and research equipment as well as production equipment at the pilot level.

1. Processing vessel complete with mixer (minimum capacity 250L)
2. Filter Press – 8 frames
3. Deionizer (minimum capacity of 100L)
4. Colloid mill
5. Liquid filling machines
   (a) Volumetric
   (b) Vacuum
6. Capping machine
7. Transfer Pumps
8. Stainless steel jacketed vessels
9. Stainless steel storage vessels

Dry Processing Laboratory

1. Rotary table press
2. Granulators (wet and dry)
3. Fitzpatrick mill model D
4. Fluid bed dryer (minimum capacity - 30kg)
5. Sieving machine & set of sieves
6. Table deduster
7. Auto dryertexextractor
8. Capsule filling machine

Testing Equipment

1. Viscometer
2. Disintegration unit
3. Disintegration Testing unit
4. Friabilator
5. Erweka AR400 Power Unit
6. Tablet Hardness Tester
7. Moisture Determination Balance

Sterile Production Laboratory

1. Water Distiller
2. Autoclaves
3. Ampoule Dryer
4. Ampoule Washer

5. Laminar flow cabinet
6. Pressure vessels/filtration systems

Clinical Pharmacy

1. Dissolution apparatus
2. Disintegration apparatus
3. Magnetic stirrer
4. pH meters and accessories
5. Refrigerators
6. Deep freezer
7. Ultracentrifuge
8. Micro centrifuge
9. Water baths
10. Digital video camera
11. Video CD/DVD Player
12. Personal computers with internet access
13. Overhead projector
14. Multimedia projector
15. Public address system
16. TV set
17. Video cassette player/recorder
18. TLC tank (20 x 20 cm)
19. Analytical balances

Animal House

1. Matrolon cage type i
2. Matrolon cage type ii
3. Matrolon cage type iii
4. Matrolon cage type iv
5. Wire cage type ii
6. Wire cage type iii
7. Wire cage type iv
8. Rack for cage type i
9. Rack for cage type ii
10. Rack for cage type iii
11. Rack for cage type iv
12. Racks for wire cage type ii
13. Racks for wire cage type iii
14. Mobile batteries for Rabbit
15. Mobile batteries for Guinea pig
16. Apartment for cat
17. Drinking bottles
18. Feeding containers for Rats
19. Feeding containers for Mice
20. Feeding containers for Guinea pig
21. Feeding Holder
22. Feeding holder for Rabbit
23. Drinking valve for mice and rats

24. Exp. Dropping tray
25. Bottle washing and transport basket
26. Identification plates
27. Food transport trolley
28. Littering box for rabbit
29. Rabbit transporting cages
30. Dog cages
31. Cages for collecting faeces and urine
32. Cat cage
33. Upright cage washer
34. Partition cabinets for staff clothing
35. Polythene dust bins
36. Record cabinets
37. Sterilising machine
38. Incinerator
39. Drawer cabinet
40. Other animal house miscellaneous equipment

Staffing

Academic Staff

The staff/student ratio is specified under different categories of staff. This will provide the necessary student/staff contact to enhance the learning process especially with the clinical core of the programme which follows after the relevant pre-requisite laboratory classes' exposure.

For quality assurance in pharmacy education, the faculty staff should be provided with adequate opportunity for development, commitment to research and scholarship.

General Considerations for Academic Staff

(i) The minimum number of teachers to start a Pharmacy programme shall be in accordance with the requirement for commencing an academic programme;

(ii) All teachers involved in the programme must contribute to and be familiar with it apart from being involved in the machinery for planning and reviewing the programme;

(iii) Staff should include persons experienced both in teaching and in providing patient care with appropriate balance to provide the desired spectrum of knowledge;

(iv) Academic staff for the programme must be holders of Ph.D. degrees, provided that staff with lower qualification can be accommodated under the staff development programme. However, staff with Ph.D. should not be less than 70% of total staff on ground;

(v) Staff assignments and expectations should provide for a balance of teaching, service, research and administrative responsibility;

(vi) Based on students' enrolment, the minimum academic staff-students ratio should be 1:15. However, there should be a minimum of six full-time equivalent of staff in each department. There is need to have a reasonable number of staff with higher degrees, as well as sufficient professional experience. With a minimum load of 18 Units per semester for students and a minimum of six full-time equivalent of staff in each programme, staff should have a maximum of 15 contact hours per week for lectures, tutorials, practicals and supervision of projects;

(vii) Full time academic staff should have a second degree minimum primarily to ensure adequate acceptance of the concept goals and objectives of the degree programme; and

(viii) For Graduate Assistants or Teaching Assistants, a minimum first degree is required. This category of staff is not considered suitable to teach and therefore not counted during any evaluation exercise.

The following are the recommended minimum academic staff mix:

Professors/Readers	20%
Senior Lecturer	35%
Lecturer I and below	45%

Professional Staff

There is always the need for some professional members of staff to complement and cater for better up-to-date exposure. Clinical Pharmacy teachers should as much as possible be practitioners with a high degree of regular responsibility for care of patients.

Administrative Support Staff

The administrative staff requirement shall be based on the prescribed NUC ratios for the category.

Technical Support Personnel

The services of technical support staff, which are indispensable in the proper running of laboratories are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance.

Classroom, Laboratories, Clinics, Workshops and Offices.

Physical Facilities

a) Spaces for Academic Area

Academic Areas	**Measurement**
Professor's office	18.5 m^2
Head of Department's office	18.5 m^2
Staff accommodation and research spaces	7.5 m^2
Non-academic staff offices (including rooms for typing, filing, storage and many others)	7.5 m^2
Research area for a lecturer	10m^2
Tutorial/seminar/audio visual Rooms	40-50m^2
Store room for chemicals	40-50m^2
Work rooms/preparatory	40-50m^2
Post graduate teaching laboratories	40-50m^2
Balance rooms	10m^2
Laboratories for teaching and research	50-180m^2
Specialised work rooms (such as Extraction, sterilisation, aseptic and instrument)	50m^2
Animal house	30m^2
Faculty library and Reference room	130m^2
Lecture theatres (for 150 students)	160m^2
Plant room	30m^2
Cold rooms	30m^2

Herbarium	40m^2
Student common room	140m^2
Staff common room	55m^2
Dispensing practice area	20m^2
Medicinal plant garden	

b) Teaching Laboratories Spaces

General Pharmaceutical Chemistry laboratory Physical Pharmaceutical Chemistry laboratory Organic Pharmaceutical Chemistry laboratory Chromatography room Instrument room	180m^2 60m^2 ,, ,, 100m^2
General Pharmaceutics laboratory	165m^2
Pharmaceutical Technology Unit operation Liquid processing Drug processing Sterile Production	90m^2 ,, 110m^2 168m^2 168m^2
General Pharmaceutical Microbiology (25 students)	165m^2
Microbiology work up area (clean, sterilization, wash up)	60m^2
Raw materials/packing store	60m^2
Pharmacognosy laboratory	60m^2
Pharmacology:	60m^2
Pharmacology general teaching laboratory	60m^2
Pharmacology demonstration area	60m^2
Solvent purification & recovery room	20m^2
Drug Information Centre	60m^2
Pharmacy communication laboratory	60m^2

C) Specialised Area

It would be desirable to have a sterilisation room (50m^2), grinding room (40m^2) and locked spaces possibly on the corridors for students' laboratory wares and overalls.

Adequate space should be provided for all Departments in the Pharmacy. Efforts must be made to provide the Faculty of Pharmacy at least:-

i) Two (2) spacious laboratories calculated according to NUC specifications of 7.5 m^2 per FTE per Department; a minimum of one (1) preparatory room for each Department at the NUC specifications of 7 m^2 each;
ii) Two seminar rooms capable of sitting at least sixty students at the NUC specification of 1 m^2 per FTE;
iii) A conference room; and
iv) A staff common room.

The Faculty itself should have two (2) large faculty lecture theatres capable of sitting up to a minimum of two hundred and fifty (250) students each according to the NUC specification of 0.75 m^2 per FTE.

d) Other Equipment

To achieve the benchmark statements for any programme, there should be a minimum number of identifiable and adequately equipped laboratories for each Department of the programme, which should be in accordance with the recommended space requirements.

Please see Section 4 for list of equipment for effective teaching and learning in the following areas:

1. Pharmaceutical Chemistry
2. Pharmacology
3. Pharmaceutics including Dispensing Laboratory
4. Pharmaceutical Microbiology
5. Pharmacognosy including Medicinal Plant Garden
6. Drug Information Unit
7. Information & Communication Technology
8. Communication Skills
9. Pharmaceutical Technology including Pilot Drug Production
10. Herbarium
11. Clinical Pharmacy
12. Model Community Pharmacy

Library

There should be a Faculty Library, which has appropriate reference books, journals and periodicals in all areas of Pharmacy. A functional e-learning facility with wireless internet access is highly recommended.

Department Structure

There shall exist a non-affiliated Faculty with the following minimum number of the departments for running the Pharmacy programme:

1. Clinical Pharmacy & Pharmacy Administration
2. Pharmaceutical and Medicinal Chemistry
3. Pharmaceutical Microbiology & Biotechnology
4. Pharmaceutics and Pharmaceutical Technology
5. Pharmacognosy
6. Pharmacology and Toxicology

Doctor of Pharmacy (Pharm. D)

Overview

The Doctor of Pharmacy (Pharm. D) programme is designed to produce well educated and competent pharmacists. This Core Curriculum and Minimum Academic Standards (CCMAS) by the National Universities Commission (NUC), is for use by all Nigerian universities offering Pharmacy.

Pharmacy has evolved from a product-oriented practice to a patient-oriented practice. This curriculum has been reviewed to include more clinical skills (especially in the last two years) with better understanding of pathophysiology of diseases, pharmacogenomics, and pharmaceutical care, to optimise patient care outcomes. The advent of the coronavirus pandemic in 2019 has revealed gaps in the healthcare systems of many countries. As the pharmacist is expected to always ensure the continued availability of quality drugs, supply chain management and logistics of health commodities have been given more prominence. It is also in this light that Emergency Preparedness was included.

21stcentury skills that will produce pharmacists with clinical, industrial, academic and leadership skills, entrepreneurial, and critical thinking for practice anywhere in the world have also been included.

Philosophy

The general philosophy of pharmacy education is to produce graduates worthy in character, capable of critical thinking, life-long learning and knowledgeable in the practice of Pharmacy, as a means of achieving optimal patient outcomes.

Objectives

The main objective of the programme is to produce pharmacy practitioners with knowledge, skills and motivation to provide detailed pharmaceutical services. To this end, the objectives of the Pharm. D degree programme are to:

1. Instil in the students a sense of appreciation of the pharmacy profession and to involve them in an intellectually stimulating and satisfying experience of learning and study;
2. Develop students who demonstrate proficiency in the knowledge, skills and attitudes of basic medical and applied pharmaceutical sciences;
3. Produce graduates who are capable of independent, analytical thinking and problem-solving, with respect to drugs and drug-related problems both in human and animals;
4. Provide students with the ability to communicate effectively with patients and caregivers, thereby promoting healthy outcome and optimal use of drugs;
5. Empower the graduates with adequate knowledge and skills to function confidently as integral members of the multidisciplinary healthcare team;
6. Produce graduates who will function in a manner consistent with professional and ethical standards of practice globally;
7. Provide students with adequate knowledge in manufacture, drug quality and distribution of quality pharmaceutical products;
8. Produce graduates empowered with leadership and management skills;
9. Instil in the students the dynamic value of the profession, which makes life-long learning a necessity;

10. Provide students with adequate knowledge and appropriate skill base from which they can proceed for further studies in specialised areas of Pharmacy;
11. Promote public health, primary healthcare, and rational use of herbal medicines and veterinary drugs;
12. Produce pharmacists who are independent, innovative, and capable of critical thinking; being able to impact their society having been equipped with the knowledge and skills to unrestrictedly lead and manage in diverse fields; and
13. Produce pharmacists with adequate knowledge and skills in supply chain management, logistics and community pharmacy services.

Unique Features of the Programme

1. The mix and quality of courses have been compiled to produce pharmacists for pharmaceutical services in the 21st century;
2. Supply chain management and logistics for drugs and other health commodities have been given more prominence to ensure continued availability of quality drugs and enhanced employability;
3. Emphasis placed on better understanding of pathophysiology of diseases, pharmacogenomics, and pharmaceutical care, to optimise patient care outcomes;
4. Acquisition of soft skills such as: leadership skills, communication skills, to produce pharmacists for the 21st century;
5. Inclusion of Emergency Preparedness for integration of pharmacists in national and international response to public health emergencies as is obtained in many countries;
6. Addition of more hospital, community and primary healthcare practical experience for an all-round service to the community;
7. The rich mix of courses prepares graduates for practice in all areas of pharmaceutical sciences as against the bias towards clinical practice alone as found with Pharm. D programmes from other countries;
8. Clinical Pharmacognosy included because of increasing use of herbal remedies and other complementary and alternative medicines by many communities the world over;
9. Emphasis on entrepreneurial and business creation for self-employment and employment creation; and
10. Minimum academic standards to produce graduates that can compete favourably globally with life skills for flexibility and competitiveness in a rapidly changing world.

Employability Skills

The Pharm. D graduate will be equipped with the following employability skills:

1. Specialist skills in hospital pharmacy practice (oncology, paediatrics, nuclear, psychiatric, veterinary, emergency medicine and many others);
2. Clinical pharmacy skills (pharmaceutical care/patient care);
3. Ambulatory care pharmacy skills;
4. Community pharmacy skills;
5. Public health pharmacy skills;
6. Complementary and alternative medicine practice (herbal);
7. Teaching and research skills in tertiary institutions;
8. Drug manufacturing skills;
9. Drug supply chain management and logistics;
10. Drug development and regulatory control; and
11. Pharmaco-informatics and robotics.

21st Century Skills
The programme will lead to the development of PharmD graduates with the following 21st century skills:
1. Learning skills which include critical thinking, creativity, collaboration and communication;
2. Literacy skills such as Information, technology, and use of media;
3. Life skills for flexibility, leadership, productivity, and social interaction; and
4. Key competencies such as Teamwork, problem solving, sense of responsibility, trustworthiness and ethics, and organizational skills.

Admission Requirement
Candidates are admitted into the Pharm. D programme in any of the following ways:
- Unified Tertiary Matriculation Examination (UTME) Mode (6-year Degree Programme)
- Direct entry

Unified Tertiary Matriculation Examination (UTME) Mode (6-year Degree Programme)
In addition to UTME score, the candidate should possess five credit passes in Senior School Certificate (SSC) to include English Language, Mathematics, Chemistry, Physics, and Biology at not more than two sittings.

Direct Entry
1. For the five-year programme: five SSC credits passes, two of which must be at Advanced Level and to include Chemistry, Physics/Mathematics and Zoology/Botany/Biology, in addition to UTME requirements; and
2. Candidates with relevant first degree having not less than Second Class Lower degree in addition to UTME requirements may be considered in line with the university policy.

Duration of the Programme
The minimum duration of the Pharm. D programme is six academic sessions for candidates who enter through the UTME Mode. Direct Entry candidates admitted to the 200 level of the programme will spend a minimum of five academic sessions.

The maximum length of time allowed for obtaining an honours degree in the Faculty shall be 16 semesters for the 6–year degree programme and 14 semesters for students admitted directly into the 200 level. Students requiring more than the normal period of graduation (not more than 150% of the normal course duration) should also be awarded degrees.

Students who transfer from other universities should have sat and passed all courses transferred from the previous university and should have attained the minimum CGPA of 3.50. Such students shall however be required to spend not less than three sessions (6 semesters) in order to earn a degree. Appropriate decisions on transfer cases shall be subjected to the approval of Senate on the recommendation of the Faculty.

Graduation Requirements
A student for the Pharm. D degree programme must have undergone six (6) or five (5) academic sessions depending on the admission entry mode. A student shall qualify for the award of a Pharm. D degree when he/she has completed and passed all the prescribed number of courses with **a score of not less than 50% in the professional courses, except**

Dispensing Practical and Pharmacy Jurisprudence which require 60% pass mark.
The student must have obtained a minimum CGPA of not less than 2.50 and earned the minimum credit units of not less than 180 for UTME and 150 for Direct Entry candidates.

Course System
The Pharm. D programme shall be run on a modularised system, commonly referred to as Course Unit System. All courses should therefore be sub-divided into self-sufficient and logically consistent packages that are taught within a semester and examined at the end of that semester. Credit weights in form of units should be attached to each course. One Unit is equivalent to one hour per week per semester of 15 weeks of lectures or 3 hours per week of laboratory work per semester of 15 weeks. It is assumed that the Nigerian university system shall continue to operate the academic year of two semesters with a minimum of 15 weeks of lectures/practicals per semester.

The courses are arranged in levels of academic progress. There shall be six levels of courses numbered 101-199, 201-299, 301-399, 401-499, 501-599 and 601-699. For ease of identification, course numbers can be prefixed by a three-character programme/subject code. Thus, the course code is in the form: DEP LNJ (where the three letters DEP identify the course, 'L' in LNJ represents the level of the course (1 or 2 or 3 or 4 or 5 or 6 for all undergraduate courses) and NJ is a two-digit numbering of courses. Thus, for example, PCH 203 is a 200-Level course with number 03 offered in the Pharmaceutical Chemistry Department.

Grading of Courses

Grading of courses shall be done by a combination of percentage marks and letter grades translated into a graduated system of Grade Point as shown in Table 1.1.

Table 1. 1 Grade Point System

Mark %	Letter Grade	Grade Point
70 – 100	A	5
60 – 69	B	4
50 – 59	C	3
45 – 49	D	2
40 – 44	E	1
0- 39	F	0

Grade Point Average and Cumulative Grade Point Average
For the purpose of determining a student's standing at the end of every semester, the Grade Point Average (GPA) system shall be used. The GPA is computed by dividing the total number of Units x Grade Point (TUGP) by the total number of units (TNU) for all the courses taken in the semester as illustrated in Table 1.2

The Cumulative Grade Point Average (CGPA) over a period of semesters is calculated in the same manner as the GPA by using the grade points of all the courses taken during the period.

Even when a student repeats the same course once or more before passing it, grades scored at each, and all attempts shall be included in the computation of the GPA.

Table 1:2 Calculation of GPA or CGPA

Course	Units	Grade Point	Units x Grade Point (UGP)
C_1	U_1	GP_1	U_1 x GP_1
C_2	U_2	GP_2	U_2 x GP_2
-	-	-	-
-	-	-	-
C_i	U_i	GP_i	U_i x GP_i
-	-	-	-
-	-	-	-
C_N	U_N	GP_N	U_N x GP_N
TOTAL	**TNU**		**TUGP**

$$TNU = \sum_{i=1}^{N} U_i \qquad TUGP = \sum_{i=1}^{N} U_i * GP_i \qquad CGPA = \frac{TUGP}{TNU}$$

Degree Classifications

A minimum CGPA of 2.50 is required for graduation. Candidates can earn either PASS or PASS WITH DISTINCTION. Candidates with CGPA of 4.50 to 5.0 shall qualify for Pass with Distinction as a way of encouraging healthy competition and excellence (Table 1.3). Others outside this category will receive Pass degrees. The Cumulative Grade Point Average (CGPA) over a period of semesters is calculated in the same manner as the GPA by using the grade points of all the courses taken during the period.

Cumulative Grade Point Average and Class of Degree

A Pass degree is awarded as follows:

Table 1.3: Degree Classification

Pass Degree	Cumulative Grade Point Average (CGPA)
Pass with Distinction	4.50–5.00
Pass	2.5-4.49

Probation

Probation is a status granted to a student whose academic performance falls below acceptable standard at the end of the session. A student whose Cumulative Grade Point Average is below 2.50 at the end of a particular session of study earns a period of probation for one academic session and may be withdrawn from the faculty after two consecutive probation periods.

Withdrawal

A candidate whose Cumulative Grade Point Average is below 2.50 at the end of a particular year should be on probation. But a candidate whose cumulative GPA is below 2.50 at the end of a particular year of probation should be required to withdraw from the Faculty.

Resit examinations

As a result of the professional nature of the Pharm. D programme, during the professional years (from 200 level), candidates may not proceed to higher levels until they have passed all relevant

courses and fulfilled the credit requirements in the preceding year. Candidates are expected to complete each year by passing all compulsory and prescribed courses in various subject areas. However, candidates who obtain a set minimum credit pass may be permitted by the Senate on the recommendation of the Faculty Board to be referred in the courses (resit examination) before another session begins. Candidates who pass less than the set minimum credit units shall be required to repeat the session (taking only the failed courses). Candidates who still fail to fulfil the set requirements above after a resit examination may be asked to repeat the session, while those who still fail after a repeat may be asked to withdraw from the programme. Resit examinations will help students who are not able to cope with all the credit load during examination to have a better grasp of their weak subject areas before proceeding to more advanced courses.

Evaluation

Technique of Student Assessment
Practicals

By the nature of the pharmacy profession, laboratory practicals are very important in the training of students. To reflect the importance of practical work, a minimum of 9 hours per week or 135 hours per semester (equivalent to 3 units) should be spent on students' laboratory practical. Consequently, some of the courses have both theory and practical components. Thus, in the course content, the number of hours of lectures (LH) and the number of hours of practical (PH) per semester are indicated. The overall performance of students in such courses is to be based on the evaluation of the performance in written examination (which tests the theory) and the performance in the laboratory work (based on actual conduct of experiments, reports and examinations).

The experiments to achieve the practical components of the courses must be designed in quality and quantity to enrich the grasp of the theoretical foundations of the courses. It is left for the department to organize all the experiments in the best way possible. Another way to achieve this is to lump the entire laboratory practicals under a course, which the student must pass.

a) Tutorials

The timetable for courses shall be designed to make provision for tutorials of at least one hour for every four hours of lecture. Thus a 3-unit course of 45 hours per semester should attract about 10 hours of tutorials.

b) Continuous Assessment

Continuous assessment of students should be by means of term paper, frequent tests (formal and informal) and practical exercises.
The general pattern approved is as follows:

1. Scores from continuous assessment shall normally constitute 30 percent of the full marks for courses which are primarily theoretical;
2. For courses which are partly practical and partly theoretical, scores from continuous assessment and practical shall constitute 40 percent of the final marks; and
3. For courses that are entirely practical, continuous assessment shall be based on a student's practical work or reports as well as practical examination and both shall constitute 100 percent of the final marks.

c) Examinations

In addition to continuous assessment, final examinations should normally be given for every course at the end of each semester. All courses shall be graded out of a maximum of 100 marks comprising:

1. Final examination: 70% - 60%
2. Continuous assessment (quizzes, assignments, tests, practicals): 30% - 40%

Each course shall normally be completed and examined at the end of the semester in which it is offered.

2. External Examiners' System

There shall be external examiners to vet and moderate the programme of courses and examination for the various subject areas to cover the professional years. This system should be used to assess courses and projects, and to certify the overall performance of students as well as the quality of facilities and teaching in the faculty. The use of different external examiners for major subject areas in the professional programme is recommended.

It is believed that effective use of external examiners will bring out the desirable assurance in achieving the set goals of the programme.

The external examiner's reports should be made to the Vice-Chancellor and be made available to the departments for appropriate action.

3. Industrial Experience

a) Students Industrial Work Experience Scheme (SIWES)

There should be a mandatory 3 months uninterrupted SIWES training at the 300- and 400-Levels during which students can gain work experience. Adequate monitoring of such activities must be built into the administration of the programme.

b) Externship/Clerkship

Pharmacy students will participate in both Externship and Clerkship programmes. These are built into the curriculum that runs during the session. For Externship/Clerkship, students are rotated between hospitals and community pharmacies and Primary Health Centres (PHC). Periods of at least 3 hours are spent with the aim of the students acquiring clinical experience. Details are as specified in the course synopses.

Attainment Level

The minimum pass mark for any pharmacy course taken in the professional years shall be fifty per cent (50%) and sixty per cent (60%) for Dispensing Practical and Pharmacy Jurisprudence. Evidence on which assessment is based shall include:

1. Informal/written examination;
2. Continuous assessment;
3. Laboratory reports;
4. Oral presentation; and
5. Conduct and reporting of project work.

Students' Evaluation of Courses

There should be an established mechanism to enable students to evaluate courses delivered to them at the end of each semester. This should be an integral component of the course credit system, serving as feedback mechanism for achieving the following:Improvement in the effectiveness of course delivery.

1. Continual update of lecture materials to incorporate emerging new concepts;
2. Effective usage of teaching aids and tools to maximize impact of knowledge on students; and
3. Improvement in students' performance through effective delivery of tutorials, timely presentation of continuous assessment and high-quality examination.

The evaluation should be conducted preferably before the final semester examinations. It is particularly important that students' evaluation of courses be administered fairly and transparently using well-designed questionnaires. The completed questionnaires should be professionally analysed and results discussed with the course lecturer(s) towards improvement in course delivery in all its ramifications.

Global Course Structure

100- Level

Course Code	Course Title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian Peoples and Culture	2	C	30	-
BIO 101	General Biology I	2	C	30	-
BIO 102	General Biology II	2	C	30	-
BIO 107	General Biology Practical I	1	C	-	45
BIO 108	General Biology Practical II	1	C	-	45
CHM 101	General Chemistry I	2	C	30	-
CHM 102	General Chemistry II	2	C	30	-
CHM 107	General Practical Chemistry I	1	C	-	45
CHM 108	General Practical Chemistry II	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 102	Elementary Mathematics II	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 102	General Physics II	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45
PCY 101	Introduction to Pharmacy	1	C	15	-
	Total	27			

200 Level

Course Code		Course Title	Units	Status	LH	PH
GST 212		Philosophy, Logic, Environment and Sustainable Development	2	C	30	-
ENT 211		Entrepreneurship and Innovation	2	C	30	-
ANA 201		Basic Anatomy	2	C	30	-
ANA 202		Neuroanatomy	3	C	30	45
ANA 203		Histology	1	C	15	-
BCH 201		Biochemistry	3	C	30	45
BCH 202		Introductory Molecular Biology	3	C	30	45
PIO 201		Introductory and Blood Physiology	3	C	30	45
PIO 202		Neurophysiology and Special Senses	3	C	30	45
PCG 201		Introduction to Pharmacognosy	3	C	30	45
PCH 201		Physical Pharmaceutical Chemistry	3	C	30	45
PCH 202		Inorganic Pharmaceutical Chemistry	3	C	30	45
PCT 201		Pharmaceutics	2	C	30	-
PCT 202		Pharmaceutical Preparations and Calculations	2	C	30	-
PCT 203		Dispensing Practical I	1	C	-	45
PCT 204		Dispensing Practical II	1	C	-	45
PHM 201		Introduction to Pharmaceutical Microbiology	3	C	30	45
		Total	40			

300 Level

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	15	45
PAA 399	Students Industrial Work Experience (SIWES)	3	C	-	12WK
CLI 301	Biopharmaceutics and Pharmacokinetics	3	C	45	-
CLI 302	Health Psychology	1	C	15	-
PCG 301	Pharmacognosy I	3	C	30	45
PCG 302	Pharmacognosy II	3	C	30	45
PCH 301	Organic Pharmaceutical Chemistry	3	C	30	45
PCH 302	Pharmaceutical Analysis I (Non-Instrumental Methods)	3	C	30	45
PCT 301	Physical Pharmaceutics I	3	C	30	45
PCT 302	Rheology	1	C	15	-
PCT 303	Dispensing Practical III	1	C	-	45
PCT 304	Physical Pharmaceutics II	2	C	30	-

PCT 306	Dispensing Practical IV	1	C	-	45
PHA 301	General Principles of Pharmacology	3	C	30	45
PHA 302	Autonomic/Neuropharmacology	3	C	30	45
PHM 301	Pharmaceutical Microbiology	3	C	30	45
SAP 301	Pharmacy Administration I	2	C	30	-
	Total	42			

400 Level

Course Code	Course Title	Units	Status	LH	PH
PAA 499	Students Industrial Work Experience (SIWES)	3	C	-	12WK
BTG 401	Pharmaceutical Biotechnology I	3	C	30	45
CLI 401	Introductory Clinical Pharmacy	2	C	30	-
CLI 402	Pharmaceutical Immunology and Vaccines	2	C	30	-
CLI 403	Essentials of Nutrition	1	C	15	-
CLI 404	Clinical and Environmental Toxicology	2	C	30	-
PAT 401	Pathology	3	C	30	45
PAT 402	Pathophysiology I	2	C	30	-
PCG 401	General Phytochemical Methods in Drug Analysis	2	C	30	-
PCG 402	Secondary Plant Metabolites	2	C	15	45
PCH 401	Pharmaceutical Analysis II (Instrumental Methods)	3	C	30	45
PCH 402	Medicinal Chemistry I- Drug Design	2	C	30	-
PCT 401	Dosage Form Evaluation and Drug Stability	3	C	30	45
PCT 402	Physical Pharmaceutics III	3	C	30	45
PHA 401	Chemotherapy	2	C	30	-
PHA 402	Cardiovascular and Endocrine Pharmacology	3	C	30	45
PSM 402	Biostatistics and Research Methodology	2	C	30	-
SAP 401	Pharmacy Laws and Ethics	2	C	30	-
SAP 402	Pharmacy Communication Skills	2	C	30	-
	Total	44			

500 Level

Course Code	Course Title	Units	Status	LH	PH
PAA 502	Veterinary Pharmacy and Agrochemicals	3	C	45	-
PAA 504	Electronic Pharmacy	2	C	15	45
BTG 501	Pharmaceutical Biotechnology II	2	C	30	-
CLI 501	Pharmacotherapeutics I	2	C	30	
CLI 502	Clinical Pharmacy Clerkship I	3	C	-	135

New

CLI 503	Pharmaceutical Care	2	C	30	-
CLI 504	Clinical Pharmacokinetics	3	C	30	45
PAT 502	Pathophysiology II	2	C	30	-
PCH 501	Drug Quality Assurance	3	C	30	45
PCH 502	Medicinal Chemistry II	2	C	30	-
PCG 501	Herbal, Complementary and other Alternative Medicines	2	C	30	-
PCG 502	Clinical Pharmacognosy	1	C	-	45
PCT 501	Industrial Set-up and Formulation Processes	3	C	30	45
PHA 501	Central Nervous System Pharmacology	3	C	30	45
PHA 502	Biochemical Pharmacology	2	C	30	-
PHM 501	Microbial Chemotherapy and Bacterial Genetics	2	C	30	-
PHM 502	Preservation and Fermentation Biotechnology	2	C	30	-
SAP 501	Pharmacy Administration II	2	C	30	-
SAP 502	Pharmacoeconomics	1	C	15	-
SAP 504	Drug Informatics	2	C	30	-
	Total	44			

600 Level

Course Code	**Course Title**	**Units**	**Status**	**LH**	**PH**
PAA 602	Project	6	C	-	270
BTG 601	Pharmacogenetics and Genomics	2	C	30	-
CLI 601	Clinical Pharmacy Clerkship II	6	C	-	270
CLI 602	Clinical Pharmacy Clerkship III	6	C	-	270
CLI 603	Emergency Preparedness	2	C	15	45
CLI 604	Pharmacotherapeutics II	3	C	45	-
CLI 606	Public Health Pharmacy and Pharmacoepidemiology	3	C	30	45
PCH 601	Radiopharmaceuticals	2	C	30	-
PCT 601	Industrial Pharmacy	2	C	30	-
PCT 603	Ethical Dispensing	1	C	-	45
SAP 601	Supply Chain Management of Drugs and other Health Commodities	2	C	30	-
	Total	35			
	TOTAL CREDIT UNITS Pharm. D	**232**			

Course Contents and Learning Outcomes

100 Level Courses

GST 111: Communication in English (2 Units C: LH 15; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. identify possible sound patterns in English Language;
2. list notable language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents
Sound patterns in English Language (vowels and consonants, phonetics and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple and complex). Grammar and Usage (tense, mood, modality and concord, aspects of language use in everyday life). Logical and critical thinking and reasoning methods (logic and syllogism, inductive and deductive argument and reasoning methods, analogy, generalisation and explanations). Ethical considerations, copyright rules and infringements. Writing Activities: (Pre-writing, writing, post writing, editing and proofreading; brainstorming, outlining, paragraphing). Types of writing, summary, essays, letter, curriculum vitae, report writing, note making and many others. Mechanics of writing. Comprehension strategies: (Reading and types of reading, comprehension skills, 3RSQ). Information and communication technology in modern language learning. Language skills for effective communication. Major word formation processes. Writing and reading comprehension strategies. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening. Report writing.

GST 112: Nigerian Peoples and Culture (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. analyse the historical foundation of the Nigerian culture and arts in pre-colonial times;
2. list and identify the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political unit;
4. analyse the concepts of trade, economic and self-reliance status of the Nigerian peoples towards national development;
5. enumerate the challenges of the Nigerian State towards nation building;
6. analyse the role of the Judiciary in upholding people's fundamental rights;
7. identify acceptable norms and values of the major ethnic groups in Nigeria; and
8. list and suggest possible solutions to identifiable Nigerian environmental, moral and value problem.

Course Contents
Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and culture; peoples and culture of the ethnic minority groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation-building (military intervention in Nigerian politics; Nigerian Civil War). Concept of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigeria peoples; trade, skill acquisition and self-reliance). Social justices and national development (law definition and classification). The Judiciary and fundamental rights. Individual norms and values (basic Nigerian norms and values). Patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts. Cultism, kidnapping and other related social vices. Re-orientation, moral and national values. The 3Rs – Reconstruction, Rehabilitation and Re-orientation. Re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline (WAI), War Against Indiscipline and Corruption (WAIC), Mass Mobilisation for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

BIO 101: General Biology I **(2 Units C: LH 30)**

Learning Outcomes
At the end of the course, students should be able to:
1. explain cell structure and organisations;
2. summarise functions of cellular organelles;
3. characterise living organisms and state their general reproduction;
4. describe the interrelationship that exists between organisms;
5. discuss the concept of heredity and evolution; and
6. enumerate habitat types and their characteristics.

Course Contents
Cell structure and organisation, functions of cellular organelles, characteristics and classification of living things, chromosomes, genes - their relationships and importance, general reproduction, interrelationships of organisms (competitions, parasitism, predation, symbiosis, commensalisms, mutualism, saprophytism). Heredity and evolution (introduction to Darwinism and Lamarkism, Mendelian laws, explanation of key genetic terms), elements of ecology and types of habitat.

BIO 102: General Biology II **(2 Unit C: LH 30)**

Learning Outcomes
At the end of the course, students should be able to:
1. state the unique characteristics of plant and animal kingdoms;
2. describe ecological adaptations in the plant and animal kingdoms;
3. give a summary of the physiology of plants and animals;
4. explain nutrition, respiration, excretion and reproduction in plants and animals; and

5. describe growth and development in plants and animals.

Course Contents
A generalised survey of the plant and animal kingdoms based mainly on study of similarities and differences in the external features, ecological adaptations of these forms. Briefs on physiology to include nutrition, respiration, circulatory system, excretion, reproduction, growth and development.

BIO 107: General Biology Practical I (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. outline common laboratory hazards;
2. provide precautions on laboratory hazards;
3. state the functions of the different parts of microscope;
4. use the microscope and describe its maintenance;
5. draw biological diagrams and illustrations; and
6. apply scaling and proportion to biological diagrams.

Course Contents
Common laboratory hazards: prevention and first aid. Measurements in biology. Uses and care of microscope: compound and dissecting microscope. Biological drawings and illustration, scaling, accuracy and proportion. Use of common laboratory apparatus and laboratory experiments designed to illustrate the topics covered in BIO 101.

BIO 108: General Biology Practical II (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. describe the anatomy of flowering plants;
2. differentiate types of fruit and seeds;
3. state ways of handling and caring for biological wares;
4. describe the basic histology of animal tissues; and
5. identify various groups in the animal kingdom.

Course Contents
Anatomy of flowering plants. Primary vegetative body: stem, leaf and root to show the mature tissues, namely parenchyma, collenchyma, sclerenchyma, xylem and phloem. Types of fruits and seeds. Care and use of dissecting kits and other biological wares. Dissection and general histology of animal tissues based on vertebrate forms. Morphology and functions of epithelial, muscular, nervous and connective tissues. Examination of various groups of lower invertebrates under microscopes, identification of various groups of organisms in the animal kingdom and any experiment designed to emphasise the practical aspects of topics in BIO 102.

CHM 101: General Chemistry I (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the students should be able to:

1. define atom, molecules and chemical reactions;
2. discuss the modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. justify the trends of atomic radii, ionisation energies, electronegativity of the elements based on their position in the periodic table;
5. identify and balance oxidation – reduction equation and solve redox titration problems;
6. illustrate shapes of simple molecules and hybridised orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using lechatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

Course Contents

Atoms, molecules, elements and compounds and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence Forces; Structure of solids. Chemical equations and stoichiometry; Chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 102: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. state the importance and development of organic chemistry;
2. define fullerenes and its applications;
3. discuss electronic theory;
4. determine structures in organic chemistry, qualitative and quantitative analysis in organic chemistry;
5. describe rules guiding nomenclature and functional group classes of organic chemistry;
6. determine rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group Ia, IIa and IVa elements; and
9. describe basic properties of transition metals.

Course Contents

Historical survey of the development and importance of Organic Chemistry; Fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds. Determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry. Nomenclature and functional group classes of organic compounds. Introductory reaction

mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The Chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

CHM 107: General Chemistry Practical I (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. describe the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. differentiate between primary and secondary standards;
5. perform redox titrations;
6. recording observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

Course Contents

Laboratory experiments designed to reflect topics presented in CHM 101. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CHM 108: General Chemistry Practical II (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. identify the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which includes ignition, boiling point, melting point, test on known and unknown organic compounds;
5. execute solubility tests on known and unknown organic compounds;
6. execute elemental tests on known and unknown compounds; and
7. conduct functional group/confirmatory test on known and unknown compounds which could be acidic / basic / neutral organic compounds.

Course Contents

Laboratory experiments designed to reflect topics presented in CHM 102.

MTH 101: Elementary Mathematics I (2 Units C: LH 30)
(Algebra and Trigonometry)

Learning Outcomes

At the end of the course students should be able to:

1. describe basic definition of set, subset, union, intersection, complements and use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;

4. describe various types of numbers; and
5. solve some problems using Binomial theorem.

Course Contents
Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers; integers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem. Complex numbers; algebra of complex numbers; the Argand diagram. De-Moivre's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 102: Elementary Mathematics II (2 Units C: LH 30)
(Calculus)

Learning Outcomes
At the end of the course students should be able to:
1. recall types of rules in Differentiation and Integration;
2. recall the meaning of Function of a real variable, graphs, limits and continuity; and
3. solve some applications of definite integrals in areas and volumes.

Course Contents
Function of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation. Extreme curve sketching; Integration as an inverse of differentiation. Methods of integration, Definite integrals. Application to areas, volumes.

PHY 101: General Physics I (Mechanics) (2 Units C: LH 30)

Learning Outcomes
On Completion of the course, the student should be able to:
1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems based on the fundamental laws of mechanics;
4. apply newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents
Space and time; units and dimension. Vectors and scalars. Differentiation of vectors: displacement, velocity and acceleration; kinematics. Newton laws of motion (Inertial frames, Impulse, force and action at a distance, momentum conservation). Relative motion. Application of Newtonian mechanics. Equations of motion. Conservation principles in physics. Conservative forces, conservation of linear momentum, Kinetic energy and work, Potential energy, System of particles, Centre of mass; Rotational motion; Torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; Circular motion; Moments of inertia, gyroscopes and precession; Gravitation: Newton's Law of

Gravitation, Kepler's Laws of Planetary Motion, Gravitational Potential Energy, Escape velocity, Satellites motion and orbits.

PHY 102: General Physics II (Electricity & Magnetism) (2 Units C: LH 30)

Learning Outcomes

At the end of the course the students should be able to:

1. describe the electric field and potential, and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law and electric potential;
3. describe and determine the magnetic field for steady and moving charges;
4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. describe electromagnetic induction and related concepts, and make calculations using Faraday's and Lenz's laws;
6. explain the basic physical of Maxwell's equations in integral form;
7. evaluate DC circuits to determine the electrical parameters; and
8. determine the characteristics of AC voltages and currents in resistors, capacitors, and inductors.

Course Contents

Forces in nature; Electrostatics; electric charge and its properties, methods of charging; Coulomb's law and superposition; electric field and potential; Gauss's law; Capacitance; Electric dipoles; Energy in electric fields; Conductors and insulators, current, voltage and resistance, Ohm's law and analysis of DC circuits; Magnetic fields; Lorentz force; Biot-Savart and Ampère's laws; magnetic dipoles; Dielectrics; Energy in magnetic fields; Electromotive force; Electromagnetic induction; Self and mutual inductances; Faraday's and Lenz's laws; Step up and step down transformers: Maxwell's equations; Electromagnetic oscillations and waves; AC voltages and currents applied to inductors, capacitors, resistance, and combinations.

PHY 107: General Practical Physics I (1 Unit C: PH 45)

Learning Outcomes

On completion, the student should be able to:

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents

This introductory course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques will be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity and many others covered in PHY 101 and PHY 102. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

PHY 108: General Practical Physics II (1 Unit C: PH 45)
This is a continuation of the experiments designed for PHY 101 and PHY 102 some of which have been covered under PHY 107.

PCY 101: Introduction to Pharmacy (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, the student should be able to:
1. define the role of Pharmacists in health services;
2. identify opportunities in various practice areas of Pharmacy;
3. identify various disciplines of Pharmacy;
4. interpret prescriptions; and
5. identify different dosage forms.

Course Contents
Orientation to Pharmacy - the role of a Pharmacist in health services. Opportunities in Pharmacy. History of pharmacy. Evolution of the Pharmacy profession. Various disciplines of Pharmacy. Stages in the development of a new drug. Concept of dosage forms. The prescription.

200 Level Courses

GST 212: Philosophy, Logic, Environment and Sustainable Development (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. analyse the concept of humanity, its origin, philosophy and cosmic environment;
2. improve their logical and critical thinking skills;
3. identify the basic roles of science and technology in human society;
4. describe renewable and non-renewable environmental resources available in the Nigerian society;
5. identify resource conservation tools and techniques for sustainable environment;
6. analyse environmental effects of plastics, and other wastes;
7. suggest possible management techniques and solutions to identifiable environmental challenges faced in different areas of the Nigerian society; and
8. list and describe unethical behaviour patterns that can hinder human societal growth and development.

Course Contents
Concept of humanity, its origin, philosophy and cosmic environment. Concepts and techniques in logic and critical thinking. Science and technology in human society and services. Renewable and non-renewable environmental resources. Climate change and the principle of sustainable development. Environmental effects of plastics, and other waste products. Elements of environmental studies for productive, safe and healthy living. Environmental Challenges – urbanisation, environmental pollution and degradation, soil erosion, desert encroachment, soil degradation and flooding. National Development Plans towards sustainable environment. Trends in global action towards environmental sustainability.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students should be able to:

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation, and risk taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment, and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe stages in enterprise formation, partnership and networking including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. state the basic principles of e-commerce.

Course Contents

Concept of Entrepreneurship (Entrepreneurship, Intrapreneurship/Corporate Entrepreneurship). Theories, rationale and relevance of Entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship and creative destruction). Characteristics of Entrepreneurs (Opportunity seeker, Risk taker, Natural and Nurtured, Problem solver and change agent, Innovator and creative thinker). Entrepreneurial thinking (Critical thinking, Reflective thinking, and Creative thinking). Innovation (Concept of innovation, Dimensions of innovation, Change and innovation, Knowledge and innovation). Enterprise formation, partnership and networking (Basics of Business Plan, Forms of business ownership, Business registration and Forming alliances and joint ventures). Contemporary Entrepreneurship Issues (Knowledge, Skills and Technology, Intellectual property, Virtual office, Networking). Entrepreneurship in Nigeria (Biography of inspirational Entrepreneurs, Youth and women entrepreneurship, Entrepreneurship support institutions, Youth enterprise networks and Environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

ANA 201: Basic Anatomy (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe the basic organization of the human body;
2. describe the gross and microscopic structure of different organ systems; and
3. explain structure-function correlation.

Course Contents

Basic organization of the human body: A study of human biological structure at various levels of complexity: from sub-cellular to gross and microscopic structure of individual organ systems. Structure-function correlations are emphasized. Integumentary system. Circulatory system.

Lymphoid system. Alimentary system. Musculoskeletal system. Respiratory system. Urinary system. Genital system. Endocrine system. Organs of special senses.

ANA 202: Neuroanatomy (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe the structural organization of the nervous system;
2. describe the spinal cord, and the brain;
3. describe the peripheral nervous system;
4. discuss general embryology, teratology and genetic anatomy; and
5. explain the influence of drugs on foetal development.

Course Contents

Basic structural organization of the nervous system: The neuron (Soma and neurites). Centralization and Telencephalization. Neural Circuitry (receptors, effectors and the synapse). Fate of the Neural Crest. Spinal Cord: general topography, grey matter, ascending and descending pathways. Brain: general topography; brainstem, cerebellum, diencephalon, cerebrum. Meninges and ventricular system. Pia, arachnoid & duramatera. Secretion and circulation of cerebrospinal fluid. Blood-brain barrier. Peripheral nervous system; basic plan, afferent and efferent cerebrospinal peripheral nerve endings, ganglia. Autonomic nervous system; Basic plan; sympathetic system, parasympathetic system, autonomic effector endings. General Embryology, Teratology and Genetic Anatomy. General embryology - Male gamete, female gamete, fertilization (gametogenesis). Development of early embryo and developmental malformations.

Systemic embryology - musculoskeletal system, respiratory system, cardiovascular system, nervous system, urogenital system, and developmental malformations.

Genetic anatomy - genetic apparatus, and genetically related malformations. Influence of drugs on development.

ANA 203: Histology (1 Unit C: LH 15)

Learning Outcomes

At the end of the course, the students should be able to:

1. explain the histology of lymphatic, alimentary and reproductive systems; and
2. describe the histology of the exocrine glands and organs of special senses.

Course Contents

The Tissues. The lymphatic system. The alimentary system. The exocrine glands. The urinary glands. The reproductive system. Organs of special senses. This will involve the use of plastic models and slides for Histology and class demonstrations.

BCH 201: Biochemistry (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. list the importance of biochemistry in health sciences;
2. explain the structure and function of proteins;
3. describe digestion, absorption and transport across membranes; and
4. describe metabolism of carbohydrates, lipids, and amino acids.

Course Contents

Importance of biochemistry to the health Sciences - levels of medical care and biochemistry. Membranes and cell structure techniques used in biochemistry and medicine. Protein structure and function- primary, secondary and tertiary structure of proteins in blood. Digestion, absorption and transport across membranes. Protein calorie malnutrition.

Metabolism - introduction of the study of intermediary metabolism. Carbohydrate chemistry, digestion, absorption and metabolism. Lipid chemistry, digestion, and metabolism including phospholipids and prostaglandins. Lipidoses. Metabolism of amino acids. Amino acid degradation and biosynthesis. Essential and non-essential amino acids. Ketogenic and glucogenic amino acids.

Practicals: Relevant experiments to demonstrate absorption and transport across membranes.

BCH 202: Introductory Molecular Biology (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe nucleic acids and their structure;
2. explain genes and heredity, DNA replication and cell division;
3. define recombinant DNA technology and list its uses;
4. describe protein synthesis, hormones and their actions; and
5. name significant biochemical transformations of medical importance.

Course Contents

Nucleic acids - DNA, RNA and elementary treatment of their structure. Biochemistry of heredity. Discovery and properties of the genetic materials, DNA replication and cell division. Cloning and recombinant DNA Technology. Mutagens and mutation. Mechanism of protein synthesis. Biochemistry of hormones and hormonal action to include actions of cyclic-AMP, cyclic-GMP, adrenaline, glucagon and insulin. Detoxification mechanisms including cytochrome P_{450} and other isoforms. Haem degradation and other significant biochemical transformation of medical importance.

Practicals: Relevant experiments to demonstrate protein and nucleic acid synthesis.

PIO 201: Introductory and Blood Physiology (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe cell physiology and transport system; and
2. discuss physiology of the cardiovascular, respiratory, renal, gastrointestinal and endocrine systems.

Course Contents
Body fluids. Cell Physiology. Transport System. Excitable cells. Contractile tissues. Homoestasis. Control systems. Blood. Introductory autonomic nervous system.
Cardiovascular and Respiratory Physiology: Cardiovascular physiology. Cardiac muscle. E.C.G., Haemodynamics. Systemic circulation. Events in cardiac cycle. Heart rate and its control. Blood pressure. Cardiac output. Introduction to mechanics of respiration. Lung volumes. Gas tensions. Oxygen Transport. Oxygen dissociation curve. Carbon dioxide transport. Carbon dioxide dissociation curve. Nervous regulation of respiration. Chemoreceptors. Hypoxia, hyperpnoea, apnoea. Periodic respiration. Dyspnea. Cyanosis.
Renal, Gastrointestinal and Endocrine Physiology: Introductory renal anatomy. Glomerular filtration and clearance. Tubular reabsorption, T_m. Countercurrent mechanism. E.C.F. Regulation. Dilute and concentrated urine output. Micturition. Renal hormones. Renin-Angiotensin system. Mastication. Deglutition. Salivation. Stomach and its emptying. Small intestine. Large intestine. Salivary, gastric and pancreatic juices. Reflexes. Digestion, absorption and assimilation. Bile. Thyroid, parathyroid and calcium metabolism. Pituitary gland. Adenohypophysis, neurohypophysis, adrenal cortex and medulla. Pancreas, thymus, pineal gland. Male and female reproductive systems.

PIO 202: Neurophysiology and Special Senses (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe the organization of the CNS and its control systems;
2. explain the state of sleep, memory and learning;
3. discuss autonomic nervous system; and
4. describe special senses.

Course Contents
Neurophysiology: Organisation of the CNS and CNS control systems. Spinal reflexes. Excitation and Inhibition. Localization of functions in the cortex. Motor system. Pyramidal and extrapyramidal sensory systems. Reticular formation. Cerebellum: Control of posture. Neurobiology rhythms. Sleep and unconscious states. Memory, learning.
Autonomic Nervous System: Parasympathetic and sympathetic neuroeffectors. Cholinergic mechanisms. Adrenergic mechanisms. Autonomic reflexes. Adrenal medulla. Autonomic drugs.
Special Senses: Eyeball: retina, sight, accommodation. Photochemical mechanism. Receptor potential. Light reflexes and adaptation. Ear: sound waves, hearing. Taste. Smell.
Practicals: Special exercises to illustrate various aspects of physiology treated above.

PCG 201: Introduction to Pharmacognosy (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of this course, the student should be able to:
1. describe the scope of Pharmacognosy;
2. define basic pharmcognostic terms;
3. classify crude drugs;
4. identify some natural drugs obtained from plant, animal and mineral sources;
5. list some unrefined drugs that aid recovery from diseases of man and animals; and

6. identify important factors involved in preparation of natural drugs for commerce.

Course Contents
Historical development and scope of Pharmacognosy. Terminologies used in Pharmacognosy. Classification of crude drugs: Vegetable Drugs: Alphabetically, morphologically, pharmacologically, and chemically. Plant description: Pharmacognostic profile of selected plants, – taxonomy, morphology, and anatomy. The cell differentiation and organic cell contents – carbohydrates, proteins, fixed oils, gums and mucilages with emphasis on those used in phytotherapy and pharmacy as excipients and pharmaceuticals, as phytocosmetics and nutraceuticals. Biological and geographical sources and other indigenous uses of medicinal plant drugs – crude drugs, animal origin: honey, cod liver oil, spermaceti, cantharides, python fat and shellac. Crude drugs of mineral origin: geophagic clay and bentonite with reference to Nigerian sources. Evaluation of crude drug: Organoleptic, microscopic, macroscopic and chemomicroscopy. Substitution of official crude drug. Field trip. Factors involved in production of plant drugs for commerce: climate, cultivated and wild, collection, adulteration, and plant pests. Practical: Introduction of whole and powdered parts of the crude drugs for evaluation; Plant drug (macroscopy, and organoleptic characters) microscopical examination of powders. Longitudinal section (L.S) and Transverse section (T.S) of the morphological part. Chemical and Limit tests for others. Field trip/study tour is necessary and is usually scored.

PCH 201: Physical Pharmaceutical Chemistry (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. state the principles of thermodynamics;
2. explain chemical and ionic equilibria; and
3. list the effect of these on the feasibility of drug synthesis and solubility.

Course Contents
Review of principles of thermodynamics, chemical and ionic equilibria. Chemical kinetics relevant to pharmacy, effect of these on the feasibility of drug synthesis, mixing, solubility. Biological redox systems.
Practicals: Conduct relevant experiments on mixing, solubility, drug synthesis and many others.

PCH 202: Inorganic Pharmaceutical Chemistry (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. explain atomic and molecular structures;
2. explain the chemical and physical properties of inorganic elements and compounds and their uses in pharmacy and medicine; and
3. differentiate between normality and molarity.

Course Contents
Atomic and Molecular Structure: Electronic structure of atoms and molecules. Relationship between the electronic structure of elements and the formation of covalent, ionic and coordinative (dative) bonds. Nature and pharmaceutically important application of co-ordination compounds, metal complexes and chelating agents.

Comparative study of the physico-chemical properties, preparation and uses of the elements of the periodic table and their compounds of pharmaceutical importance.
Practicals: Conduct relevant experiments pertaining to physico-chemical properties of compounds of pharmaceutical importance.

PCT 201: Pharmaceutics (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. recall the fundamental operations in weighing;
2. recognize errors in measurements and measuring techniques; and
3. describe the ethics of dispensing and identify different types of labels for the presentation of products.

Course Contents
Fundamental operations in weighing: Errors in using dispensing balances. Minimum weighable amounts and weighing techniques. Conical and beaker shaped measures for dispensing liquids. Errors in measurements and measuring technique. Household measures and weighing of small amounts of materials.
Ethics of dispensing and presentation of products: General dispensing procedure. The prescription. Information given on the labels of dispensed medicines. Presentation of information on labels. Additional labels.

PCT 202: Pharmaceutical Preparations and Calculations
(2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. employ various calculations applicable to pharmaceutical preparations;
2. describe types of pharmaceutical preparations;
3. list pharmaceutical solutions; and
4. identify factors affecting the solubilities of pharmaceutical solutions.

Course Contents
Percentages, proportional calculations and allegation. Calculations involving very small quantities. Types of Pharmaceutical preparations: Solutions, mixtures, linctuses, syrups, elixirs, oral liquids, emulsions, applications, lotions, gargles, mouth washes, nasal and ear drops. Divided and bulk powders, granules, cachets, capsules and tablets and many others.
Pharmaceutical solutions and solubility. Factors affecting solubility. Solutions of liquids in liquids. Distribution of solutes between immiscible liquids and applications of the distribution law in pharmacy. Colligative properties of solutions.
Phase equilibria: The phase rule. Systems of one and two components and applications in pharmacy, such as eutectic mixtures and sublimation (freeze drying).

PCT 203: Dispensing Practical I (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. use simple dispensing techniques;
2. prepare simple solutions; and
3. use appropriate packaging and labeling requirements for simple solutions.

Course Contents
Introduction to dispensing, packaging and labelling requirements for dispensing, containers and closures. Weighing techniques, measurement of volumes, techniques in unit operations, trituration and mixing of solids. Preparation of simple solutions. Dilutions of simple solutions, syrup and aromatic waters.

PCT 204: Dispensing Practical II (1 Units C: PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. prepare elixirs, syrups, mixtures, and suspensions;
2. conduct measurements using aliquot methods; and
3. prepare different types of pharmaceutical powders.

Course Contents
Preparation of Liquid dosage forms, compounding, and dispensing of drugs, extemporaneous and bulk preparation of mixtures of liquids and solid drug ingredients. Preparation of collodions and paints, gargles, inhalants and drops (nasal and eye). Preparation of pharmaceutical powders (bulk, compound and divided). Prescription reading.

PHM 201: Introduction to Pharmaceutical Microbiology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. list the characteristics, and classify microorganisms;
2. state the nutritional requirements of bacteria, and identify culture media;
3. identify fungi, molds, viruses, other atypical organisms and parasites of public health importance; and
4. recognise basic techniques of culturing, isolation, identification and counting of bacteria.

Course Contents
Historical development of microbiology and the effects on health. General structure of the bacterial cell. The bacterial spore, its structure and resistance to inactivating agents. Systematic classification of bacteria and characteristics of major groups – Taxonomy. Protoplasts, spheroplasts and L-Forms. Nutritional requirements and growth of bacteria. Bacterial culture media and evolution of pure culture technique. Enumeration of microorganisms. Fungi and molds; their importance in pharmacy, and medicine. The Richettstia, Chlamydia, Viruses (including HIV/AIDS) and viral replication. Introductory parasitology. Protozoal parasites of Public Health importance.

Practical - Laboratory exposure for handling, identification and growing of microorganisms. Experiments to bring out other salient parts of the course.

300 Level Courses

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe roles of international organisations, media and traditional institutions in peace building.

Course Contents

Concepts of Peace, Conflict and Security in a multi-ethnic nation. Types and Theories of Conflicts: Ethnic, Religious, Economic, Geo-political Conflicts; Structural Conflict Theory, Realist Theory of Conflict, Frustration-Aggression Conflict Theory. Root causes of Conflict and Violence in Africa: Indigene and settlers Phenomenon; Boundaries/boarder disputes; Political disputes; Ethnic disputes and rivalries; Economic Inequalities; Social disputes; Nationalist Movements and Agitations; Selected Conflict Case Studies – Tiv-Junkun; Zangon Kataf, Chieftaincy and Land disputes. Peace Building, Management of Conflicts and Security: Peace and Human Development. Approaches to Peace and Conflict Management --- (Religious, Government, Community Leaders). Elements of Peace Studies and Conflict Resolution: Conflict dynamics assessment Scales: Constructive and Destructive. Justice and Legal framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and Terrorism. Peace Mediation and Peace Keeping. Peace and Security Council (International, National and Local levels) Agents of Conflict resolution – Conventions, Treaties, Community Policing: Evolution and Imperatives. Alternative Dispute Resolution (ADR). a) Dialogue b). Arbitration, c). Negotiation d). Collaboration. Roles of International Organizations in Conflict Resolution. (a). The United Nations, UN and its Conflict Resolution Organs. (b). The African Union and Peace Security Council (c). ECOWAS in Peace Keeping. Media and Traditional Institutions in Peace Building. Managing Post-Conflict Situations/Crisis: Refugees. Internally Displaced Persons (IDPs). The role of NGOs in Post-Conflict Situations/Crisis.

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students, through case studies and practical approaches, should be able to:

1. describe the key steps in venture creation;
2. identify opportunities in problems and in high potential sectors regardless of geographical location;
3. state how original products, ideas, and concepts are developed;
4. develop business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;

6. implement the requirements for establishing and managing micro and small enterprises;
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity Identification (Sources of business opportunities in Nigeria, Environmental scanning, Demand and supply gap/unmet needs/market gaps/market research, Unutilised resources, Social and climate conditions and Technology adoption gap). New business development (business planning, market research). Entrepreneurial Finance (Venture capital, Equity finance, Micro finance, Personal savings, Small business investment organisations and Business plan competition). Entrepreneurial marketing and e-commerce (Principles of marketing, Customer Acquisition and Retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, E-commerce business models and Successful E-Commerce Companies,). Small Business Management/Family Business: Leadership and Management, Basic book-keeping, Nature of family business and Family Business Growth Model. Negotiation and Business communication (Strategy and tactics of negotiation/bargaining, Traditional and modern business communication methods). Opportunity Discovery Demonstrations (Business idea generation presentations, Business idea Contest, Brainstorming sessions, Idea pitching). Technological Solutions (The Concept of Market/Customer Solution, Customer Solution and Emerging Technologies, Business Applications of New Technologies - Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoTs), Blockchain, Cloud Computing, Renewable Energy. Digital Business and E-Commerce Strategies).

PAA 399: Students Industrial Work Experience (SIWES) (3 Units C: PH 12 weeks)

Learning Outcomes

At the end of the course, students should be able to:

1. prepare to handle industrial work they will likely meet after graduation;
2. familiarise themselves with methods and techniques in handling equipment and machinery that may not be available in their institutions; and
3. transit from school to workplace easily.

Course Contents

This is a supervised work-experience progress of approximately three months' duration, commencing with the long vacation (following the end of the 300 level second semester examinations) as determined by the university calendar. During the programme, students are attached to pharmaceutical establishments including drug manufacturing units, hospital pharmacies, community pharmacies and many others. Each student keeps a record of his/her training and experience during the programme in a logbook and is visited for supervisory purposes by an academic staff member from the faculty. In addition, an experienced pharmacist located in the pharmaceutical establishment to which the student is attached provides day-to-day supervision.

CLI 301: Biopharmaceutics and Pharmacokinetics (3 Units C: LH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe the fate of a drug after administration;
2. describe pharmacokinetic parameters and learn their calculations;
3. identify different dosage regimens including prolonged dosage form administration and their applications in therapy; and
4. discuss the relationship between pharmacokinetic parameters and pharmacologic response.

Course Contents
Definition of terminologies and symbols used in pharmacokinetics. Fate of drugs after administration. Physical significance of drug concentration in the blood. Biological factors in drug absorption. Physicochemical factors affecting drug absorption. Dosage form consideration in gastrointestinal absorption. Drug-drug and drug-food interactions. Bioavailability and bioequivalence with emphasis on product registration with regulatory bodies. Problems associated with pre-formulation of drugs and the design of dosage forms from an industrial perspective. Compartment models: single and multiple compartment models. Drug clearance. Hepatic elimination of drugs. Intravenous infusions. Multiple dosage regimens. Prolonged action dosage form administration. Non-linear pharmacokinetics. Relationship between pharmacokinetic parameters and pharmacologic response. Calculation of various pharmacokinetic parameters.

CLI 302: Health Psychology (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, the students should be able to:
1. enumerate the general principles of psychology;
2. describe medical sociology;
3. explain the role of psychology in healthcare delivery; and
4. list the psychological factors in anxiety, depression and psychosomatic illnesses.

Course Contents
General principles of psychology. Medical sociology. Role of psychology in healthcare delivery. Management of aggression and stress. Psychological factors in anxiety, depression and psychosomatic illnesses.

PCG 301: Pharmacognosy I (2 Units C: LH 15; PH 45)

Learning Outcomes
At the end of the course the students should be able to:
1. identify natural sources and uses of resins and oleoresins;
2. recall ethnomedicinal uses and ethnobotanical sources of phytoenzymes;
3. classify and evaluate surgical fibers and sutures; and
4. describe pharmacognosical profile of toxicants of higher plants.

Course Contents
Resins and Oleoresins: Introduction, classification, active constituents and pharmacological uses of turpentine, benzoin, cannabis, myrrh and balsam enzymes: Enzymes obtained from plant sources (phytoenzymes) Papain, Bromelain and malt extract. Enzymes obtained from animal sources, renin, pepsin, pancreatin and pancrelipase. Surgical Dressings: Classification of fibers as vegetable, animal and synthetic fibers. Evaluation of fibers and sutures with discussion based on official compendia (BPC). Natural Toxicants: Plant toxicants, Description, Pharmacognostic features, pharmacological actions, chemical constituents, treatment and prevention. *Abrus precatorius*, Eucalyptus spp. *Nicotiana tabacum*, *Papaver sominiferum* and *Datura metel*. Plant collection, preparation and storage of hebarium specimens. Standardization/evaluation of crude drugs with particular emphasis on chemical constituents, adulteration and substitution, microbial contamination, toxic residues, moisture content, ash values, extractive values, crude fibers, and other numerical values of crude drugs. Formulation and production of phytomedicines of some Nigerian medicinal plants. Physico-chemical characteristics and assessment of quality of the phytomedicines.
Practicals: Conduct relevant experiments pertaining to identification of sources and uses of resins and oleoresins, evaluate surgical fibers and sutures, standardization and evaluation of crude drugs.

PCG 302: Pharmacognosy II (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course the student should be able to:
1. recognize the current state of herbal medicine globally;
2. prepare monograghs, and herbarium specimens;
3. explain the principles involved in formulation of phytomedicines into dosage forms; and
4. assess herbal medicines for quality, efficacy, and safety.

Course Contents
History and present state of herbal medicines. The practitioners. The plant – collection, drying and storage, pests and pesticides. Hebarium: Hebarium specimen and voucher numbers. Research findings and documentation of medicinal plants. Selected examples of Nigerian medicinal plants: local names, geographical sources, macroscopy microscopy, ethnomedicinal uses, chemical constituents and toxicity profile. Preparation of Monograph of medicinal plants. Effective use of Herbal Pharmacopoiae. Examples will be taken from the following areas: antimalarials, antisicklings, antihypertensives, antidiabetics, antimicrobials. Toxic special plants – hallucinogens, allergens and molluscicides. Phytochemical principles involved in formulation of phytomedicines and nutraceuticals. Physicochemical and pharmacological assessment of quality, efficacy and safety of medicinal plants.
Practicals: Conduct relevant experiments pertaining to collection, drying and storage of plant materials, prepare monographs and hebarium specimens.

PCH 301: Organic Pharmaceutical Chemistry (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. synthesis and relate functional groups of compounds to physical and chemical properties and the application of these groups in Pharmacy;

2. write the structure and discuss the chemistry of heterocyclic compounds especially those being used as drugs and Pharmaceuticals; and
3. synthesise some drugs.

Course Contents
Reactivity of organic compounds. General review of the concept of aromaticity in benzene and how this affects substitution in such structures. General review of organic reactions leading to interconversion and modification of functional groups through nucleophilic and electrophilic substitution, elimination, addition and rearrangement reactions. Utilization of these reactions for isolation, characterisation, elucidation of structure and synthesis of medicinal products.
Stereochemistry - Review of total concept of stereoisomerism as distinct from isomerisms of other types. Optical and geometrical isomerism. Chiral and achiral molecules. Resolution of racaemic mixtures and importance in Pharmacy. Optical rotatory dispersion and its uses. Importance of stereochemistry in terpenes.
Practical: Organic synthesis of medicinal compounds such as preparation of benzocaine (Ethyl-p-aminobenzoate), preparation of aspirin, preparation of sulphanilamides.

PCH 302: Pharmaceutical Analysis I (Non-Instrumental Methods) (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, students should be able to:
1. explain Official standards for active pharmaceutical ingredients (APIs) and formulated products;
2. describe Limit tests; and
3. identify sources of impurities in pharmaceuticals.

Course Contents
Official standards for pharmaceutical chemicals and formulated products. Drug description - solubility, test for identity, physical constants. Qualitative and quantitative assays of pure chemical entities in the case of pharmaceutical chemicals, or of the active pharmaceutical ingredients (APIs) in the case of formulated product. Limit tests. Sources of impurities in pharmaceuticals.
Practicals: Qualitative and quantitative assays of pure chemical entities, active pharmaceutical ingredients, limit tests and determination of sources of impurities in pharmaceuticals.

PCT 301: Physical Pharmaceutics I (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course the student should be able to:
1. describe adsorption and its mechanism;
2. explain surface and interfacial phenomena;
3. describe micelle formation and recall methods for the determination of the critical micelle concentration (CMC); and
4. classify colloids and enumerate properties of colloidal solutions.

Course Contents
Adsorption: The mechanism of adsorption: The Langmuir and Brunauer-Emmett-Teller (BET) isotherms. Chemisorption and factors affecting the amount adsorbed. Application of adsorption in pharmacy.
Surface and Interfacial Phenomena: Surface tension, contact angle and the wetting of solids. Spreading of one liquid over another. Mechanism of capillary rise and effect of temperature. Method of determining surface tension. Surface active agents and their classification. Pharmaceutical applications and medicinal importance of surface active agents. Bulk properties of surfactant solutions. Micelle formation and methods for the determination of the Critical Micelle Concentration (C.M.C.). Factors affecting micelles. Stability of micelles. Solubilization. Factors affecting solubilization, and pharmaceutical applications of solubilization.
Colloidal systems. Classification of colloids. Properties of colloidal solutions. Preparation of lyophobic solutions. Stability of lyophobic colloids.
Practicals: Conduct relevant experiments relating to: mechanism of adsorption illustrating the Langmuir and Brunauer-Emmett-Teller (BET) isotherms, Surface and interfacial phenomena, determine surface tension and contact angle of liquids, Micelle formation and methods for the determination of the Critical Micelle Concentration (C.M.C.).

PCT 302: Rheology (1 Unit C: LH 15)

Learning Outcomes
At the end of the course the student should be able to:
1. describe flow characteristics of Newtonian fluids and effect of temperature on them; and
2. enumerate rheological properties of suspensions, emulsions, ointments and creams.

Course Contents
Newtonian fluids. Flow characteristics of Newtonian fluids and effect of temperature. Determination of viscosity - principles of capillary tube, Redwood and falling sphere viscometers, rotational viscometers. The flow properties of disperse systems and viscosity coefficients of collodial dispersions. Viscosity imparting agents in pharmacy. Non-Newtonian fluids. Plastic, pseudoplastic and dilatant flows. Thixotropic systems. Rheological properties of suspensions, emulsions, ointments and creams. Mechanism of fluid flow. Significance of Reynold's number. Distribution of velocities across a tube and boundary layers.

PCT 303: Dispensing Practical III (1 Unit C: PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. prepare mixtures and suspensions;
2. carry out measurements using aliquot methods; and
3. prepare different types of pharmaceutical powders.

Course Contents
Preparation of Liquid dosage forms -mixtures, suspensions, compounding, and dispensing of drugs, extemporaneous and bulk preparation of mixtures of liquids and solid drug ingredients. Prescription reading.

PCT 304: Physical Pharmaceutics II (2 Units C: LH 30)

Learning Outcomes

At the end of the course the student should be able to:

1. list the factors affecting filtration and explain its mechanism;
2. describe filter media and aids;
3. enumerate principles of centrifugation;
4. compare flocculated and deflocculated systems;
5. differentiate and identify emulsion types;
6. identify different types of creams, ointments, pastes, gels and their preparations; and
7. describe suppositories and pessaries, their methods of preparation and packaging.

Course Contents

Filtration: factors affecting filtration. Mechanism of filtration. Filter media and aids. Filtration equipment (continuous rotary vacuum filter, the filter press and the edge filters).

Centrifugation: principles of centrifugation. Laboratory and large-scale centrifuges. Dispersed systems: Suspensions: factors affecting the preparation of a physically stable suspension. Flocculated and deflocculated systems. Caking and resuspension. Sedimentation behaviour of flocculated and deflocculated suspensions. Pharmaceutical applications of suspensions. Colouring agents used in the formulation of suspensions.

Emulsions and emulsification: types of emulsion and testing of emulsion types. Theories of emulsions (Bancroft Harben's oriented wedge and the complex film theories). Emulsifying agents and their classification. Methods available for the preparation of emulsions. Preservation and stability of emulsions. Concept of hydrophilic-lipophilic balance (HLB). Formation of emulsions by HLB methods. Methods for determining HLB numbers. Semi-solid emulsions.

Creams - types and preparations.

Ointments - types of ointment bases and methods of preparation.

Pastes - their bases and method of preparation.

Jellies and Poultices - Kaolin Poultice B.P.C.

Gels: The structure and properties of gels. Application of gels in pharmacy.

Suppositories and pessaries: Methods of their preparation. Shapes and size properties of an ideal suppository base. Types of suppository bases. General methods of preparation of suppositories and their packaging.

PCT 306: Dispensing Practical IV (1 Unit C: PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. prepare emulsions, semi-solid dosage forms, suppositories and dispense these preparations to Out-patients and In-patients; and
2. read prescriptions, compound and dispense drugs.

Course Contents

Emulsions, lotions, liniments, semi-solid dosage forms, suppositories, prescription reading, compounding, and dispensing of drugs.

PHA 301: General Principles of Pharmacology (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe the basic principles and concepts in pharmacology;
2. describe methods and measurements in pharmacology;
3. explain process of drug development and clinical trials;
4. discuss pharmacokinetic processes that a drug undergoes in the body;
5. describe mechanisms of drug action, factors affecting drug action, dose-response relationships and to differentiate between agonists and antagonists; and
6. describe drug toxicity and adverse drug reactions.

Course Contents

Definition of pharmacology. Scope and sub-divisions of pharmacology. Methods and measurements in pharmacology: Drug development and evaluation. Biological assays. Clinical trials. Measurement and evaluation of toxicity. Pharmacokinetics: routes of drug administration, kinetics of drug absorption, distribution. Blood-brain-barrier, placental barrier, biotransformation and elimination. Pharmacodynamics: mechanisms of drug action, drug receptors, signal transduction and second messengers, selectivity of drug action, factors affecting drug action in man, dose-response relationships, agonists, antagonists and their interactions with receptors. Drug toxicity and adverse drug reactions.

Practicals: Conduct relevant experiments pertaining to methods and measurements in pharmacology, bioassays, measurements and evaluation of toxicity, routes of drug administration.

PHA 302: Autonomic/Neuropharmacology (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. identify the mechanisms of actions of drugs on the ANS;
2. describe the synthesis, release and degradation of acetylcholine, the structure – activity relationship for cholinergic agonists and antagonists;
3. describe mechanism of action, pharmacological actions, and adverse effects; of cholinergic agonists and antagonists and their therapeutic applications;
4. describe synthesis, release, uptake and metabolism of noradrenaline;
5. classify different adrenergic receptors and identify their locations;
6. explain the mechanism of action, pharmacological actions and adverse effects of adrenergic agonists and antagonists and their therapeutic applications; and
7. discuss effect of drugs on some systems of the body and their therapeutic applications.

Course Contents

Review of the anatomy and physiology of the autonomic and somatic nervous systems. General principles of neurohumoral transmission.

Cholinergic transmission: Synthesis, storage and release of acetylcholine. Muscarinic and nicotinic actions of acetylcholine. Muscarinic receptor agonists and antagonists. Cholinesterases and anticholinesterases. Drugs used in myasthenia gravis. Drugs affecting autonomic ganglia. Neuromuscular blocking agents.

Adrenergic transmission: Synthesis, storage, release and inactivation of noradrenaline. Neuronal and extraneuronal uptake mechanisms. Sympathomimetic amines. Adrenergic neuron blocking

drugs. Drugs affecting the storage, release and disposition of neurotransmitters. Adrenoceptor blocking agents (alpha and beta blockers). Methods of studying neurotransmitters. Nitric oxide (NO) and non-adrenergic non-cholinergic (NANC) transmission.
Histamine and 5-Hydroxytryptamine (5-HT): Synthesis and metabolism; receptors, physiological functions. Antihistamines and 5-HT antagonists and their clinical applications.
Systemic Pharmacology: Ocular Pharmacology: - Miotics and mydriatics. Drugs used in glaucoma. Ophthalmological diagnostic agents. Respiratory Pharmacology: - Asthma and anti-asthmatic drugs. Expectorants, mucolytics and antitussives. Gastrointestinal pharmacology: - Laxatives and purgatives. Anti-diarrhoeal drugs. Oral rehydration therapy. Anti-peptic ulcer drugs. Spasmolytics, emetics and anti-emetics.
Renal Pharmacology: - Diuretics: osmotic diuretics, carbonic anhydrase inhibitors, thiazides, loop diuretics, potassium sparing diuretics. Urine-pH altering agents.
Practicals: Conduct relevant experiments pertaining to pharmacologic actions and adverse effects of cholinergic, adrenergic agonists and antagonists. The effect of drugs on selected systems of the body (cardiovascular, gastrointestinal and renal systems)

PHM 301: Pharmaceutical Microbiology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. list the factors affecting microbial death;
2. describe the production and storage of water; and
3. identify sources of microbial contamination of pharmaceuticals.

Course Contents
Production and storage of water. Quality determination. Parenteral products. Pyrogens and pyrogen testing. Evaluation of microbial contents of pharmaceutical preparations and products. Sources of microbial contamination of Pharmaceuticals. Hospital and Factory sanitation and Hygiene.
Practicals: Conduct relevant experiments pertaining to identification of sources of microbial contamination of pharmaceuticals.

SAP 301: Pharmacy Administration I (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. recall and apply management principles in pharmacy practice;
2. generate and develop business ideas; and
3. select an appropriate business location.

Course Contents
Definition of pharmacy business, management and administration. Management process. Importance of management in pharmacy business (customers/patients/public relationship, retail competition, selling and promotion in hospital and community pharmacies). Industrial pharmaceutical organisations (medical and sales representative). Marketing (concept, functions, marketing mix and communication, product growth, salesmanship). Advertising and sales promotion. Personnel management (leadership, recruitment, renumeration, negotiation, staff training, evaluation, motivation and management). Entrepreneurial Development - Generating

and developing business ideas. Conducting market surveys. Preparing a business plan. Selecting a business location, including roads, water and electricity supplies, and appropriate technology for the business.

400 Level Courses

PAA 499: Students Industrial Work Experience (SIWES) (3 Units C: PH 12 weeks)

Learning Outcomes
At the end of the course, students should be able to:
1. prepare to handle industrial work they will likely meet after graduation;
2. familiarise themselves with methods and techniques in handling equipment and machinery that may not be available in their institutions; and
3. transit from school to workplace easily.

Course Contents
This is a supervised work-experience progress of approximately three months' duration, commencing with the long vacation (following the end of the 400 level second semester examinations) as determined by the university calendar.
During the programme, students are attached to pharmaceutical establishments including drug manufacturing units, hospital pharmacies, community pharmacies and many others.
Each student keeps a record of his/her training and experience during the programme in a logbook and is visited for supervisory purposes by an academic staff member from the Faculty. In addition, an experienced pharmacist located in the pharmaceutical establishment to which the student is attached provides day-to-day supervision.

BTG 401: Pharmaceutical Biotechnology I (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. appraise basic techniques in biotechnology;
2. describe the clinical importance of recombinant proteins;
3. explain the use of biotechnology in the production of monoclonal and recombinant antibodies, and vaccine development;
4. identify potential biotechnological products; and
5. appraise biotechnological products in current use.

Course Contents
Basic techniques in biotechnology – cutting and joining of DNA molecules. Cloning techniques. Construction of RNA structure. Screening methods. DNA analysis. Mutagenesis. Polymerase Chain Reaction (PCR). Clinical importance of recombinant proteins such as human insulin, growth hormones and interferon. Pharmaceutical immunology including but not limited to Engineering antibodies for therapy – production of monoclonal antibodies, recombinant antibodies and antibody fragment. Gene Therapy. Biotechnology in vaccines development – DNA vaccines, vaccine production by recombinant DNA for prevention of viral and bacterial infections. Identification of potential biotechnological products; plants and transgenic animals as potential

sources of recombinant biotechnological products. Characterization of expressed proteins. An overview of biotechnological products in current use.
Practicals: Conduct relevant experiments pertaining to basic techniques in biotechnology, identify potential biotechnological products and those in current use.

CLI 401: Introductory Clinical Pharmacy (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. outline the concept of clinical pharmacy;
2. define and utilise medical terms and abbreviations; and
3. obtain patient medication profile.

Course Contents
Introduction to clinical pharmacy. Principles of clinical pharmacy. Clinical pharmacy in the tropics. Use of medical terms and abbreviations. Patient medication profile.

CLI 402: Pharmaceutical Immunology and Vaccines (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. state the principles of immunology;
2. describe antigen/antibody reactions and their applications;
3. recognise the importance of bacterial and viral vaccines; and
4. describe immunization procedures.

Course Contents
Principles of immunology. Antigen/antibody reactions and applications. Antibody production. Antigen/antibody reaction – allergy. Immunological products. Immunization procedures. Bacterial and viral vaccines. Diagnostic reagents. Immuno-sera.

CLI 403: Essentials of Nutrition (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, the students should be able to:
1. recall the importance of nutrition to good health;
2. explain the use of nutritional products in therapeutics; and
3. describe the usefulness of total parenteral nutrition.

Course Contents
Nutrition and food health. Total parenteral nutrition in emergency cases such as shock, coma, and gastro-intestinal obstruction. Essential and non-essential amino acids formulation of total parental nutrition.

CLI 404: Clinical and Environmental Toxicology (2 Units C: LH 30)

Learning Outcomes
At the end of this course, the students should be able to:
1. describe toxicology and toxicant;
2. identify and describe the different toxins; and
3. describe the toxicity and management of poisoning by these toxins.

Course Contents
Definition of toxicology and toxicant. Management of acute drug poisoning. Plant, bacterial and animal poisoning. Solvent poisoning. Pesticides and herbicides. Radiation toxicology. Air-borne poisoning. Food additives and food poisoning. Poisoning caused by animal bites. Heavy metals and chelating agents. Toxicity of drug-drug interactions. Management of poisons.

PAT 401: Pathology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe the normal and the adopted cell;
2. explain cell injury and cell death, inflammation and repair;
3. discuss cancers and its clinical presentations; and
4. discuss the pathophysiology of immune diseases, some systemic diseases, infectious diseases, and deficiency disorders.

Course Contents
The normal cell and the adopted cell. Cell injury and cell death. Inflammation and repair. Neoplasia and its clinical aspects. Diseases of immunity. Systemic diseases: Diabetes mellitus, Iron storage disorders, Gout and urate deposits in the kidneys, Fluid and haemodynamic derangements. Infectious diseases. Deficiency diseases: protein-calorie malnutrition, vitamins and minerals deficiencies. Blood vessels and the heart. Lymph nodes and spleen. All systems: skin, liver, gastrointestinal tract, pancreas, breast and biliary tract.
Practicals: conduct relevant practicals pertaining to identification of normal and adopted cell, deficiencies in some disease states.

PAT 402: Pathophysiology I (2 Units C: LH 30)

Learning Outcomes
At the end of the course, students should be able to:
1. recall the various pathophysiological mechanisms of disease processes involved in the disease conditions treated which are vital for the drug use decision-making process; and
2. apply the scientific knowledge essential for the application of pharmaceutical care.

Course Contents
The pathophysiological changes occurring in disease conditions which include cardiac, pulmonary and vascular organ systems, metabolic and endocrine disorders, pathophysiology of gastrointestinal and hepatic disorders. Effect of liver disease on drug disposition. Principles of enteral and parenteral nutrition. Monitoring of therapeutic outcomes.

PCG 401: General Phytochemical Methods in Drug Analysis

(3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. use the equipment provided;
2. identify which of the equipment are applicable in natural products analysis; and
3. carry out simple analysis using paper and thin layer chromatography.

Course Contents

Plant collection, drying and processing. Extraction methods including marceration, percolation, Soxhlet and counter-current methods and other bioassay guided chemical tests. Separation and isolation of constituents. Chromatographic techniques- analytical and preparative (paper, conventional column, HPLC, GC, gel filtration, and affinity chromatography). Adsorbents in chromatography. Application in analysis of natural products include determination of iodine value, Saponification value, unsaponifiable matter, ester value and acid value. Chemical tests for lipids, agar, beeswax and gelatin.

Practicals: Conduct relevant practicals pertaining to extraction methods including maceration, percolation, demonstrate Soxhlet and counter-current methods and other bioassays, separation and isolation of constituents using chromatographic techniques.

PCG 402: Secondary Plant Metabolites (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe the biological sources, biosynthesis, chemical constituents, and identification tests for secondary plant metabolites; and
2. recall uses, side effects, precautionary measures, and control of the selected secondary metabolites that were discussed.

Course Contents

Sources, biosynthesis, chemical constituents, identification tests, medicinal uses and toxicities, side effects, precautionary measures and control of the following secondary metabolites: Glycosides. Saponins – steroids, triterpenoids, carotinoids and many others. Natural steroids for the production of pharmaceuticals Tannins and Galls. Anthraquinones – purgative drugs – biological sources. Cardiac glycosides- biological sources. Alkaloids – Tropane alkaloids (including cocaine), quinoline, isoquinoline, indole, steroids, alkaloid, glycosides. Indian hemp, and anticancer agents from plants and semi-synthetic products. Others – Coumarins and flavonoids.
Practicals: Conduct relevant practicals pertaining to identification of secondary metabolites.

PCH 401: Pharmaceutical Analysis II (Instrumental Methods)

(3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. describe and apply the principles of spectroscopic, chromatographic and other analytical techniques in quality control of medicines; and
2. perform qualitative and quantitative assay of drugs and other pharmaceuticals.

Course Contents
Absorption spectrophotometry. Infra-red (NIR, FTRI) spectroscopy. Fluorimetry. Atomic Absorption spectroscopy. Nuclear Magnetic Resonance (NMR) spectrometry, chromatographic methods (TLC, GC, LC and hyphenated systems). Mass spectrometry. Other methods such as Polarography, potentiometry; and polarimetry.
Practicals: Conduct relevant experiments pertaining to spectroscopic, chromatographic and other analytical techniques in quality control of medicines. Qualitative and quantitative assay of drugs and other pharmaceuticals.

PCH 402: Medicinal Chemistry I –Drug Design (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe physicochemical approaches to drug design; and
2. discuss the nomenclature, physical and chemical properties, SAR, synthesis, assay, metabolism and uses of the classes of drugs listed.

Course Contents
Physicochemical approaches to drug design. Historical, Free-Welcon and Hansch approaches. The concept of isosterism. Bioisoterism as a tool in drug design. Structure-Activity-Relationship (SAR) in drug design. Anti-metabolite and pro-drug approach to design of new drugs.
A study of the following classes of drugs in respect of their nomenclature, physical and chemical properties, SAR, synthesis, assay, metabolism and uses: General and local anaesthetics, sedative-hypnotics, antipsychotics, anticonvulsants, analgesics, and antidepressants. Chemistry of drug metabolism.

PCT 401: Dosage Form Evaluation and Drug Stability (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe standards for tablets and capsules;
2. describe in-vitro dissolution tests for solid dosage forms;
3. recall physical factors influencing chemical and microbiological degradation; and
4. perform relevant practicals in dosage form evaluation and drug stability.

Course Contents
Standard for tablets and capsules. Formulation factors affecting the dissolution rates of solid dosage form. Liquids. Semi-solids. Tablets and Capsules. In-vitro dissolution tests for solid dosage forms. Natural convention: Non-sink methods such as solvometer, hanging pellet, and static disc methods. Forced convention: Non-sink methods such as wruble, beaker, oscillating tube rotating disc, Sounder & Ellenbogen methods. Forced convention: Sink methods (adsorption, partition, dialysis and column methods, continuous flow through system, computerised automated systems). Drug Stability. Incompatibilities in liquid dosage forms. Chemical degradation of pharmaceutical products. Physical factors influencing chemical degradation. Microbiological degradations. Accelerated stability testing.

Metals (tin, iron and aluminium) and plastics. Solvent properties, toxicity, permeability and light transmission characteristics.
Glass - mechanical strength and resistance to thermal shock. Flake and spicule formation.
Paper and board. Closure testing. Folded, bung and push-on seals. Reasons for test failures. Package testing.
Practicals: Conduct relevant experiments to determine standards for tablets and capsules, microbial degradation and drug stability including accelerated stability testing.

PCT 402: Physical Pharmaceutics III (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the student should be able to:
1. describe size classification;
2. describe size distribution during comminution;
3. explain mixing of powders and drying of solids;
4. enumerate factors affecting the flow properties of powders; and
5. describe methods of manufacture of solid dosage forms – tablets and capsules production.

Course Contents
Size classification. Particle shape and size. Sieving and sifting. Determination of particle size.
Comminution: General principles, size distribution during comminution and importance of fine particles in pharmacy, communiting machines.
Mixing: Definition and objective of the mixing process. The degree of mixing and de-mixing of powders. Drying of solids: Freeze drying. Flow properties of powders. Cohesive pharmaceutical powders. Experimental methods used for measuring the "cohesiveness" of powder beds. Factors affecting the tensile strength of powders. Factors affecting the flow properties of powders. Granulation and tablet technology. Reasons for and methods of granulation. Essential granule properties. Tablet manufacture. Solid dosage coating. Types of coating materials and methods. Requirements for core tablets and coating of granules. Fluidized bed and compression coating. Capsules: Hard gelatin capsule, materials for capsules. Method of capsule production. Capsule filling equipment and operations. Formulation and finishing of capsules. Soft gelatin capsules: Nature of the soft gelatin shells and of the capsule content.
Practicals: Conduct relevant experiments pertaining to particle size analysis, mixing of powders, drying of solids, flow properties of powders, granulation, characterization of granules, compression and characterization of tablets. Filling of hard gelatin capsules and it's characterization.

PHA 401: Chemotherapy (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe the concept of chemotherapy and its application in the treatment of infections and malignancies; and
2. discuss different chemotherapeutic agents and their applications in treatment of infections and malignancies.

Course Contents
The pharmacology of the following drugs: Sulphonamides. Beta-lactam antibiotics (penicillins, cephalosporins, carbapenems, and monobactams). Tetracyclines. Chloramphenicol. Aminoglycosides. Miscellaneous antibiotics - macrolides, polymyxins, lincosamides, flouroquinolones, metronidazole, bacitracin.
Chemotherapy of tuberculosis and leprosy. Antifungal agents. Chemotherapy of protozoan parasitic infections: antimalarials, antiamoebics, drugs used in trichomoniasis, giardiasis, trypanosomiasis, leishmaniasis. Antihelmintics. Antiviral agents; HIV/AIDS treatment. Antineoplastic agents.

PHA 402: Cardiovascular and Endocrine Pharmacology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. identify different classes of drugs and describe their application in cardiovascular disorders; and
2. identify and describe drugs affecting the endocrine system and their therapeutic applications.

Course Contents
Physiology of the cardiovascular system. Cardiac glycosides. Anti-arrhythmics. Vasodilators. Anti-angina drugs. Anti-hypertensive drugs including diuretics, vasoactive peptides and their analogues. Drug treatment of shock. Cholesterol and hypocholesterolaemic drugs. Anti-coagulants and fibrinolytics. Oxytocin and the ergot alkaloids.
Introduction to endocrine pharmacology. Hypothalamo-pituitary axis. Hormones of the hypothalamus and pituitary gland. Thyroid and antithyroid drugs. Adrenocortical hormones. Oestrogens and progestogens. Oral contraceptives and ovulatory drugs. Androgens, anabolic steroids; mineralocorticoids. Insulin and orally effective hypoglycemic drugs. Parathyroid hormone, calcitonin and vitamin D.
Practicals: Conduct relevant experiments pertaining to the cardiovascular and endocrine systems.

PSM 402: Biostatistics and Research Methodology (2 Units C: LH 30)

Learning Outcomes
At the end of this course, students should be able to:
1. explain numerous study designs and best practices for their use;
2. use and evaluate biostatistical and research methodologies in pharmaceutical care;
3. evaluate the appropriateness of the research methodology designed to answer a research question or to test a hypothesis; and
4. select an appropriate statistical test, analyse data using a statistical computer package, explain and evaluate the results, and apply the results to decisions about research and practice.

Course Contents
Review of basic statistics including types of data, sampling methods, and presentation of data. Measures of central tendency. Paired and unpaired sample hypothesis: Parametric and non-parametric analysis. Multi-sample hypotheses and multiple comparisons including analysis of variance (one way and multi-factorial). Data transformations. Measures of association including

regression (simple, multiple, correlation, non-linear, logistic), chi square test (and Fisher's Exact test), odds ratios, and relative risk. Binomial distribution, testing for randomness and analysing data using statistical computer packages. Designing research methodology. Selecting appropriate statistical test. Computer-based data analysis. Interpretation and evaluation of results.

SAP 401: Pharmacy Laws and Ethics (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the students should be able to:

1. relate the history of Pharmacy;
2. list the various arms of the Pharmacy Profession;
3. describe the role of the Pharmacist in each of these practice sector; and
4. recall the laws, regulations and ethics guiding the practice of Pharmacy.

Course Contents

History of pharmacy in Nigeria. Ethics of pharmacy profession in Nigeria. Laws related to the National Agency for Food and Drug Administration and Control (NAFDAC), National Drug Law Enforcement Agency (NDLEA), Standard Organization of Nigeria (SON), Pharmacists Council of Nigeria (PCN), WHO/FAO Codex Alimentarium Commission, United Nations Narcotic Commission, National Environmental Standards and Regulations Enforcement Agency (NESREA), Food, drug and cosmetics laws including regulation, inspection, registration, advertising, manufacture, and sale/distribution. Poison, Dangerous Drugs and Pharmacy Acts. Essential Drugs List (EDL). Fake and Counterfeit Drug Laws. Consumer Protection Council Law. Policy and Legal Framework - Legal procedure. Information service. Intellectual property rights and patenting of inventions. Risk and insurance. Legal aspects of employment. Taxation. Ethics and good business practice. All other relevant laws related to the practice of pharmacy including those of the Pharmacists Disciplinary Committee and Assessors Rules, Pharmacists Registration Rule, Dispensing of Drugs, Patent and Proprietary Medicines, Legislation on animal health products. National Health Insurance Scheme (NHIS) and other health policies, and National Drug Policy.

SAP 402: Pharmacy Communication Skills (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. counsel patients regarding the use of their medications;
2. communicate with other health care professionals and the public; and
3. deliver seminars and health presentations to lay audience and professional groups.

Course Contents

Principles of communication. Appearance as a mode of communication. Various styles of listening and response to patient interview and education. Interpersonal communication. Emphatic listening. Conflict management, assertiveness, patient education and counselling. Patient interview. Medication history taking. Pharmacist relationship with other health care professionals. Case studies and scenarios to be presented.

500 Level Courses

PAA 502: Veterinary Pharmacy and Agrochemicals (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. explain formulation, storage and administration of veterinary drugs;
2. list common animal diseases of ruminants and their treatment;
3. identify common veterinary drugs, vaccines and other biologicals; and
4. describe use of insecticides, pesticides, disinfectants and recall their effects on veterinary animals.

Course Contents

Introduction to Veterinary Pharmacy. Formulation and storage of veterinary drugs. Administration of veterinary drugs. Growth promoters. Agrochemicals.
Common animal diseases of ruminants (sheep, goats and cattle), horses, pigs, fish, small animals (cats and dogs) and poultry. Contagious bovine pleuropneumonia, foot and mouth disease, sleeping sickness, African swine fever, rinderpest, rabies, fowl cholera, salmonellosis and coccidiosis.
Therapy of common animal diseases. Veterinary dosage forms and routes of drug administration in veterinary practice. Common veterinary drugs – antibacterial, antiviral, antifungal, antiprotozoan and anthelmintics. Vaccines and other biologicals. Anti-inflammatory agents and corticosteroids. Vitamins, haematinics, dietary supplements, digestants and other feed additives. Insecticides, ascaricides and rodenticides. Disinfectants (antiseptics - topical and urinary).

PAA 504: Electronic Pharmacy (2 Unit C: LH 15; PH 45)

Learning Outcomes

At the end of this course, the student should be able to use electronic technology to:

1. dispense medicines;
2. access patient medication history; and
3. identify possible harmful interactions.

Course Contents

Definition of terminology. Risks. Types. Benefits. Requirements. Automated dispensing. Barcode medicine identification. Health information technology (HIT). Electronic prior authorisation (ePA); retrospective prior authorisation, prospective prior authorisation. Rational database, Queries, Forms Reports; Receipt of e-Prescriptions via Pharmacy Electronic Medical Records (EMR) platforms. Feedback media (online same/similar EMR platform, Fax, email, Telephone Management) Patients follow up- pre/post dispensing using programmed pharmacy software alerts/notifications including Pharmacy appointment booking, Medication reminders, prescription & dispensing card/label printing. ePharmacy Billing practice including Medical Insurance billing. Software applications for medical/pharmaceutical operations: Software for digital pharmacy practice is usually designed and tailored to the needs of a Pharmacy institution/operations based on local needs, so the faculty should acquire one and use it for training. Innovations in use of robotics in dispensing, drug delivery and counselling (drones, robots).
Practicals: Hands -on training using software for digital pharmacy practice.

BTG 501: Pharmaceutical Biotechnology II (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the students should be able to:

1. appraise basic techniques in biotechnology;
2. recognise techniques in cloning;
3. recognise the role of biotechnology in vaccine development;
4. describe vaccine production by recombinant DNA for prevention of viral and bacterial infections;
5. explain the layout and requirements of biotechnological manufacturing facilities; and
6. employ quality assurance in production and biosafety.

Course Contents

Vaccine production by recombinant DNA for prevention of viral and bacterial infections. Biotechnological manufacturing facility and environment. General layout, environmental requirements and associated quality assurance (QA) in production. Biosafety. Biotechnological products and Pharmaceutical Care - an overview of relevant information service to patients on storage, re-constitution, stability, antigenicity, and self-administration.

CLI 501: Pharmacotherapeutics I (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the students should be able to:

1. develop skills for planning rational therapeutic and non-drug therapy of selected diseases using knowledge of their pathophysiology; and
2. evaluate clinical outcomes of treatment and management plans for the diseases using case studies and WHO/other standard indicators/prescribing guidelines.

Course Contents

Application of the knowledge of the pathophysiology, clinical manifestations, epidemiology, diagnosis, biopharmaceutics and pharmaceutical care to develop skills in planning the rational therapeutic and non-drug therapy of selected diseases.

Case studies and WHO/other standard indicators/prescribing guidelines employed as approaches to developing the ideas of rational drug therapy, monitoring drug therapy and drug interactions. Areas to be covered include cardiovascular system, nephrology, psychiatry, neurology, haematology, oncology, infectious diseases (including HIV/AIDS and STDs), common eye and ear disorders, paediatric and geriatric drug therapeutics, drug therapy in pregnancy and clinical toxicology.

CLI 502: Clinical Pharmacy Clerkship I (3 Units C: PH 135)

Learning Outcomes

At the end of the course, the student should be able to:

1. apply previously acquired pharmaceutical knowledge in a patient care environment;
2. utilize clinical pharmacy communication skills emphasizing empathy, education and ethics through interactions with a variety of patients on specific-drug related problems and medical diseases;
3. improve professional communication and interpersonal relationship with other health care providers through ongoing interactions related to patient care issues;
4. develop good problem-solving skills and professional judgment;
5. perform drug information services to clinicians, patients and the community; and
6. consider appropriate selection of drugs and monitoring of drug therapy.

Course Contents

Areas where students will be posted to will include psychiatry and community pharmacy practice. Activities will cover history taking, medication records review, patient education and counselling, drug therapy monitoring, interventions and counter prescribing, health promotion, disease prevention and responding to symptoms.

The students will be rotated through different sites including teaching and specialist hospitals, community pharmacies, and primary health care centres.

In consultation with hospital authorities, students will participate in each rotation under the instruction of a preceptor (registered pharmacist resident in the site) who will be assisted by a Faculty clinical instructor. In hospitals, students will also participate in consultants ward rounds and be involved in drug decision-making process in the care of in-patients, in consultation with the medical/pharmaceutical consultants.

Each student will make an oral case presentation and submit a written report at the end of each rotation.

CLI 503: Pharmaceutical Care (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the student should be able to:

1. explain the concept and philosophy of pharmaceutical care;
2. describe its applications in the provision of patient-oriented care;
3. analyse the cultural aspects of attitudes, beliefs and behaviours related to medical and non-medical uses of drugs; and
4. apply pathophysiologic, and pharmacotherapeutic considerations in the management of the listed illnesses.

Course Contents

Principles and concept of pharmaceutical care including health promotion, health defeating behaviours, proper nutrition; responding to symptoms; referral and intervention, counter prescribing. Interaction of healthcare professionals to provide care in hospitals, long-term care facilities, ambulatory and managed-care institutions. Role of government as payer and provider of healthcare, the effect of managed-care systems on quality and access to healthcare, and the

mechanisms by which health policies are formulated. Cultural aspects of attitudes, beliefs and behaviours related to medical and non-medical uses of drugs, decisions about non-prescription drugs and subscription to unorthodox healing systems. Pathophysiologic, pharmaceutical, pharmacologic, and therapeutic considerations in managing pain, fever, nausea, vomiting, constipation, and diarrhoea.

CLI 504: Clinical Pharmacokinetics (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. apply the knowledge of pharmacokinetics in choosing medications for individual patients;
2. describe the effect of some disease/physiologic states on the pharmacokinetics of some drugs; and
3. calculate and adjust drug dosages in individual patients with impaired drug elimination due to hepatic or renal dysfunction.

Course Contents

Linear and non-linear pharmacokinetics; compartment models (single and multiple compartment models) that describe disease progression with and without simultaneous drug treatment. Drug clearance: Hepatic elimination of drugs, Intravenous infusions, Multiple dosage regimens. Prolonged action dosage form administration. Bioavailability and bioequivalence including methods of determination. Clinical relevance of pharmacokinetic parameters; bioequivalence and bioavailability in clinical practice. Therapeutic drug monitoring. Drug-drug interactions. Pharmacokinetics of drugs under conditions that modify body functions such as cardiac, renal and liver diseases, pregnancy and lactation, elderly and pediatric population, protein binding and many others. Adjustment of drug dosage in individual patients with impaired drug elimination due to renal and hepatic dysfunction. Clinical pharmacokinetics of individual drugs and groups of drugs.

Practicals: Conduct relevant experiments pertaining to bioavailability and bioequivalence, state the clinical relevance of pharmacokinetic parameters. Analysis pharmacokinetic data in therapeutic drug monitoring.

PAT 502: Pathophysiology II (2 Units C: LH 30)

Learning Outcomes

At the end of the course, the student should be able to:

1. explain various pathophysiological mechanisms of disease processes involved in the disease conditions treated which are vital for the drug use decision-making process; and
2. acquire scientific knowledge essential for the application of pharmaceutical care.

Course Contents

Pathophysiology and clinical manifestation of selected haematologic and oncologic disorders. Rational use of supportive therapy in management of patients receiving chemotherapy. Appropriate therapy of common infectious diseases. Pathophysiology and clinical manifestations of selected diseases affecting the immune system, skin and eyes, acute and chronic renal disorders. Principles of fluid and electrolyte therapy. Monitoring therapeutic outcomes.

PCG 501: Herbal, Complementary and other Alternative Medicines

(2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. list the benefits and risks of herbal medicines;
2. name the importance of taking proper case history of patients on herbal therapy;
3. identify other forms of alternative medicine practices;
4. compare complementary and alternative medicines with orthodox medicines;
5. identify and describe the use of specific plants in the treatment and management of diseases in animals and humans;
6. identify drug – herb interactions; and
7. state the role of regulatory agencies in controlling the use of herbal, complementary and alternative medicines.

Course Contents

Health conditions where herbalists are frequently consulted: Reasons for the rising trend towards alternative medicine: cultural, socioeconomic, immigration, and perceptions of conventional medicine. Global situation in the use of traditional medicine. Plant toxicants and antidotes and their biological sources. Drug-herb interactions.

Clinical Pharmacognosy: Study of the rational use of herbs, herbal medicines and nutraceuticals in the management and treatment of diseases in animals and humans. These include:

CNS disorders- *Strychnos nux-vomica, Datura stramonium, Cannabis sativa, Papaver somniferom, Atropa belladonna.*

Musculo-skeletal disorders: *Nigella sativa, Phycotis ajowan, Trigonella foemaum-graecum, Zingiber officinale.*

Renal disorders: *Cucumis indica, Berberis vulgaris, Zea mays, Tribulus terrestris*.

Reproductive disorders: *Saraca indica, Ruta graveolens, Nigella sativa, Glycyrrhiza glabra, Claviceps purpurea, Myristica fragrance*.

G.I.T. disorders: *Foeniculum vulgare, Ferula foetida, Cumimum cynimum, Aegle marmelos, Prumus domestica.*

Other forms of Alternative medicine: Acupuncture, Ayurveda, Unani, Hypnosis, Aromatherapy, Homoeopathy, Hydrotherapy.

Regulation of herbal and alternative medicines. Possible reasons for synergy, antagonism and contraindication and drug-herb interactions.

PCG 502: Clinical Pharmacognosy **(1 Unit C: PH 45)**

Learning Outcomes

At the end of the course, students should be able to:

1. appraise the concept of clinical pharmacognosy;
2. describe the prevalent diseases in the environment and identify plants that are known for their management;
3. recognise poisonous plants as well as antidotes that can be administered in acute poisoning;
4. identify herbal drug interactions;
5. acquire knowledge of food plants of medicinal interest; and
6. utilize professional approach to traditional communication skills with reference to accurate rational dosage patterns towards achievement of expected outcomes in phytotherapy by

visiting selected natural medical centres/herbal clinics in their locations for practical experience.

Course Contents
Clinical practice: posting of students to designated selected natural medicinal institutions/herbal clinics. Familiarising them with patient/pharmacist, traditional healers/pharmacist interactions, developing communication skills with reference to weights and measurements that enhance accurate dosing in phytotherapy. Recognition of plants used in medicines, food and cosmetics, and their interrelationships. Efficacy of secondary metabolites, their nutraceutical effects, and plants toxicants and antidotes.
Practical management of poisonous, drug-drug, herbal-drug interactions.

PCH 501: Pharmaceutical Quality System (PQS) (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe basic test methods for essential drugs;
2. illustrate how laboratory testing methods become official/monograph or pharmacopeial method; and
3. describe pharmaceutical quality system and its impact on quality of medicines.

Course Contents
Definitions and elements of pharmaceutical quality system. Concept and impact of a good quality system on the following: pharmaceutical manufacturing facilities, good manufacturing practices, good packaging practices, good compounding practices and many others. International Standard Organization (ISO) and WHO standards and certification/accreditation systems for pharmaceuticals, including vaccines and other biologicals. International Conference on Harmonization (ICH) series on stability, QbT, QbD, APIs. Maintenance/calibration of analytical instruments, Analytical testing, Public monograph development.
Practicals: Drug quality assurance system. Monographs and specifications for drugs and drug products. Applications of chemical and physicochemical analytical methods in purity determinations. Identification of pharmaceuticals, radiopharmaceuticals and medicinal products. Basic tests methodology for essential drugs. Equivalence and bioequivalence of drug products. Biopharmaceutical methods in purity determination. Analysis of drugs in biological samples.

PCH 502: Medicinal Chemistry II (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. explain the chemistry of medicinal compounds and their synthesis where necessary; and
2. recall the metabolism and uses of various medicinal agents.

Course Contents
Study of the chemistry of medicinal compounds. The chemistry, nomenclature, physicochemical properties, stereochemistry, synthesis (where necessary), structure-activity-relationship, metabolism and uses of the following groups of drugs:

Antihypertensives, diuretics, steroids including steroidal hormones. Chemotherapeutic agents such as sulphonamides, anti-malarials, antibiotics, anthelmintics, trypanocides, schistosomicides, amoebicides, anticancer and antiviral agents.
Photochemistry: General principles. Characteristics of photochemical reactions and applications both in the synthesis and spoilage of drugs.

PCT 501: Industrial Set-up and Formulation Processes (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe formulation and production of medicines;
2. recognise present state and systematic development of pharmaceutical industry in Nigeria;
3. scale up technologies from pilot to full scale for tablets and capsules; and
4. formulate herbal medicines and aerosol systems.

Course Contents
Formulation and production of medicines. Present state of Pharmaceutical industry in Nigeria. Systematic development of Pharmaceutical industry. Essential elements for setting up a viable Pharmaceutical industry including primary and auxiliary industries. Materials of construction, plant design, infrastructural facilities, building specifications. Production management. Potential and unexplored raw materials in Nigeria for Pharmaceutical industry: pilot plant, scale up technologies for tablets, capsules, semi-solids. Formulation of herbal medicines into dosage forms. Standardization, stability studies, microbiological evaluation and standardization of doses. Aerosol science and technology. Formulation of aerosols. Basic aerosol technology. Formulation techniques of different aerosol systems. Factors affecting spray characteristics of aerosols. Filling techniques and testing methods of aerosol packs.
Practicals: Conduct relevant experiments pertaining to formulation and production of medicines including industrial visit(s).

PHA 501: Central Nervous System Pharmacology (3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the students should be able to describe:
1. drugs acting on the CNS including drugs of abuse and dependence;
2. drugs used in the management of psychiatric and neurological disorders; and
3. drugs used in pain and inflammation.

Course Contents
Review of the functional organization of the CNS. Local anaesthetics. Theories of general anaesthesia. General anaesthetic agents. Pre-anaesthetic medication. Hypnotics and sedatives. Centrally acting muscle relaxants. Alcohol and alcohol abuse. CNS stimulants. Drugs used in Parkinson's disease. Drugs used in other neurodegenerative diseases. Antipsychotics. Antidepressants and mood stabilizing drugs. Opioid analgesics and antagonists. Non-steroidal anti-inflammatory analgesics. Antiepileptic drugs.
Practicals: Conduct relevant experiments pertaining to some selected drugs acting on central nervous system.

PHA 502: Biochemical Pharmacology (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. describe the principles of biochemical pharmacology;
2. enumerate various methods for screening of drugs; and
3. discuss biochemical mechanisms of drug action and drug resistance.

Course Contents
Principles of biochemical pharmacology. Pharmacological methods of screening various drugs such as analgesics. Screening of sedatives, hypnotics, neuroleptics, diuretics, muscle relaxants, local and general anaesthetics. General principles of drug evaluation – clinical trials, potency and toxicity. Statistical calculations of LD_{50}, ED_{50}, and data comparison (Student t-test). Drug antagonism and determination of pA values – Schild plot. Transport of drugs across biological membranes. Function of sub-cellular structures. Neurohumoral transmission. Drug-receptor interactions and theories of drug action. Mechanisms of drug action. Biochemical mechanisms of drug resistance. Structure-activity-relationships (sympathomimetics, cholinomimetics, narcotic analgesics, barbiturates and many others).

PHM 501: Microbial Chemotherapy and Bacterial Genetics (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. reiterate a brief historical perspective of chemotherapy;
2. describe the fundamental principles of rational chemotherapy;
3. classify antimicrobial, antifungal and antiviral agents by their mechanism of action and chemical structure; and
4. describe the development of resistance to antibiotics by microorganisms and proffer solutions.

Course Contents
Brief historical perspective of chemotherapy. Fundamental principles of rational chemotherapy – selective toxicity principle. Classification of antimicrobial agents with special reference to mechanism of action and chemical structures. Drugs inhibiting cell wall synthesis (beta-lactam antibiotics). Inhibitors of protein synthesis (aminoglycosides, macrolides, tetracyclines). Drugs which interfere with cell membrane integrity. Inhibitors of RNA and DNA synthesis (quinolones). Miscellaneous antimicrobials such as sulphonamides, trimethoprim, fusidic acid, clindamycin, lincomycin, chloramphenicol. Antifungal agents. Antiviral agents. Interferon and interferon inducers. Development of resistance to antibiotics by microorganisms: plasmid mediated and biochemical basis. Control of emergence of resistance. Introduction to bacterial genetics and genetic engineering.

PHM 502: Preservation and Fermentation Biotechnology (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. discuss the general principles of spoilage and preservation against biodegradation;
2. describe water and its quality standards;
3. describe fermentation and product recovery; and

4. describe isolation of mutants and media development.

Course Contents
General principles of spoilage and preservation against biodegradation. Raw materials quality. Water and its purity. In-process microbiological controls. Quality Assurance of finished products. Limiting number of viable organisms. Principles of preservation of multiphase systems. Factory and Hospital hygiene. Code of Good Pharmaceutical Manufacturing Practice (GPMP). Fundamentals of industrial fermentation. Use of microorganisms in biotechnology. Search for cultures. Approaches in strain development. Genetic/enzymatic engineering techniques. Selective isolation of mutants. Maintenance and preservation. Media development and processing. Fermentation and product recovery. Primary and secondary metabolites. Clinical trials registration. Intellectual property and patent rights of biotechnological products.

SAP 501: Pharmacy Administration II (2 Unit C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. establish and manage a pharmacy enterprise; and
2. manage human and material resources.

Course Contents
Starting and managing a Pharmacy Enterprise: Pharmacy financing and administration (sources and limitations of funds, choosing between new pharmacy and buying existing one, purchasing part-time interest in existing pharmacy) and healthcare financing (government and donor finance, revolving funds. Managing drug supply (drug procurement, quality assurance, storage, distribution, and inventory control/management). Finance and Record Keeping: Financing business venture. Costing and pricing products/services. Financial analysis and control (record-keeping systems, financial statements and their analysis, budgeting and cash flow).
Research and Development: Consultancy and research services. Product design, development and presentation. Launching of new products/services.

SAP 502: Pharmacoeconomics (1 Unit C: LH 15)

Learning Outcomes
At the end of the course, students should be able to:
1. recall the concept of Pharmacoeconomics and apply it in pharmacy practice; and
2. describe the National Health Insurance Scheme and its impact on the patient.

Course Contents
Definitions, overview of basic economics. Structure and politics of Nigerian health system. Healthcare costs. Pharmacoeconomic techniques i.e., cost minimization, cost effectiveness, cost utility, cost benefits. Pharmacoeconomic methods - objectives, study design, comparison of alternatives and cost assessment. Pharmaceutical outcomes. Health maintenance organizations (HMOs). National Health Insurance Scheme (NHIS).

SAP 504: Drug Informatics (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. identify various types of reference sources;
2. apply systematic approach to answering drug information requests;
3. generate drug information, evaluate the literature and communicate a drug information response;
4. recall the legal status of advice on drug information and its relationship to professional responsibility and negligence; and
5. describe the principles of pharmaco-informatics.

Course Contents

Information sources and services. Methods of use and the nature and status of information available such as books and journals. The pharmaceutical associations. Drug information centres, poison centres, self-help societies, industries and Internet-based information. Skills required in disseminating information. Limitations on the use of drug leaflets. Legal status of advice from local drug information centres and its relationship to professional responsibility and negligence. Principles of information evaluation. Drug information service and monitoring/evaluation of adverse drug events. Principles of pharmaco-informatics.

600 Level Courses

PAA 602: Project (6 Units C: PH 270)

It is expected that each student at the level of final year (fifth professional year) should carry out independently a project encompassing a written research dissertation as well as a specific amount of laboratory or field work in some fields under a capable academic supervisor. The period spent on such projects will have to be carefully guided. Seminars and oral defence.

BTG 601: Pharmacogenetics and Genomics (2 Units C: LH 30)

Learning Outcomes

At the end of the course students are expected to be able to:

1. explain the basic principles of human genetics and heredity as they apply to inter-individual variation in treatment response;
2. apply the principles of molecular and cellular biology to explain the genetic basis of variability in drug response;
3. outline how genetic variability in genes encoding drug metabolizing enzymes, drug transporting proteins, and drug receptors (targets) can contribute to variability in drug disposition and action, leading to changes in pharmacokinetics, pharmacodynamics, and clinical outcome;
4. describe the impact of pharmacogenetics and genomics in different therapeutic areas;
5. discuss case studies reporting the clinical consequences of pharmacogenomics on therapeutic efficacy or toxicity; and
6. apply pharmacogenomic concepts to drug therapy to solve relevant problems in pharmaceutical care.

Course Contents
Genomics. Phenotyping, Genotyping. Drug metabolism and disposition. Drug-drug interactions. Implication and application in drug delivery systems.

CLI 601: Clinical Pharmacy Clerkship II (6 Units C: PH 270)

Learning Outcomes
At the end of the course, the student should be able to:
1. apply previously acquired pharmaceutical knowledge in a patient care environment;
2. utilize clinical pharmacy communication skills emphasizing empathy, education and ethics through interactions with a variety of patients on specific-drug related problems and medical diseases;
3. improve professional communication and interpersonal relationship with other health care providers through ongoing interactions related to patient care issues;
4. develop good problem-solving skills and professional judgment;
5. perform drug information services to clinicians, patients and the community; and
6. consider appropriate selection of drugs and monitoring of drug therapy.

Course Contents
Areas where students will be posted to will include general practice medicine, obstetrics and gynaecology, surgery as well as first aid and cardiopulmonary resuscitation.
Activities will cover history taking, medication records review, patient education and counselling, drug therapy monitoring, interventions and counter prescribing, health promotion, disease prevention and responding to symptoms.
The students will be rotated through different sites including teaching and specialist hospitals, community pharmacies, and primary health care centres.
In consultation with hospital authorities, students will participate in each rotation under the instruction of a preceptor (registered pharmacist resident in the site) who will be assisted by a Faculty clinical instructor. In hospitals, students will also participate in consultants ward rounds and be involved in drug decision-making process in the care of in-patients, in consultation with the medical/pharmaceutical consultants.
Each student will make an oral case presentation and submit a written report at the end of each rotation.

CLI 602: Clinical Pharmacy Clerkship III (6 Units C: PH 270)

Learning Outcomes
At the end of the course, the student should be able to:
1. apply previously acquired pharmaceutical knowledge in a patient care environment;
2. utilize clinical pharmacy communication skills emphasizing empathy, education and ethics through interactions with a variety of patients on specific-drug related problems and medical diseases;
3. improve professional communication and interpersonal relationship with other health care providers through ongoing interactions related to patient care issues;
4. develop good problem-solving skills and professional judgment;
5. perform drug information services to clinicians, patients and the community; and
6. consider appropriate selection of drugs and monitoring of drug therapy.

Course Contents
Areas where students will be posted to will include paediatrics, internal medicine, critical care/drug information service.
Activities will cover history taking, medication records review, patient education and counselling, drug therapy monitoring, interventions and counter prescribing, health promotion, disease prevention and responding to symptoms.
The students will be rotated through different sites including teaching and specialist hospitals, community pharmacies, and primary health care centres.
In consultation with hospital authorities, students will participate in each rotation under the instruction of a preceptor (registered pharmacist resident in the site) who will be assisted by a Faculty clinical instructor. In hospitals, students will also participate in consultants ward rounds and be involved in drug decision-making process in the care of in-patients, in consultation with the medical/pharmaceutical consultants.
Each student will make an oral case presentation and submit a written report at the end of each rotation.

CLI 603: Emergency Preparedness (2 Unit C: LH 15; PH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. respond to an emergency;
2. demonstrate some first aid techniques;
3. recall standard precautions; and
4. utilise aseptic techniques.

Course Contents
Emergency management. First Aid techniques: Cardio- Pulmonary Resuscitation (CPR), Abdominal thrust. Choking, Burns, Bites, Stings, Cuts, Sprain, Muscle Cramps. Infectious diseases; Personal Protective Equipment (PPEs). Hand washing, Standard Precautions. Aseptic techniques. Disaster and Humanitarian services.
Practicals: Conduct training in first aid techniques and emergency management. Organisations such as Red Cross, FRSC, NDLEA and many others can be utilised for such trainings.

CLI 604: Pharmacotherapeutics II (3 Units C: LH 45)

Learning Outcomes
At the end of the course, the students should be able to:
1. apply their knowledge of pathophysiology in developing skills for planning rational therapeutic and non-drug therapy management of selected diseases; and
2. evaluate clinical outcomes of treatment and management plans for the diseases using case studies and WHO/other standard indicators/prescribing guidelines.

Course Contents
This course emphasises the application of the knowledge of the pathophysiology, clinical manifestations, epidemiology, diagnosis, biopharmaceutics and pharmaceutical care to develop skills in planning the rational therapeutic and non-drug therapy of selected diseases. Case studies and WHO/other standard indicators/prescribing guidelines are employed as approaches to developing the ideas of rational drug therapy, monitoring drug therapy and interactions.
Areas to be covered will include, fluid and electrolyte balance, pulmonary system, gastroenterology, rheumatology, endocrinology, medical emergencies and critical care therapeutics including treatment of poisoning and adverse drug reactions.

CLI 606: Public Health Pharmacy and Pharmacoepidemiology
(3 Units C: LH 30; PH 45)

Learning Outcomes
At the end of the course, the student should be able to:
1. describe the principles and concept of Primary Health Care (PHC);
2. identify and use epidemiological methods in designing research;
3. explain the place and role of Pharmacy and Pharmacy professionals in promoting public health; and
4. demonstrate knowledge on drug use and management in PHC including the Essential Drug List concept.

Course Contents
Overview of epidemiological methods (types of epidemiological studies, sampling techniques, sample size and power). Epidemiology, prevention and control of communicable and non-communicable diseases. Literature search, data gathering modalities, questionnaire design, approaches to data analysis, operational research and experimental design and report writing. Principles and concept of Primary Health Care (PHC). Drug use and management in PHC (commonly used drugs, drug selection and distribution/essential drug list concept and drug information/education in primary health care). Traditional Medicines in PHC with emphasis on health technology and available resources, community participation.
Drug use in infertility and family planning management. Nutrition (good nutrition, nutritional status of the community and drug management/prevention of malnutrition). The provision of preventive, curative, promotive and rehabilitative services and public education/enlightenment in primary health care, with special emphasis on the role of pharmaceutical care in promoting public health.
Practicals: Conduct relevant practicals on epidemiological methods, field visits to PHC centers and some communities for hands-on training.

PCH 601: Radiopharmaceuticals **(2 Units C: LH 30)**

Learning Outcomes
At the end of the course, students should be able to:
1. identify the types of radioactivity and radioactive decay particles and their measurements;
2. describe the application of radio isotopes in research and clinical settings;
3. describe the production, handling, and use of radiopharmaceuticals; and
4. calculate radiation doses for diagnosis and therapy.

Course Contents
Introduction to Radiopharmacy. Types of radioactivity and radio-active decay particles and their measurements. Pharmaceutical application of radio isotopes. Radiotherapy and dose calculations, dosing intervals, radiation safety determinations. Regulations guiding use of radiations in research and therapy. Nuclear medicine. Role of the International Atomic Energy Agency (IAEA) in production, utilization, storage and disposal of radioactive isotopes.

PCT 601: Industrial Pharmacy (2 Units C: LH 30)

Learning Outcomes
At the end of the course, the students should be able to:
1. correlate in-vitro and in-vivo tests of some selected drugs;
2. discuss drug delivery systems and biotechnology, and manufacture of sterile products;
3. explain all aspects of cGMP; and
4. explain the application of nanomedicines in biomedical sciences.

Course Contents
Correlation of in-vitro and in-vivo tests. Examples of correlation of in-vitro and in-vivo data of some drugs, such as aspirin, digoxin, griseofulvin and oxytetracycline tablets and capsules. Problems involved in obtaining perfect correlation. Regulatory affairs and clinical trials.
Drug Delivery Systems and Biotechnology. Drug release mechanisms. Ocular, transdermal and transnasal delivery systems. Other novel drug delivery systems: site-specific/targeted delivery, bioartificial organs, production of therapeutic proteins/biochemicals, gene therapy, protein/peptide delivery, liposomes, polymeric substances. Design of therapeutic and diagnostic agents. Applications of nanomedicines in biomedical sciences.
cGMP. General introduction with glossary of terms. General inspection, quality assurance and quality control procedures and sampling. Personnel and training. Building and environmental hygiene. Planning formula and manufacturing instructions. Handling of starting materials, packaging materials, intermediate products, and finished products. Standard and batch packaging and labelling instructions. Control of packaging materials and packing operations. Supervision of production, storage, transport and distribution. Manufacture and control of sterile medicinal products including premises processing environment, aseptic area and equipment.

PCT 603: Ethical Dispensing (1 Unit C: PH 45)

Learning Outcomes
At the end of this course, the student should be able to:
1. interpret prescriptions and medication orders;
2. identify drug interactions;
3. dispense drugs and counsel both in-patients and out-patients;
4. utilise generic drugs to make substitutions; and
5. maintain records in prescription books and dangerous drugs register.

Course Contents
Handling of prescription (in- and out-patients). Patient counselling. Pharmacist and Doctor interactions. Re-constitution solutions. IV admixtures and rate of flow. Interpretation of prescriptions or medication orders: Expiry date, calculations associated with drug availability and

pharmacokinetics, patient safety, dosage form non-bioequivalence, veterinary rugs and veterinary pharmacy practice, generic substitution, drug interactions, drugs supply to end user facilities. Emergency supplies – Requisitions. Record keeping: Prescription books, dangerous drugs register, disposal of poisons and dangerous drugs with respect to their sale and supply. Use of computers in Dispensing.

SAP 601: Supply Chain Management of Drugs and other Health Commodities
(2 Units C: LH 30)

Learning Outcomes
At the end of the course, the student should be able to:
1. describe the principles and practice of supply chain of drugs and other health commodities;
2. describe the standard operating procedure for SCM facilities;
3. manage human resources;
4. recall the different inventory systems and determine stock status;
5. demonstrate ability to select products, quantify and procure health commodities; and
6. monitor and supervise logistic systems.

Course Contents
Introduction to drugs and health commodities supply chain management; Standard operating procedure manual for SCM facilities and staff; logistics management information systems; Maximum-minimum inventory control system (max-min ICS). Adjusting the pipeline in the max-min ICS and assessing stock status. Storage of drugs and other health commodities; assessing health logistics systems; product selection and quantification of drugs and other health commodities; supply planning scheduling; procurement of drugs and other health commodities; monitoring and supervision of logistics systems.

Minimum Academic Standards

Centralised Facilities

Computer Laboratory
Students of pharmacy are to be exposed to computing in all its facets so that they can utilize the expertise in the practical and analytical aspects of their training. The computer laboratory should be adequately equipped to ensure reasonable contact hours by students. Students are to have first-hand experience in the use of pharmaceutical software for analysis of data and for drug information search such as WINOLIN, SPSS, HapMap database and many others.

Central Laboratory Equipment
Certain equipment necessary for training of students will be centrally located. The recommended high degree of centralisation is dictated by the generally high cost of modern laboratory equipment and the need to utilise this equipment optimally.

1. High performance liquid chromatography (HPLC)
2. Gas chromatography (GC)
3. Gel imaging apparatus

Subject-Based Facilities

Pharmacology

1. Thermocirculators
2. Avery balances
3. Small animal respirators
4. Jacketed baths (5ml, 10ml, 25ml and 50ml capacities)
5. Assorted organ baths
6. Langendoffs
7. Refrigerators
8. Deep freezers
9. Brown-Schastermyograph stand
10. Aerator (organ bath)
11. Infusion pump
12. Peristaltic pump
13. Bench Centrifuge
14. Hot plates
15. Water baths
16. Syringes of various sizes (1ml, 2ml, 5ml)
17. Smoking burners
18. Assorted sizes of white glazed paper
19. Assorted levers
20. Stop-watch
21. Stop clock
22. Upright clamping rods
23. Oxford clamp
24. Angle poise lamp
25. pH meters
26. Autoclave
27. Assorted surgical instruments
28. All glass water distiller
29. Automatic ice flake machine
30. Cell homogenizers
31. Kymograph/microdynamometer/Data capsule

Pharmaceutics

1. Dispensing balances with weights
2. Analytical balances
3. Top loading balances
4. Beam balances with flat pan for weighing ointment
5. Refrigerator
6. Hot air ovens
7. Suppository moulds
8. pH meters
9. Thermostat controlled water baths
10. Viscometers
11. Bench centrifuges

12. Counting machine
13. Fluid energy mill (Jet mill)
14. Sets of test sieves
15. Sieve shaker
16. Fluidized bed dryer (5kg capacity)
17. Single station table press
18. Punches
19. Multipurpose motor units (Erweka AR 400)
20. Table hardness tester
21. Roche friabilator
22. Dissolution apparatus
23. Disintegration tester
24. Bowl mixer
25. Hygrometer
26. Coulter counter
27. Millers
28. Food processors
29. Oven

Pharmaceutical Microbiology and Biotechnology

1. Vertical autoclave (giant size)
2. Portable autoclaves
3. Sterilizing ovens
4. Drying ovens
5. Incubators (37oC)
6. Cool Incubators (5oC)
7. Distilled Water still
8. Refrigerators/ Freezers (4oC, -20oC and -80oC)
9. Centrifuges (bench)
10. Cooled centrifuges
11. Water baths/water baths with shakers
12. Laminar flow cabinets
13. Microscopes (binocular and inverted)
14. Turbidometers
15. Nephlometers
16. pH meters
17. Vacuum pumps
18. Spin mixer
19. Weighing balances (analytical and top loading)
20. Air conditioner
21. Gel electrophoresis apparatus
22. Thermal cycler (PCR machine)
23. ELISA micro plate reader
24. Colony counter
25. Ampoule sealing machine
26. UV/Visible spectrophotometer

27. Vortexer
28. Deioniser
29. CO2 incubators for cell culture
30. Complete apparatus for protein gel (western blot) analysis

Pharmacognosy

1. Assorted heating mantles
2. Microscopes
3. Drying oven
4. Refractometer
5. Colorimeter
6. pH meters
7. Distilled water still
8. Ultra-microtome
9. Mortars and pestles (glass)
10. Centrifuge (bench)
11. Melting point apparatus
12. Freeze dryer
13. Hot plates
14. Fridge
15. Combined hot plate magnetic stirrer
16. TLC adjustable spreader
17. TLC Chromatanks (20 x 20)
18. Precoated TLC plates
19. UV Spectrophotometer
20. Assorted soxhlet apparatus
21. Fractional distillation assembly
22. Museum equipment and furniture
23. Miscellaneous glassware
24. Rotary evaporator
25. Fume cupboard

Pharmaceutical Chemistry

1. Complete TLC units – tanks with covers, UV lamp 254 & 360nm, TLC spreader
2. Refractometer
3. Polarimeter
4. Colorimeter
5. pH meter
6. Centrifuge
7. Conductivity bridge
8. Thermostirrers
9. Hot plates
10. Heating mantles
11. Magnetic stirrer
12. Laboratory shakers
13. Thermostat – controlled water bath
14. Balances: (Adequate number of balances for students to use)
15. Top loading balances

16. Analytical balances
17. Ultraviolet/visible Spectrometer
18. Infra-red Spectrometer
19. Vacuum pumps
20. Water pumps
21. Air pumps
22. Rotary evaporators
23. Ice-making machine
24. Ovens
25. Functioning fume cupboards
26. Molecular models
27. Water distiller
28. Refrigerators/Freezers (4°C, -20°C and -80°C)
29. Appropriate assorted apparatus and glassware for:
    a. Synthesis
    b. Analysis
    c. Purification and extraction process
30. Fully equipped first aid box
31. Fire extinguishers
32. Gloves and safety spectacle
33. Dissolution apparatus
34. Disintegration tester
35. Friabilator
36. Hardness tester
37. Sonicators
38. Spray guns
39. Soxhlet extractors
40. Water baths
41. Sand bucket

Pharmaceutical Technology Laboratories

i. Unit Operations Laboratory

Laboratory models of the following must be provided

1. Hammer mill
2. Ball mill
3. Tripleroll mill
4. Cube mixer
5. Bowl mixer
6. Sigma-blade mixer
7. Homogenizer/blender
8. Top Loading balance electronic
9. Filter Press
10. Tray dryer
11. Fluidised bed dryer 5kg

i. Liquid Processing Laboratory

The models to be provided here will serve as teaching and research equipment as well as production equipment at the Pilot level.

1. Processing vessel complete with mixer (minimum capacity 250L)
2. Filter Press – 8 frames
3. Deioniser (minimum capacity of 100L)
4. Colloid mill
5. Liquid filling machines
6. Volumetric
7. Vacuum
8. Capping machine
9. Transfer Pumps
10. Stainless steel jacketed vessels
11. Stainless steel storage vessels

ii. Dry Processing Laboratory

1. Rotary table press
2. Granulators (wet and dry)
3. Fitzpatrick mill model D
4. Fluid Bed Dryer (minimum capacity - 30kg)
5. Sieving machine & set of sieves
6. Table Deduster
7. Auto dryertex extractor
8. Capsule filling machine

iii. Testing Equipment

1. Viscometer
2. Disintegration unit
3. Disintegration Testing unit
4. Friabilator
5. Erweka AR400 Power Unit
6. Tablet Hardness Tester
7. Moisture Determination Balance

iv. Sterile Production Laboratory

1. Water distiller
2. Autoclaves
3. Ampoule dryer
4. Ampoule washer
5. Laminar flow cabinet
6. Pressure vessels/filtration systems

Clinical Pharmacy

1. Dissolution rate apparatus
2. Disintegration testing apparatus
3. Magnetic stirrer
4. pH meters and accessories
5. Refrigerators
6. Deep freezer
7. Ultracentrifuge

8. Micro centrifuge
9. Water baths
10. Digital video camera
11. Video CD/DVD Player
12. Personal computers with internet access
13. Overhead projector
14. Multimedia projector
15. Public address system
16. TV set
17. Video cassette player/recorder
18. TLC tank (20 x 20 cm)
19. Analytical balances
20. Hospital bed
21. Examination bed
22. Sphygmomanometer
23. Stethoscope
24. Standiometer
25. Glucometer
26. Rapid diagnostic test (RDT) kits etc

Animal House Equipment

1. Matrolon cage type i
2. Matrolon cage type ii
3. Matrolon cage type iii
4. Matrolon cage type iv
5. Wire cage type ii
6. Wire cage type iii
7. Wire cage type iv
8. Rack for cage type i
9. Rack for cage type ii
10. Rack for cage type iii
11. Rack for cage type iv
12. Racks for wire cage type ii
13. Racks for wire cage type iii
14. Mobile batteries for Rabbit
15. Mobile batteries for Guinea pig
16. Apartment for cat
17. Drinking bottles
18. Feeding containers for Rats
19. Feeding containers for Mice
20. Feeding containers for Guinea pig
21. Feeding Holder
22. Feeding holder for Rabbit
23. Drinking valve for mice and rats
24. Experimental Dropping tray
25. Bottle washing and transport basket
26. Identification plates

27. Food transport trolley
28. Littering box for rabbit
29. Rabbit transporting cages
30. Dog cages
31. Cages for collecting faeces and urine
32. Cat cage
33. Upright cage washer
34. Partition cabinets for staff clothing
35. Polythene dustbins
36. Record cabinets
37. Sterilizing machine
38. Incinerator
39. Drawer Cabinet
40. Other animal house miscellaneous equipment

Staffing

General Considerations for Academic Staff

1. The minimum number of teachers to start a Pharmacy Programme shall be in accordance with the requirement for commencing an academic programme;
2. All teachers involved in the programme must contribute to and be familiar with it apart from being involved in the machinery for planning and reviewing the programme;
3. Staff should include persons experienced both in teaching and in providing patient care with appropriate balance to provide the desired spectrum of knowledge;
4. Academic staff for the programme must be holders of Ph.D. degrees, provided that staff with lower qualification can be accommodated under the staff development programme. However, staff with Ph.D. should not be less than 70% of total staff on ground;
5. Staff assignments and expectations should provide for a balance of teaching, service, research and administrative responsibility;
6. Based on students' enrolment, the minimum academic staff-students ratio should be 1:10. However, there should be a minimum of six full-time equivalent of staff in each department. There is need to have a reasonable number of staff with higher degrees as well as sufficient professional experience. With a minimum load of 15 units per semester for students and a minimum of six full-time equivalent of staff in each programme, staff should have a maximum of 15 contact hours per week for lectures, tutorials, practicals and supervision of projects;
7. Full time academic staff should have a second degree minimum primarily to ensure adequate acceptance of the concept goals and objectives of the degree programme; and
8. For Graduate Assistants or Teaching Assistants, a minimum first degree is required. This category of staff is not considered suitable to teach and therefore not counted during any evaluation exercise.

The following are the recommended minimum academic staff mix:

Professors/Readers	20%
Senior Lecturer	35%
Lecturer I and below	45%

Professional Staff
There is always the need for some professional members of staff to complement and cater for better, up-to-date exposure (for example, industrialist, public health and supply chain management experts). Clinical Pharmacy lecturers and Preceptors in the hospital should as much as possible be practitioners with a high degree of regular responsibility for care of patients.

Administrative Support Staff

The administrative staff requirement shall be based on the prescribed NUC ratios for the category.

Technical Support Personnel
The services of technical support staff, which are indispensable in the proper running of laboratories are required. It is important to recruit very competent senior technical staff to maintain teaching and research equipment. They are also to undergo regular training to keep them abreast of developments in equipment operation and maintenance.

Library

There should be a faculty library, which has appropriate and current reference books, journals and periodicals in all areas of Pharmacy. A functional e-learning facility with wireless internet access is highly recommended.

Classroom, Laboratories, Clinics, Workshops and Offices

Physical Facilities

a) Spaces for Academic Area

Academic Areas	Measurement
Professor's office	18.5 m^2
Head of Department's office	18.5 m^2
Staff accommodation and research spaces	7.5 m^2
Non-academic staff offices (including rooms for typing, filing, storage)	7.5 m^2
Research area for a lecturer	10 m^2
Tutorial/seminar/audio-visual rooms	40-50 m^2
Storeroom for chemicals	40-50 m^2
Work rooms/Preparatory	40-50 m^2
Postgraduate teaching laboratories	40-50 m^2
Balance rooms	10 m^2
Laboratories for teaching and research	50-180 m^2
Specialised Work Rooms (Extraction, sterilization, Aseptic and Instrument)	50 m^2
Animal house	30 m^2
Faculty library and Reference room	130 m^2

Lecture Theatres (for 150 students)	160 m^2
Plant room	30 m^2
Cold room	30 m^2
Herbarium	40 m^2
Student common room	140 m^2
Staff common room	55 m^2
Dispensing practice area	20 m^2
Medicinal plant garden	

b) Teaching Laboratory Spaces

General Pharmaceutical Chemistry Laboratory Physical Pharmaceutical Chemistry Laboratory Organic Pharmaceutical Chemistry Laboratory Chromatography room Instrument room	180 m^2 60 m^2 ,, ,, 100 m^2
General Pharmaceutics laboratory	165 m^2
Pharmaceutical Technology Unit operation Liquid processing Drug processing Sterile Production	90 m^2 ,, 110 m^2 168 m^2 168m^2
General Pharmaceutical Microbiology (25 students)	165 m^2
Microbiology work up area (clean, sterilisation, wash up)	60 m^2
Biotechnology laboratory	60 m^2
Raw materials/packing store	60 m^2
Pharmacognosy laboratory	60 m^2
Pharmacology:	60 m^2
Pharmacology general teaching laboratory	60 m^2
Pharmacology demonstration area	60 m^2
Solvent purification &recovery room	20 m^2
Drug Information Centre	60 m^2
Pharmacy communication laboratory	60 m^2
Pharmacy practice laboratory	60 m^2
Patient Simulation and Demonstration Laboratory	60 m^2
Model Community Pharmacy	

c) Specialised Area

It would be desirable to have a sterilisation room (50 m^2), grinding room (40 m^2) and locked spaces possibly on the corridors for students' laboratory wares and overalls.

Adequate space should be provided for all departments in Pharmacy. Efforts must be made to provide the Faculty of Pharmacy with at least: -

Two (2) spacious laboratories calculated according to NUC specifications of 7.5 m^2 per FTE per Department; a minimum of one (1) preparatory room for each Department at the NUC specifications of 7 m^2 each;

Two seminar rooms capable of sitting at least sixty students at the NUC specification of 1 m^2 per FTE;

A conference room; and
A staff common room.

The faculty itself should have two (2) large faculty lecture theatres capable of sitting up to a minimum of two hundred and fifty (250) students each according to the NUC specification of 0.75 m^2 per FTE.