

GOMBE STATE UNIVERSITY

GOMBE, NIGERIA

STUDENTS' HAND BOOK



- 2021/2022

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Foreword

The preparations for the establishment of Faculty of Pharmaceutical Sciences, Gombe State University, commenced in April 2010. After concerted efforts by all the stakeholders the first edition of the undergraduate student handbook of the Faculty of Pharmaceutical Sciences, Gombe State University is hereby presented. The development of this student handbook followed due process with meetings and wide consultations with the various Departments of the Faculty and appropriate stakeholders, including other interest groups. This process has resulted in the production of a qualitative guide/companion for students of this Faculty.

This book is a very useful material and guide to all students of the Faculty. It has most relevant information about the Faculty, from history of the Faculty, philosophy and objectives of the B. Pharm. programme, entry requirement, examination regulations, course(s) information and other general information. The courses offered are of high academic standard and broad spectrum that stand the taste of the time. With the information contained in this book, it is expected that, the student handbook, will become a major reference document, alongside the university handbook, for all students of the Faculty of Pharmaceutical Sciences. It is indeed a useful student companion.

I, therefore, recommend this handbook to all students of this Faculty and to all staff of the Faculty of Pharmaceutical Sciences, both academic, Technical and administrative staff. It will be a useful resource in your libraries. I commend all those who put in their unquantifiable time, knowledge and resources, towards the production of this very first edition of the student handbook. It is my pleasure to specially mention for gratitude the present management of Gombe State University, who made sure that the student handbook is completed.

Finally, we welcome feedbacks from Faculty members and students including suggestions or ideas regarding any aspect of this handbook more especially, now that we are preparing to start Pharm.D Programme.

Prof. Abdulkadir Umar Zezi

Dean

Principal Officers of the University

VISITOR: ALHAJI IBRAHIM HASSAN DANKWAMBO, PhD, OON
(Executive Governor, Gombe State)

CHANCELLOR: HIS ROYAL HIGHNESS, ALHAJI ABUBAKAR SHEHU ABUBAKAR III
(The Emir of Gombe)

PRO-CHANCELLOR: ALHAJI HARUN KADIR RASHID II
(Emir of Dukku)

VICE CHANCELLOR: PROF. IBRAHIM MUSA UMAR, B.Sc(ABU), MSc, Ph.D,(Salford), FCSN,
FMSN, OON

DEPUTY VICE CHANCELLOR: PROF. IBRAHIM WAZIRI ABUBAKAR, BA. (Hons.),
M.A.(ABU), Ph.D (Abuja), FIM, FHSN, IPMA

REGISTRAR: MOHAMMED ABDULLAHI YUGUDA, B.Sc (Hons.) ABU

BURSAR: HAJIYA SHABIKI SHU'AIBU JIMETA, B.Sc (Hons) Accounting (ABU), MBA (BUK),
FCNA, FIPMA, FIICA, FAISM

UNIVERSITY LABRARIAN: DAVID DANLADI, BLS. (ABU), MLS. (UNIMAID)

Principal Officers of the Faculty

PROF. ABDULKADIR U. ZEZI DEAN

PROF. OLAWAKANYINSOLA HOD, PHARMACOLOGY AND THERAPEUTICS

A. SALAWU

DR. MUHAMMAD GARBA THOM HOD, PHARMACEUTICAL AND MEDICINAL CHEMISTRY

DR. TOLA A. S. MIDALA HOD, CLINICAL PHARMACY AND PHARMACY
PRACTICE

DR. IFEANYI V. EMENIKE HOD, PHARMACEUTICS AND PHARM. TECHNOLOGY

PROF. KABIR Y. MUSA HOD, PHARMACOGNOSY AND DRUG DEVELOPMENT

DR ADEUL A. ONANUGA HOD, PHARM. MICROBIOLOGY AND BIOTECHNOLOGY

MRS JAMILA M. BOYI FACULTY OFFICER

History of the Faculty

The idea of establishing the Faculty of Pharmaceutical Sciences was first conceived in 2006 by the then Governor of Gombe State, Alhaji (Dr) Danjuma Goje. Preparations for the establishment of Faculty of Pharmaceutical Sciences, Gombe State University, commenced in April 2010, first with an invitation to an inauguration of five member committee drawn from Faculties of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, University of Maiduguri, representative from Pharmaceutical Council of Nigeria (PCN) and Directorate of State Pharmaceutical Services, Bauchi. The following were at the first meeting of Professionals in the field of Pharmacy

1. Professor Magaji Garba Chairman(ABU)
2. Professor K.S Gamaliel Member(UNIMAID)
3. Dr I.V Emenike Member (Director, Pharm Serv., Bauchi)
4. Dr M.A Usman Member (ABU)
5. Pharm. Usman D. Sambo Member(PCN)
6. Hafiz Muhammad Secretary(Gombe State University)

The professional committee was requested to do the following.

- i. Produced a detailed curriculum at each level
- ii. Advise on courses to be taken at each level
- iii. Advise on strategies for staffing and staff development and organogram
- iv. Produced a standard list of equipment needed for teaching and research
- v. Produce a list of publications for general reference, exit, journals and e-resource for the library
- vi. Advise on accreditation requirements and strategies
- vii. Any other matter, deemed relevant to the successful take-off and establishment of the programme

The committee started deliberations immediately, and on Friday 23rd April, 2010, the committee reconvened and received inputs from its members and deliberated on them further. It submitted its reports to the then Vice-Chancellor, Prof. Abdullahi Mahdi, CON ; with executive presentation by the Chairman of the committee, the Dean then, Faculty of Pharmaceutical Sciences ABU Zaria.

After the submission of report, its implementation commenced immediately by offering admissions to thirty (30) pioneer B. Pharm. Students to 100 level through JAMB in 2010/2011 Academic Session. An Ag. Dean, Dr B.B Maiha, from Department of Pharmacology and Therapeutics (ABU Zaria) assumed duty on Sabbatical Leave, with five permanent staff (Academic), and six Visiting Staff, cut across all the Departments of the Faculty, all from Ahmadu Bello University Faculty of Pharmaceutical Sciences.

Similarly, the second set of students, fifteen in numbers (15), were admitted in 2011/2012 Academic Session, with increased number of both permanent staff to thirteen (13), and visiting to eleven (11), Three (3) Technologists and four (4) Assistant Technologists in the laboratories were recruited. Two Administrative staff, Jamila Boyi, as Faculty Officer, and Mal. Ahmed A. Muhammad, as secretary to the Dean were deployed to the Faculty. Following the admission of the two sets of students, the University invited the National University Commission (NUC) for resource verification visit and advice. The NUC

team visited the Faculty in response to the request in October, 2013. After the visit, NUC wrote a report of advice to the University of the need to have additional staff of senior lecturer and above. Concerted efforts were made by the Government of Gombe State led by the present Governor and Visitor to the University, Alhaji (Dr) Ibrahim Hassan Dankwambo, OON together with the management of Gombe State University by employing full-time senior staff into the Faculty of Pharmaceutical Sciences. This resulted in NUC giving the University the permission to start the B. Pharm. with Prof Barnabas K. Toge as the then Dean.

Philosophy of the Bachelor Pharmacy Program

The philosophy of the Pharmacy program is to produce well-educated graduates and trained professionals for a wide range of scientific, professional and managerial functions, which best serve the needs of the community with sufficient adaptability to meet the demands of a changing health care delivery system. Students will be provided with the opportunity to apply Pharmaceutical and Biomedical knowledge to problems of drug therapy related to patient care. Students will become aware of the broader social content of health care and use of medicines in order to encourage the concept of Pharmaceutical care within the health care delivery system. The ultimate goal is to produce graduate practitioners with knowledge, skills and motivation to contribute meaningfully to proper patient care, public health, teaching, research and local drug production. The programme, which is based on an internationally competitive curriculum, will be able to increase the necessary knowledge and man power that is required to achieve excellence in Pharmacy education and mitigate the deplorable drug situation in the country on the long term.

Our Motto

Pharmaceutical Training and Research for Mankind

Vision

To pursue excellence in Pharmacy education through learning, research and quality community services.

Values

culcate:

- Integrity: -as the hallmark of our staff and students.
- Respect for persons.
- Trust: - to be trusted by the society and each other.
- Equity and fairness:-respect other people's point of view.
- Good governance:- documentation and justification of our actions

Mission Statement

To train students to develop competence in Pharmacy education and Pharmacy practice for the development and delivery of quality Pharmaceutical services.

Aims and Objectives of the Bachelors of Pharmacy Program

The ultimate *aim* of the program is to produce Pharmacy Practitioners with knowledge, skills and motivation to provide Pharmaceutical Services. The skills are to be sufficient enough to compete with pharmacists all over the world.

The *specific objectives* are as follows:

- i. Instill in the students a sense of appreciation of the Pharmacy profession and involve them in intellectually stimulating and satisfying experience of learning and study.

- ii. Instill in the student the dynamic value of the Pharmacy profession, which makes life-long learning a necessity.
- iii. Develop in the student the ability to apply Pharmaceutical knowledge in Health Care Delivery System.
- iv. Provide to the student a broad and balanced foundation in all areas of Pharmaceutical knowledge.
- v. Provide students with Pharmaceutical knowledge and skills to identify and solve drug related problems. The knowledge includes Human and Veterinary related drug therapeutic problems.
- vi. Provide students with adequate knowledge and appropriate skills from which they can proceed to acquire more knowledge in specialized areas of Pharmacy.

Faculty Admission Requirements

Entry into the University is done through the Joint Admission and Matriculation Board (JAMB) examination. Candidates wishing to be admitted into the 100 level Bachelors of Pharmacy degree must have the Senior Secondary Certificate (SSCE) or its equivalent. They must have scored a minimum of credit in Biology, Chemistry, Mathematics, Physics and English. In addition candidate must obtain minimum UTME score determined by the University/Faculty depending on the performance of applicants at the UTME for the relevant year. Those seeking direct entry admissions (200 Level) in addition to the SSCE requirement must have a minimum of pass in Interim Joint Matriculation Board examination (IJMB) or its equivalent in Biology, Chemistry and Physics. The above requirements are subject to scrutiny and satisfaction of a Faculty screening committee during registration of fresh students.

Duration of the Course

The Duration of the current Bachelor of Pharmacy program is five (5 years) for UTME entry and 4 years for IJMB (direct) entry students.

Regulations Governing the Bachelors of Pharmacy Degree Program

Matriculation

All students of the University including the Faculty must undergo matriculation presided by the Vice-Chancellor in the first year (at 100 or 200 Level) of the programme.

Matriculation oath

All bonafide students of the University must fill, sign and return their Matriculation Oath form to be provided at the matriculation ceremony before they are considered to have fully registered.

Course registration

Each student is required to register with the university every session according to the rules made by the senate of the university (see also University Students Handbook for details) and students are required to abide by them. In addition, students are required to formally register for courses they wish and are qualified to offer at the beginning of every session. Each student is requested to register for a minimum of 18 credit units and a maximum of 24 credit units every semester. Candidates shall have up to three weeks (21 days) from the commencement of the semester within which to add or drop courses.

Examination

Examinations are normally held at the end of each semester according to rules and regulation made by senate. The examination regulations listed can also be found in the university students hand book. Each semester examination question for courses offered in the Faculty consists of two sections (except for some practical courses):

1. Multiple choice
2. Essay

Multiple choice questions carry 20% of total score while the essay portion carries 40% of grade and continuous assessment is 40%.

Absenteeism

Any student who happens to absent himself/herself from the university for upwards of six weeks without a written official permission, should normally be deemed to have withdrawn from the university.

Deferment

A student who for a good cause is unable to participate in normal academic activities is free to seek to defer studies upon a written application to the senate through the Faculty Board. A student may interrupt his/her study programme for two continuous semesters only, if the maximum period allowable for the completion of the programme is not exceeded. A student who wishes to interrupt his/her study programme shall apply in advance to his/her Dean of Faculty stating reasons why he/she wants to interrupt his/her study programme, and permission duly granted before he/she leaves the university. At the express permission of the Vice Chancellor, a student may be permitted to interrupt his/her studies by two additional semesters, but not exceeding four semesters overall. A student who interrupts his/her studies for more than four continuous semesters shall be deemed to have lost any accumulated credit. Consequently his/her studentship shall be cancelled. Other details are found in the university students' handbook.

Students grievances

In the event that the grade a student received for a course is totally not what he/she expected, the first step to take is to apply through the Dean to the Head of the respective Department where the course is domicile for verification of result. If the Department verifies that a different grade was turned into the Dean's Office, the Dean is notified of the changes in the grade through a formal letter from the Head of Department concerned. If, however, the grade was correctly recorded and the student wishes to contest it, he/she should write to the Chairman of Senate through the Registrar and through the Dean. Any other grievances should be referred to the university hand book.

Definition of Course Codes

Each Department in the university has a unique code which is used for denoting the courses offered in the Department. Course codes consist of three letters representing the Department and three number codes, the first of the numbers represent the level at which course is being offered and the last represent semester. The course codes in the Faculty of Pharmaceutical Sciences are:

1. PCP: Representing Clinical Pharmacy
2. PCH: Representing Pharmaceutical Chemistry
3. PCT: Representing Pharmaceutics
4. PCG: Representing Pharmacognosy
5. PCL: Representing Pharmacology
6. PMB: Representing Pharmaceutical Microbiology and Biotechnology
7. ANA: Representing Anatomy
8. BCH: Representing Biochemistry
9. PHY: Representing Human Physiology
10. GENS: Representing General Studies
11. PHJ: Student Industrial Work Experience Scheme (SIWES)
12. PHM: Pharmacy Project

Definition of Course Types

Core courses

These are courses offered in the Faculty. They are compulsory and are the basic (minimum) requirement for the Award of B. Pharmacy degree. These courses are parallel with the requirement of the Pharmacists' Council of Nigeria (PCN) and are as specified by the Nigerian Universities Commission (NUC) minimum bench mark requirements.

Cognate courses

These are courses offered outside the Faculty. They are compulsory and are among the minimum requirement for the Award of B.Pharmacy degree. These courses are parallel with the requirement of the Pharmacists' Council of Nigeria (PCN) and are as specified by the Nigerian Universities Commission (NUC) bench marks requirements. Such course include Anatomy, Physiology, Biochemistry, General Studies courses and all the courses offered at 100 Level.

Elective courses

A course that students take within or outside the Faculty, students may graduate without passing the course provided the minimum credit units for B. Pharmacy had been attained.

Pre-requisites

These are lower level courses that are related to a higher-level courses. A student needs to offer and acquire the minimum pass mark for the pre-requisite before he is allowed to register for the specified higher level courses. These courses are listed in the curriculum.

Course Unit

This is a quantitative organization of a course curriculum for which a student is required to earn credits. The Pharmacy curriculum is broken down into several professional and non- professional course unit areas.

Credit Units (CU)

Each course is divided into credit units; each credit unit (1) is equivalent to 15 hours of teaching and examination. Credit units are registered by students each semester, the total credit unit registered is called TCUR. The minimum credit unit allowed per semester is 12 while the maximum is 24. A student is said to earn the credit units allocated for a course if he has scored the minimum pass mark of the course, this is called CUE. The Total Credit Unit Earn (TCUE) is important in promoting students to the next higher level.

TCUE required for promotion to levels are as follows:

100-200L = 24

200-300L = 48

300-400L = 72

400-500L = 96

Grade Point (GP)

Means the points allocated to a letter grade for a course. Letter grades are awarded based on the actual percent score of a student in a course. The numerical value of grades is as follows: A=5, B=4, C=3 and F=0.

Grade Point Average (GPA)

This is the average weighted grade points earned in courses taken in a semester and is obtained by the summing up of all the multiples of GP obtained in a course by the credit unit (CU) allocated for the course. $GPA \text{ for semester is } = \frac{\sum (TGP \times CU)}{TCUR}$. The Cumulative Grade Point Average (CGPA) is the sum of all grade point average acquired by a student throughout his stay in the program. In the B. Pharm. program the minimum CGPA allowed is 2.5.

Probation

A student is said to be on probation if he/she fails to acquire the minimum CGPA of 2.5 for two consecutive semesters and a student will be advised to withdraw from the course if his CGPA is below 2.5 for four (4) consecutive semesters.

Continuous Assessment

Each course has a continuous assessment component which includes class tests, practicals and attendance. The continuous assessment component in each course is 40% of total score of the course for the semester for which it is offered.

Admission into Examination

A student will only be allowed to take examination for a course if he/she is registered and has attained 75% attendance in the lectures and practical session of the course.

Graduation Requirements for the Pharmacy Degree

Each student is required to have offered and passed all the courses specified by the NUC as core and cognate courses and all the courses required by the Pharmacists' Council of Nigeria. This requires that UTME students have acquired 180 TCUE and 160 TCUE for DE students. Also, a minimum CGPA of 2.5 is required at the end of the study except as specified by the senate of the university. All 100L courses are passed at 45% (D) and as from 200L (Professional year) the minimum pass mark is 50 (C) or 60 (B) depending on status of the course.

Award of Bachelor of Pharmacy Degree

All students who have attained a minimum of 180 TCUE for UTME or 160 for direct entry, with a minimum CGPA of 2.5 shall be awarded Pharmacy degree. For a student with a distinction in a course, such shall be indicated in his certificate.

Students Welfare

The staffs of the Faculty of Pharmaceutical Sciences, Gombe State University are dedicated to cater for students welfare and counseling on academic and personal matters.

Pharmaceutical Association Of Nigeria Students (PANS) And Student Activities

All registered students of the Faculty of Pharmaceutical Sciences, Gombe State University, may be full members of the PANS. Membership is voluntary. However, students are encouraged to participate in student body associations. PANS may necessarily coordinate student involvement in running the day-to-day activities of the Faculty. All financial members of PANS are requested to pay an annual subscription to the body. This will qualify them to be entitled to all the welfare packages as well as participate in all activities of the association. The aims and objective of PANS are:

1. To facilitate the social and intellectual interest of Pharmacy students

2. To establish and maintain good and exemplary precedents.
3. To encourage the development of a strong PANS thereby promoting mutual understanding between pharmacists and pharmacy students by exchange of ideas through correspondence and visits.
4. To enlighten the public on what pharmacy stands for, through symposia, lectures and film show.
5. To help maintain a high standard of ethics among pharmacy students

General Information

The B. Pharmacy program may demand time-management and a little bit of coordination, in order to be successful. Students are advised to plan their academic and social activities effectively. Some useful tips for success include:

1. Working out an effective study schedule that is “tailor-made” to bringing success to student’s individual academic career.
2. Acquiring skills in dealing with assignment, continuous assessment and examination schedules.
3. Appreciating the importance of recreation such as exercise, sports and other student activities that will aid in keeping fit and managing stress.
4. Development of a healthy social life, especially an enlightened and healthy relationship with the opposite sex.
5. Adopt proper attitude towards lecturers and student that will encourage success.
6. Remember that both success and failure are part of life. So, it is you who will choose if you are successful or not.

University Examination Regulations

1. Students shall not be admitted into the examination hall if they have not been dully registered by the various Departments/ Faculties as having fulfilled the prescribed conditions of the study.
2. Eligible candidates shall report at the stipulated examination halls fifteen minutes before the start of the examination.
3. No candidate shall be allowed into the examination hall after 30 minutes of the start of the examination.
4. No candidate shall be allowed to withdraw from the examination within 30 minutes from the commencement of the examination.
5. Candidate may go to the toilet, etc during examination if that they are accompanied throughout the period of absence by a suitable official. Such absence must not be unreasonably prolonged and the candidate shall not be allowed any extra time because of such absence.
6. The chief invigilator may under special circumstances accept a candidate into the examination hall after 30 minutes of the start of the examination, if he/she is satisfied that there are reasonable grounds for the lateness. A report of the situation must be formally made to the Chief Examiner (Dean of the Faculty).
7. Candidate shall not be allowed to bring into the examination hall any answer sheet/booklets used or unused.
8. Candidate shall not walk out of the examination hall with any answer sheet/booklet used or unused.

9. Candidate shall comply with any instruction given by the Chief invigilator as to the submission of their answer sheets at the conclusion of the examination.
10. It shall be the responsibility of each candidate to ensure that his/her examination sheets are dully accounted for by the Chief invigilator /Co-ordinator at the examination hall.
11. All rough notes, scrap sheets, draft answers, must be submitted after appropriate cancellation to the Chief invigilator /Co-ordinator with the answer sheets at the conclusion of the examination.
12. Candidate shall not talk to one another, give or receive from one another any form of assistance, pens, erasers, pencils, rulers, etc.
13. All questions pertaining to the examination must be directed to the Chief invigilator /Co-ordinator or any of the accredited invigilators.
14. The Chief invigilator / Co-ordinator shall report any examination misconduct formerly to the Chief Examiner (Dean of the Faculty).
15. Any contravention of any of the above rules and regulations shall constitute examination misconduct. All candidates shall comply with these regulations in their own interest.
16. Invigilators shall tell the candidates the exact time at the start of the examination and therefore inform them of the time at reasonable intervals.
17. Invigilators shall ensure that personal effects such as bags, textbooks, scrap notes, etc are not brought into the examination hall by the candidates and that unused answer scripts are not taken out.
18. Silence shall be maintained throughout the duration of the examination.
19. Invigilators shall ensure that all candidates sign the attendance register.
20. At the end of the examination each invigilator shall collect and count scripts before handing them over to the Chief invigilator, who shall sign the answer booklets.

Penalties

a. Expulsion

The following offences shall carry the punishment of expulsion: Impersonation at Examinations. This may involve the exchange of examination numbers or names on answer sheets or the intentional use of someone else's examination number.

Introduction of relevant foreign materials and cheat notes into the examination Venue.

Exchange of relevant materials in the Examination Venue which may involve:

1. The exchange of question papers containing relevant jotting and materials, or
2. Exchange of answer scripts
3. Theft/Removal of examination scripts or materials.
4. Mischief by fire to examination scripts or materials before, during and after examinations.
5. Copying from cheat notes.
6. Consulting/abetting cheating.

b. Rustication for one academic year

The following offences shall carry punishment of rustication for one session:

- i. Non-submission or incomplete submission of answer scripts.
- ii. Introduction of foreign materials to the examination venue.

c. Written warning

The following offences shall attract a written warning:

- i. Speaking/ conversion during examinations.
- ii. Writing on question papers or scraps of paper.

d. Offences involving staff

Any act or omission amounting to examination malpractice by a member of staff shall be referred to staff disciplinary committee for appropriate punishment.

e. Absence from examination

i. Candidates must present themselves at the University Examinations for which they have registered under the regulations. Candidates who fail to do so shall be deemed to have failed that examination. Misreading or clash of the timetable shall not be accepted as a satisfactory explanation for absence,

ii. Once a candidate has written his/her identity number on his/her scripts, the number so written should not be tampered with, for example, in the form of cancellation and rewriting.

External Examiner

There shall be external examiners appointed to vet and moderate the programme of courses and examinations for the various subject areas in groups to cover the professional years. External Examiners will be involved in examination moderation from 300 level. It is recognized that professional organisations usually participate in special areas needing professional input. The external examiner report should be made to the Vice-Chancellor and be made available to the Department for appropriate action.

Cognate Courses offered in the Various Departments for B. Pharm Degree

Courses offered in the Directorate of General Studies

GENS 101: Communication in English(2CU)

This course unit is designed to teach effective communication and writing and speaking in the English Language such as basic grammar, phonetics, comprehension, lexis and structure, and summary. Other parts of the course are language such as the word, the sentence, and the paragraph, essay writing, writing an outlines, paragraph, the collection and organization of primary and secondary materials, figures of speech, logical presentation, and punctuation.

GENS 102: Communication in English II(2CU, 30hrs)

This method will be devoted to composition and other forms and practices of writing such as essays, letters, reports, the long essay, Minutes of Meetings and various kind of writing such as invitations, public announcement, speech writing, feature and magazine writing. Attention will be paid to logical presentation of the materials and ideas in writing, correct language use and other technical matters connected with these kinds of writing. Yet other parts of the course will deal with the strategies of good academic writing (the formal aspects of literary and critical composition), literary study skills (such as the use of the library, title or author catalogue, index, how to find primary and secondary literature) and finally, the different kinds of style sheets in library studies.

GENS 103: Communication in French(2CU)

This offers a basic introduction to French, the French alphabet, numeric in the language, effective communication, written and oral, in the language, and conjugation and simple sentence construction, based on communicative approach to comprehension and literary appreciation of simple texts.

GENS 103: Communication in Arabic(2CU)

This course introduces the student to the Arabic alphabet and writing systems, elementary composition, conversational exercise in the language, and instruction in basic reading skills, sentence construction, and literary appreciation.

GENS 104: Use of Library, Study Skills, and Information Communication Technology(2CU, 30hrs)

This course unit introduces students to the use of library, a brief history of the library, library education, and how to best locate and tap into the resources of modern library holdings, including instruction in different types materials, e-learning, e-materials, and so on. Other parts of the course will deal with library cataloguing systems such as Card, OPAC, etc., and classification. The course will raise questions of copying, and specific techniques of database resource topic are: the development of bibliographic citation and referencing. Other course topic are: the development of modern ICT, hardware and soft technologies, input, output, and storage devices, communication and internet services, word processing and other editorial skills.

GENS 106: Logic, Philosophy and Human Existence(2CU, 30hrs)

This introduces students to the rudiments of philosophical discourse, including drawing inference from what is known. The course also introduces students to the study of reasoning, and the basic logical concepts; symbolic logic, propositions and sentences; arguments, premises, and conclusions; Induction and deduction: definition, Fallacies, categorical Syllogisms; Probability, Law of Tort Illustration will be taken from standard text book discussions, and from literature, law reports and other relevant materials.

GENS 201: Introduction to Entrepreneurial Studies(2CU, 30hrs)

This is an introduction to entrepreneurial and new venture creation. It also includes such topics as entrepreneur and practice, forms of business ventures, marketing, capital requirements, capital rising, and finance planning and management. Other topics are how to start a business, flexibility studies, innovation legal issues, insurance and environmental considerations. The course will also pay attention to issues of business opportunities in Nigeria.

GENS 202: Peace Studies and Conflict Resolution(2CU, 30hrs)

The course offers instruction in the concepts and theories of peace, peace studies, and conflict resolution. Other topics will be the role of peace in unity and development, conflict issues and types of conflict, the root causes of conflict and violence on Africa and the world, the native-setter divide, peace building, peace enforcement, peace-making, peace keeping, and peace support operation. Others are conflict resolution, management of conflict and dialogue and arbitration in conflict resolution, the role of international organizations such as the United Nations, ECOWAS, the African Union, in conflict resolution.

GENS 203: History and Philosophy of Science(2CU, L30hrs)

This course will study the basic history of science, including the development of the scientific spirit of investigation and discovery; the origins and nature of human beings in relation to the other animals, and scientific methodology itself. Other parts of the course include the study of science and technology in relation to societal and human needs, renewable and non-renewable resources; the impact of scientific and technological process on the environment; and the issue of waste, conservation, and chemical and radio chemical hazards.

GENS 204: Nigerians People, Culture and Community Service(2CU, 30hrs)

The course studies Nigeria history, culture and the arts in their pre-colonial contest; the evolution and development of the Nigerian cultures, their characteristics; Nigerian economic history, issues in the question of economic and social justice; the environmental issues, the individual and national development; the questions of values and national density, the social contract traditional and modern Nigerian Institutions such as trade unions, civil society groups, and other voluntary groups: the moral and civic responsibilities of the state and the citizens. The course includes a voluntary service in a non-profit organization. A report will be submitted to the director for confirmation.

GENS 301: Introduction to Entrepreneurial Skills(2CU)

This course presents a tactical approach to some of the issue raised in GENS 201, namely a detailed focus on specific ventures such as the following:

1. Soap/detergent, tooth brush, and tooth paste making
2. Photography
3. Brick, nail and screw
4. Dyeing, textile, block paste making
5. Rope making
6. Plumbing
7. Vulcanizing
8. Brewing
9. Glassware production, ceramic production
10. Paper production
11. Water treatment/ Condition/Packaging
12. Form processing/Packing
13. Food Processing/Preservation
14. Metal work/Fabrication-steel and Aluminum door and windows
15. Training Industry
16. Vegetable oil/ salt extraction
17. Fisheries/Aquaculture
18. Refrigeration/Air condition
19. Plastic making
20. Farming
21. Domestic Electrical wiring
22. Radio/TV repairs
23. Carving
24. Weaving
25. Brick making/Laying
26. Bakery
27. Tailoring
28. Iron welding
29. Building Drawing
30. Carpentry
31. Leather tanning
32. Interior decoration
33. Printing
34. Animal husbandry (Poultry, piggery, goat herding)
35. Metal Craft (Blacksmithing, tinsmith)
36. Sanitary Wares
37. Vehicle maintenance
38. Book keeping

Courses offered in the Department of Biological Sciences

BIOL 101: General Biology I (3 CU, 45hrs)

Cell structure and Organization, functions of cellular organelles, diversity, characteristics and classification of living things, general reproduction, interrelationship of organism; heredity and evolution, elements of economy and types of habitat.

BIOL 102: General Biology II (3 CU, 45hrs)

The generalized survey of the plant animal kingdom based on study of similarities and differences in the external features, ecological adaptation of these forms.

BIOL 107: Practical Biology I (1 CU, 45hrs)

Fundamental laboratory techniques; Basic laboratory principles; Health and safety measures; Investigative approach; principles of measurement, SI units and their uses, observation and drawing of diagrams; obtaining and identifying specimens; collection, fixation, preservation, naming and classification of plant and animal specimens.

BIOL 108: Practical Biology II (1CU, 45hrs)

Manipulating and observation specimens; Microscopy, sterile techniques, cell cultures, immunological methods, enzyme studies.

Courses offered in the Department of Chemistry

CHEM 101: General Chemistry 1(3 CU, 45hrs) L30, P0, T15

Review of laws of conservation of matter: - Avogadro's hypothesis; Atoms, molecules and chemical reaction, chemical equation and stoichiometry; Modern atomic theory of atoms: -Sub- atomic particles, electrons, protons and neutrons, atomic numbers, mass number, isotopes, periodicity, periodic laws, electronic energy levels, s, p, d and f orbital including the work of John Dalton, Neils Bohr, J.J Thompson, Rutherford, Milikan and Morseley; their contributions, draw backs and challenges of their theories; Atomic structure: Interpretation of Schrodinger wave equation, Quantum numbers, Aufbau principle, Hund's rule, Pauli exclusion principle, Heisenberg uncertainty principle. Introduction to radioactivity; Chemical bonding: - Types of Bonding and factors influencing them; properties of gases; chemical equilibrium: - Reversible and irreversible reactions, dynamic equilibrium, K_c and K_p and their relationship; Thermodynamics: - calculation of Enthalpy, change in Entropy, Gibbs free energy, and spontaneity of chemical reaction. Chemical kinetics: - reaction rate, factor, affecting reaction rate, Arrhenius equation, simple calculation limited to 1st order reaction only, distinction between order and molecularity; Electrochemistry: Balancing redox reactions in term of change in oxidation number.

CHEM 103: Experimental Chemistry I (1 CU, 45hrs) L0, P45, T0

General laboratory safety guides. Weighing and preparation of primary and secondary standard solutions. Use $M_1 V_1 = M_2 V_2$ Acid – base titrations, redox titrations, simple qualitative inorganic analysis.

CHEM 102 General Chemistry II 1 (3 CU, 45hrs) L45. P0. T0

Historical survey of the development and importance of organic chemistry; nomenclature and classes of organic compounds; Homologous, series; functional groups; isolation and purification of organic compounds: - Melting and Boiling point determination, crystallization and recrystalliation, sublimation, separation techniques, chromatographic separation, liquid extraction, detection of elements C, N, S, H and

HoloGENS by sodium fusion test; Introduction to Qualitative and Quantitative organic chemistry; stereochemistry; Determination of structure of organic compounds; Electronic theory in organic chemistry: - Inductive, mesomeric and steric effects; saturated Hydrocarbons; unsaturated Hydrocarbon; concept of Hybridization: - sp , sp^2 and sp^3 and their effects on structure and reactivity. Periodic table and periodic properties; valence forces; structure of solids. The chemistry of selected metal and non-metals.

CHEM 104 Experimental Chemistry II (1 CU, 45hrs) L0, P45, T0

Test for saturation and un-saturation in organic compounds. Detection of elements (C, H, N & S) by sodium fusion test. Simple distillation, depression of m.p/elevation of b.p and determination of molecular mass of a compound, preparation and crystallization of simple inorganic compound.

Courses offered in the Department of Mathematics

COSC 101: Introduction to Computer Science (2CU, 30hrs)

Prerequisite – O/L Mathematics

1. Introduction to Computers- Definition, Characteristic of Computers, Evolution of Computers, Generations of Computers, Basic Organization, Types of Computers)
2. Basic Computer Organization – Input Unit, Output Unit, Storage Unit, Arithmetic & Logic Unit, Control Unit, Central Processing Unit.
3. Introduction to Software and Firmware, Software types (System, Application, Business & Scientific, Real time software),
4. Introduction to Operating System- Definition, functions, categories, Concept of CUI&GUI, Working in CUI&GUI environments, Introduction to Windows Family Operating Systems Categorization of OS based on Users, Task Handling Capabilities and Manufacturers.
5. Software Installation (General Software installation) – Basic System Requirements for installing Software, Windows XP/Windows 7 Installation, Installation of Application Packages such as Microsoft Office.
6. Introduction to computer program planning – purpose of program planning, Algorithms, Flowcharts (Flow chart symbols, sample flow charts, levels of flow charts, flow charting rules, Advantages and limitations of flow charts), Decision tables, Pseudo codes.
7. Introduction to Hardware Components – With special reference to Adapter Cards, Display, Floppy Disk Storage, Hard Disk Storage, Optical Storage, Switch Mode Power Supply, Printers, Architecture of Pentium Series Motherboards, Semiconductor Memories (RAM & ROM), Static & Dynamic RAM (introduction to SD, RD & DDR Technology of RAMs)
8. Hardware Lab- Identification of various computer components, preventive maintenance & troubleshooting techniques.
9. Computer Threats and Security – Computer Virus, Internet Security.
10. Introduction to Basic programming – Data Types, Variable and Variable Definition, Rules for Writing Variables Operators (Arithmetic and Logical), Basic Statements, Writing Simple Programs (Calculating Area, Volume, Comparing Numbers). (Version: QBasic).

Text Books

- a. Computer Course, Vishnupriya Singh, Computech Publications Ltd. (India).
- b. Introduction to Information Technology, V. Raja Raman, Tata McGraw Hill.
- c. Absolute Beginner's Guide to PC Upgrade, TJLee, Que

d. Computer System Architecture, M.M. Mano, PHI

MATH 101: General Mathematics I (3 CU, 45hrs)

Prerequisite – O/Level Mathematics

1. **Sets:** Definition of a set, finite and infinite sets, equality of sets, subsets, union, intersection, universal set, complements, empty set, Venn diagram. Symmetric difference, power sets and De-Morgan Theorems Inclusion- Exclusion principle, Elements of relations and functions.
2. **Some Properties of number systems:** Natural numbers, integers, rationales, irrationals and real's. Order relations in the set of real numbers Open and closed intervals on the number line.
3. **Complex Numbers:** Definition of a complex number, addition, multiplication and division. Geometric interpretation, modulus and conjugation. Polar representation, De-Moivre's theorem, n^{th} roots of a complex number, n^{th} roots of unity.
4. **Trigonometry:** Circular Measure, trigonometric functions of angles of any magnitude, $\sin(A+B)$, $\cos(A+B)$, $\tan(A+B)$ and their proofs, addition and factor formulae.

MATH 121: General Mathematics II (3CU, 45hrs)

Prerequisite – O/Level Mathematics

1. **Plane Polar Coordinates:** Relation between polar and Cartesian coordinates, plotting and sketching of simple curves whose polar equations are known.
2. **Coordinate Geometry of lines and Circles:** Pair of straight lines and system of circles (Emphasis on concepts rather than formulae).
3. **Conics:** Properties of parabola, ellipse, hyperbola, rectangular hyperbola, their Cartesian and parametric equations, problems involving elimination of parameters, tangents and normal.
4. **Rate of Change:** Velocity, acceleration and other rates.
5. **Differential equations:** First order differential equations only.

Courses offered in the Department of Physics

PHYS 101:Mechanics, Thermal Physics and Waves: (3 CU, 45hrs) L 30: P0: T 15)

Space and Time, Units and dimension, Kinematics; Fundamental Laws of Mechanics, statistics and dynamics; work and energy; Conservation Laws. Elasticity; Hooke's Law, Young's shear and bulk moduli, Hydrostatics; Pressure; buoyance, Archimede's Principles, Surface tension; adhesion,cohesion,capillarity, drops and bubbles.Temperature; heat; gas laws of thermodynamics, kinetic theory of gases.Sound, applications.

PHYS 102: Electricity, Magnetism and Modern Physics (3 CU, 45hrs) L 30: P0: T 15)

Electrostatics; conductors and currents; dielectrics; magnetic fields and induction; Maxwell's equations; electromagnetic oscillations and waves; Applications.

PHYS 107: General Physics Laboratory I (1 CU, 45hrs)

Three (3) hours weekly laboratory course covering the basic experiments in Mechanics, Heat and Properties of Matter

PHYS 108: General Physics Laboratory II (1 CU, 45hrs)

Three (3) hours weekly laboratory course covering the basic experiments in Optics, Electricity, Magnetism and Modern Physics

Courses offered in the Department of Anatomy

ANA 207: Anatomy and Histology I (3CU, L30hrs, P45hrs)

Lecture 2CU (30hrs)

Basic organization of the human body: A study of human biological structure at various levels of complexity: from subcellular to gross and microscopic structure of individual organ systems. Structure – function correlations are emphasized: integumentary system(2hrs), Circulatory system(2hrs), Lymphoid system(2hrs), Alimentary system(2hrs), Musculoskeletal system(2hrs), Respiratory system(2hrs), Urinary system(2hrs), Genital system(2hrs), Endocrine system(2hrs), Organs of special sense(2hrs).

Histology. The tissue: The lymphatic system(1hrs). The alimentary system(1hrs). The exocrine glands(1hrs). The Urinary glands (1hrs). The reproductive system(1hrs).

Tutorials 5hrs

Practical 1CU (45hrs): Histology

212: Anatomy and Histology II (3CU), L30hrs, P45hrs)

Lecture 2CU(30hrs)

Neuroanatomy

Introduction to Neuroanatomy. Basic structural organization of the various system. The neuron (soma and neuritis) (2hrs); Centralization and Telencephalization; Neural Circuitry (Receptors, Effectors and the synapse)(2hrs); Spinal cord and brain vesicles; Fate of the Neural Crest(2hrs). Spinal Cord: General Topography; Grey matter; Ascending and descending pathways(2hrs). Brain: General Topography: Brainstem; Cerebellum(2hrs); Diencephalon; Cerebrum. Meninges and Ventricular system: pia, Arachnoids and Dura Matera(2hrs); Secretion and Circulation of Cerebrospinal fluid; Blood-Brain Barrier(2hrs). Peripheral Nervous system: Basic plan; Afferent and Efferet cerebrospinal peripheral nerve endings(3hrs); Gangilia. Autonomic Nervous system; Autonomic effectors endings(2hrs). Organs of special senses(5hrs).

Tutorial: 6hrs

Practicals 1CU (45hours): This will involve the use of plastic models and slides for histology and class demonstrations.

Courses offered in the Department of Medical Biochemistry

BCH 211: Medical Biochemistry I(3CU)

Lecture (1CU) 30hrs

pH and Buffers, acid base balance in the body fluids, water and electrolyte balance in the body cell and sub-cellular components(6hrs). Properties, structure and function of carbohydrates/introductory enzymology(6hrs). Properties, structure and function of proteins (6hrs). Properties, structure and function of Nucleic Acids(6hrs). Properties, Structure and Function of Lipids and Lipoproteins(6hrs).

Practical (1CU) 45hrs

General Laboratory Procedure in Biochemistry I

212: Medical Biochemistry II(3CU)

Lecture (1CU) 30hrsLipid and Lipoprotein Metabolism (5hrs), Carbohydrate Metabolism (5hrs), Protein and Amino Acid Metabolism (5hrs).Nucleic Acid Metabolism(5hrs),Bioenergetics(5hrs), Biochemistry of Hormone and Hormonal Actions (5hrs), Nutritional Biochemistry (6hrs).

Practical (1CU) 45hrs.

pH and Buffers

Courses offered in the Department of Physiology**HPY 209: Physiology I 2CU (30hrs)****Introductory Physiology(10hrs)**

Body fluids, cell Physiology, Transport system, Excitable, cells, contractile tissues. Homeostasis. Control System; Blood Introductory Autonomic Nervous system.

Cardiovascular Physiology (10hrs)

Cardiac muscle, E.C.G, Hemodynamics, Systemic Circulation, Events in Cardiac cycle, Heart rate and its control, Blood pressure, Cardiac output.

Neurophysiology (10hrs)

Organization of the CNS and CNS control systems, Spinal reflexes, Excitation. 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.

HPY 212: Physiology II (3CU, L30hrs, P45hrs)**Respiratory Physiology (6hrs)**

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, hyperpnea, Apnoea, periodic respiration, Dyspnea, Cyanosis.

Renal Physiology(6hrs)

Introduction 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.

Gastrointestinal Physiology(6)

Introduction: Mastication, deglutition; Salivation, Stomach and its emptying, small intestine, Large intestine, salivation, gastric and pancreatic juices reflexes, digestion absorption and Assimilation, Bile.

Endocrinology & Reproduction(8)

Introduction and general features, Thyroid: parathyroid and calcium Metabolism, Pituitary gland, Adenohypophysis, Adrenal Cortex and Medulla. Pancreas, Thymus, Pineal Gland, Male and Female Reproductive systems.

Special Senses (4hrs)

Eye, retina, sight, accommodation, photochemical mechanism, receptors potential, light reflexes, adaptation, ear, sound waves, Hearing, Taste, smell physiology

Practical (45hrs)

Practical is designed to augment and enhance understanding of the topics covered in Physiology.

Core Courses offered in the Various Departments for B. Pharm Degree

Courses offered in Department of Pharmacognosy and Drug Development

Synopsis of 200 Level Pharmacognosy and Drug Development Courses

PCG 201: Introduction to Pharmacognosy (First Semester)

Credit Units = 2 (Pre-requisite = BIOL 101,102)

Course description: The course is designed to provide students with fundamentals of pharmacognosy.

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

- i. Describe the meaning of pharmacognosy and outline its scope.
- ii. Classify and describe crude drugs from natural sources.
- iii. List and describe the plant cell wall materials and cell inclusions.
- iv. Manipulate the simple light microscope for evaluation of crude drug.

Course Content

Lectures, 1CU-15 hours

1. **Introduction (3 hrs.):** Definitions, history and scope of Pharmacognosy (1hr.). Crude drugs (sources, forms, classification and description) (1 hr.), collection and preparation of crude drugs. Introduction to binomial system of naming plants (1 hr.).

2. **Microscopy (7 hrs.):** The microscope and its parts, microscopic techniques and specimen preparations, mountants and staining reagents (2 hrs.). Modified light microscopy (dark field illumination, phase contrast system etc., demonstration on use of polarized light etc. (2 hrs.). Micrometry (Quantitative microscopy); use of camera lucida, graticules, image shearing eyepiece (1hr.), determination of various physical constants involving microscopic characters; Lycopodium spore method and its utility etc. (1hr.). Photomicrography and its application in the study of natural drugs (1hr.).
3. **Cytology (5 hrs.):** plant cell structures, cytomorphology (basic cell types such as parenchyma, collenchyma, sclerenchyma etc.)(1 hrs.). Specialized cells such as trichomes, stomata etc. (2 hrs.), cell wall materials (cellulose, hemicellulose, pectin, inulin etc.), cell inclusions (starches, calcium oxalate, calcium carbonate, silica etc.) (2 hrs.).
4. **Practical Classes, 1CU (45 hours):** Application of Microscopy

PCG 202: Organized and Unorganized Vegetable Drugs (Second Semester)

Credit Units = 3(Pre-requisite = BIOL101,102)

Course description: The course is designed to provide students with knowledge of plant organs used for medicinal purposes with reference to typical official plant drugs.

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

- i. Outline the basic morphological & microscopical features of organized vegetable drugs.
- ii. Use simple physical & chemical test to identify cell-wall materials and cell inclusions.
- iii. List some natural products obtained from selected organized official drugs.
- iv. Describe the physical and chemical nature of unorganized vegetable drugs.
- v. List the applications of unorganized drugs in Pharmacy and other industries.
- vi. Apply simple physical and chemical test to identify pharmaceutically important unorganized vegetable drugs.

Course Content

Lectures, 2CU-30 hours

1. **Organized vegetable drugs** (Underground and Over ground structures) **(25 hrs.):** General features of plant organs and detailed discussion on some drug examples:
 - (a) Root/bulb/rhizome/corm and their tissue distribution, drug examples include rauwolfia, liquorice, rhubarb, ginseng, ipecacuanha, ginger podophyllum, colchicum, squill and onion (5 hrs.)
 - (b) Bark and Wood and their tissue distribution, drug examples include cascara, cinchona, quillaia, wild cherry, cinnamon and quassia (4 hrs.)
 - (c) Leaf and its tissue distribution drug examples include digitalis, senna, belladonna, stramonium, squill, tobacco, cannabis etc (5 hrs.)
 - (d) Flower and its tissue distribution drug examples include pyrethrum, clove (2 hrs.)
 - (e) Fruit and its tissue distribution drug examples include anise, fennel, cardamom, capsicum (2 hrs.)
 - (f) Seed and its tissue distribution drug examples include nux-vomica, castor, nutmeg, strophanthus, Calabar bean etc. (2 hrs.)

- (g) **Fibers:** Sources, classification, microscopically characters and general properties of fibres, identification tests for common fibres. Fibers to be studied include: cotton, hemp, jute, wool, etc. (3 hrs.).
- (h) **Surgical dressings:** Classification, composition and arrangements of component material, qualitative, quantitative and functional standards(2 hrs.).
2. **Unorganized vegetable drugs(5 hr).** (gums, mucilages, lattices, balsams, styrax, gelatin, resins *etc.*). Drug examples include acacia, tragacanth, agar, sterculia, spermacetic *etc.*).
3. **Practical Classes, 1CU (45 hours):** Microscopical Examinations of Organized Crude Drugs

Synopsis of 300 Level Pharmacognosy Courses

PCG 301: Extraction Processes and Separation Techniques (First Semester)

Credit Units = 2 (Pre-requisite = PCG 201 and PCG 202)

Course description: The course is designed to provide students with knowledge and skills on the extraction and isolation/purification of natural products.

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

- i. Outline different methods of preparing galenicals.
- ii. Describe in details the official methods of extraction of crude drugs.
- iii. List the advantages and disadvantages of extraction methods.
- iv. Suggest the appropriate choice of solvent for extraction.
- v. Explain the mechanisms of separation by chromatography.
- vi. Develop appropriate solvent systems for chromatographic separations.
- vii. Set up planar and column chromatographic experiments.
- viii. Describe the modes of operation of electrophoresis and ion exchange.

Course Content

Lectures, 1CU-15 hours

1. Extraction processes(5 hrs.): Introduction, definition, general conditions, and solvents used in extracting active constituents from natural drugs (1 hr.). Extraction processes used in the preparation of galenicals in pharmacy; (e.g. preparation of infusion, decoction, tinctures and extracts) (2 hrs.). Official methods of extraction of crude drugs e.g. maceration, percolation hot and cold extractions, continuous hot extraction, expressions *etc.* (2 hrs.)

2. Introduction to Separation Techniques (10 hrs.): Definitions, history, principles, classification of chromatography (by mechanism of separation e.g. absorption, partition *etc.*, by techniques (e.g. frontal analysis, displacement chromatography, elution chromatography *etc.*) by configuration (e.g. planar, column *etc.*) by applications (e.g. analytical, preparative *etc.*). Adsorbents and solvents, analytical versus preparative chromatography (2 hrs.).

- (a) *Paper Chromatography*; Adsorbents, equipment and materials, development techniques (e.g. ascending, descending, two dimensional etc.) visualization of chromatogram, detection of spots, use of spraying reagent, application (1 hr.).
- (b) *Thin Layer Chromatography (TLC)*: Introduction: Principles, adsorbents, development techniques, distinction between TLC and paper chromatography; preparation of plates, application of samples; methods of development e.g. ascending two dimensional, gradient etc. (1 hr.), Characterization of spots (R_f –values). Comparative thin layer chromatography (Co-TLC), application of thin layer chromatography (2 hr.).
- (c) *Column Chromatography (CC)*: Introduction; type, principles etc., adsorbents used in Column chromatography e.g. alumina, silica, magnesium silicate, charcoal etc., solvents used, elutropic solvent series. Techniques used in column chromatography e.g. frontal analysis, displacement and elution, application of column chromatography (1 hr.).
- (d) *Gel Filtration*: Introduction: fundamental of separation types, technique of separation on sephadex, e.g. including preparation of gel, packing of column application of sample, development, of column etc. application (1 hrs.).
- (e) *Electrophoresis*: Introduction, principles, techniques and types, electrophoresis on paper, low, medium and high potential gradients, application etc. (1 hrs.).
- (f) *Ion-exchange chromatography*: Fundamentals, terminologies, chemical reactions, and affinities in ion exchange etc. Techniques of chromatography on organic synthetic ion exchange resins (principle of ion exchange operation). Characterization of resins selection, fractionations, buffering of ion-exchangers, binding, storage and aeration of the resins, application of samples, flow rate, collection and analysis of fractions (1 hrs.). Ion-exchange and chromatography on synthetic resins (separation of cations onions sugars, alkaloids, amino acids etc.). Chromatography on cellulosic ion exchangers (techniques and applications etc.), ion exchange on papers (1 hr.)

**3. Practical Classes ICU (45 hours): Extraction processes and Chromatography
PCG 302: Phytochemical Methods in Drug Analysis (Second Semester)**

Credit Units = 3 (Pre-requisite = PCG 301)

Course description: The course is designed to familiarize the students with bioactive constituents of medicinal plants, their chemistry and application in pharmacy.

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

- i. Classify secondary metabolites according to their chemistry.
- ii. Suggest biosynthetic pathways for the plant metabolites.
- iii. Carry out simple chemical test for detection of the plant metabolites
- iv. Demonstrate some simple methods for isolation of plant metabolites

- v. Identify plants that produce bioactive metabolites of pharmaceutical importance

Course Content

Lectures 2CU(30hrs)

- 1. Introduction to Phytochemistry(1 hrs.):** Definition, scope, classification of plant metabolites, importance of primary and secondary metabolites, brief mention of nature and properties of various plant constituents e.g. carbohydrates, glycosides, alkaloids, tannins, fats and oils etc.
- 2. Biogenesis of natural products (4 hrs.):** Definitions, history, types of biochemical reactions - transfers of radicals, hydrolysis, esterification, oxidation and reduction *etc.* Study of biosynthesis of some selected class of plant constituents including carbohydrates, isoprenoids, flavonoids, alkaloids, *etc.*
- 3. Phytochemistry of Alkaloids (10 hrs.):** Definitions, true and pseudo alkaloids, occurrence and distribution, structure and classification, chemical and physical nature/properties (e.g. formation of salts and solubility in water and organic solvents etc.). General chemical tests for alkaloids (Wagner's reagent, Mayer's reagent and Dragendoff's reagent etc.) and specific chemical tests for alkaloids (Vitali-Morin test for tropane alkaloids). Extraction, isolation and characterization of alkaloids. Discussing various groups of alkaloids including but not restricted to non-heterocyclic alkaloids (Ephedra alkaloids, e.g. ephedrine), Colchicum alkaloids, (e.g. Colchicine) Heterocyclic alkaloids (Pyridine-Pyrrolidine group e.g. Nicotine), Tropane group (e.g. Hyoscyne, Atropine/hyoscyamine from *Stramonium* and *Balladonna*), Quinoline group (e.g. Morphine, Papaverine from Opium), Quindizidine (nor-lupinane) Indole (Benzopyrrole) group (e.g. reserpine, ergotamine; strychnine, vinblastine from *Rauwolfia*, Ergot, *Nux-Vomica*, *Catharanthus*), Imidazole group (e.g. Pilocarpine), Purine group (e.g. Caffeine from Tea and Coffee), Steroidal alkaloids (e.g. Veratramine), Terpenoid group (e.g. Aconitine) etc. Representative of each group above should be discussed under:
 - Sources and Distribution
 - Biosynthesis&Classification (where necessary)
 - Chemistry and properties
 - Tests for detection and identification
 - Methods of extraction, isolation and purification
 - Pharmacological actions and uses
 - Medicinal preparation and pharmaceutical applications
- 4. Phytochemistry of carbohydrates (3 hrs.):** Introduction, chemical nature, types of compounds, configuration, significance of α and β position and linkages, general chemical tests, classifications: mono-saccharides, disaccharides, polysaccharides, chemical reactions of different groups of carbohydrate. Detailed studies on the pharmaceutically important carbohydrates such as sugars, starch etc. with their distinguishing chemical tests.
- 5. Phytochemistry of glycosides (6 hrs.):** Introduction, sources, classification, occurrence and distribution in nature, general properties and chemical nature, nomenclature of the following

glycosides: saponins, cardiac glycoside, coumarins, phenyl propanoids, flavonoids and tannins including their biogenesis, identification tests, medicinal uses and toxicities. Drug examples include the following: Anthraquinones (*Aloes, Cascara Sagrada, Rhubarb and Senna.*)Cardiac glycosides(*Digitalis;Strophanthus, Squill*)Saponins (*Glycerrhiza, Dioscorea, Sarsaparilla*)Cyanogenic glycosides (Wild cherry bark).

6. Tannins (1 hr.) History, chemical nature and properties of tannins, classification of tannins, test for tannins, medicinal and industrial uses of tannins. Drug examples include: cinnamon, wild cherry, cinchona, willow, acacia, catechu and hamamelis

7. Phytochemistry of lipids (2 hrs)

- (a) Introduction: definition occurrence, distribution, sources and classification, properties, chemical composition, chemical tests and physical constituent of fixed oils.
- (b) Extraction of fixed oils and fats from their natural sources, pharmaceutical and other uses of lipids.
- (c) Detailed study of cod-liver oil, castor oil, wool fat and bees wax (covering their official natural sources, collection and preparation for the market, preservation and storage chemical constituents medicinal and other uses).

8. Phytochemistry of the volatile oils (2 hrs.)

- (a) Definition and occurrence, characteristics chemical nature, classification.
- (b) Extraction of volatile oils from their natural sources, medicinal and other uses, distinction between fixed oils and volatile oils.
- (c) Detailed study (sources, distinguishing characters, cultivation, collection, extraction, constituents and uses) of the following drugs: peppermint, cardamom, clove, cinnamon, camphor and eucalyptus.

9. Phytochemistry of amino acids, protein and enzyme (1hrs)

- (a) Introduction: definition, identity, importance etc.; nature, properties classification and nomenclature, co-enzymes. Therapeutic and industrial importance and uses.
- (b) Detailed study of the following pharmaceutical enzymes including their official natural sources, collection and preparation, medicinal and industrial uses. Drug examples: papain, pancreatin, pepsin, renin.

10. Practical Classes, 1CU (45 hours): Phytochemical Screening of Extracts

PCG 401: Evaluation of Crude Drugs(First Semester)

Credit Units = 2 (Pre-requisite = PCG 301, PCG 302)

Course Description: to understand the simple methods used for evaluation of crude drugs and quality control mechanisms for commercial crude drugs including detection of adulteration/spoilage.

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

- i. Outline the causes and methods of detecting adulteration from crude drugs.
- ii. Describe simple methods for validation of medicinal products from natural sources

- iii. Carryout simple experiments for determination on quality control of crude drugs.

Course Content

Lecture, 1CU-15 hours

1. **Introduction (2hr):** definitions of quality and purity; methods of preserving quality in crude drugs, methods of establishing identity of crude drugs. Adulteration of crude drugs (types of adulterants, causes and detection of adulteration).
2. **Methods of evaluation (3hr):** (organoleptic, microscopic, chemical, physical, and biological or pharmacological methods), steps involved in systematic evaluation of drugs and chemicals (sampling, preliminary examination; determination of foreign organic matters, etc. Determination of moisture content, extractive values, ester values (for Balsams), determination of acetyl values (for volatile oils), optical rotations, refractive indices.
3. **Spectroscopic analyses (10 hrs.):** Spectroscopic analyses used in the evaluation of drugs (principles and applications of u.v, i.r, mass, and n.m.r spectroscopic methods). Interpretation of u.v., i.r., m.s. and n.m.r. spectra.
4. **Practical Classes, ICU- 45hours:** Standardization and Quality Control of Crude Drugs.

PCG 402: Plant Tissue Culture, Genetics and Chemotaxonomy(Second Semester)

Credit Units = 2 (Pre-requisite = PCG 301)

Lectures, 1CU-15 hours

1. **Plant tissue culture for the production of pharmaceuticals (5 hrs.):** Introduction to tissue culture technique, its scope in Pharmacognosy, methods of initiation of cultures, Equipment and facilities for tissue culture work, culture growth media, sterilization of media, and equipment. Factors, affection growth of cultures, advantages of tissue cultures over intact plant for the production of medicinal plants and their active constituents. Applications of plant tissue culture in plant breeding, testing drug efficacy and toxicity, metabolic studies, production of medicinal compounds. Secondary plant products produced by plant cell cultures with specific examples of alkaloids, glycosides, essential oils, antibiotics etc.
2. **Plant genetics and ecology (5 hrs.):** General introduction to the topic including aims, definitions, scope terminology, significance of genetics in the study of medicinal plants etc. Mendel's law of inheritance. Role of the genetics in higher plants in the production of active principles; mutation, polyploidy, cross breeding inheritance of characters etc. Generation of new plants. Anatomical/morphological and chemical adaptation of plants to different environmental and climatic factors.
3. **Chemotaxonomy and plant systematics (5 hrs.):** historical background, definitions terminology, relationship among chemotaxonomy, plant systematics and comparative phytochemistry. Introduction to techniques used in comparative phytochemistry.

4. Practical Classes, 1CU(45 hours): Field trips and Preparation of Herbarium Specimens

PCG 501: Traditional and Complimentary/Alternative Medicine (First Semester)

Credit Units = 2 (Pre-requisite = PCG 401 and PCG 402)

Course Description: The course is designed to enable students acquire a working knowledge of the most commonly used medicinal plants in traditional medicine in Nigeria. The course will give relationship between the various alternative medical practices and orthodox medicine.

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

- i. Outline the meaning and history of traditional medicine
- ii. Discuss African system of traditional medicine with emphasis to Nigeria.
- iii. Explain the influence of culture, religion, myths, superstitions etc. on traditional medicine
- iv. Explain the role of traditional medicine to health care system.
- v. Discuss the contribution of traditional medicine practitioners (TBAs, bone-setters etc.)
- vi. Explain the different systems of traditional medicine as perceived and practiced by different cultures of the world.
- vii. Prepare herbarium samples for Medicinal plants commonly found in Nigeria.

Course Content:

Lectures, 1CU-15 hours

1. **Traditional Medicine (5 hrs.):** Introduction, definition, history, medicine-men, herbalists, documentations, etc. Tradition and superstitions in traditional system (influence of culture, habit, religion, myths, superstitions etc.) Impact of traditional medicines on rural health and economy. African traditional medicine, practice of traditional midwifery and traditional birth attendance (TBAs), bone setting, traditional surgery, traditional methods of diagnoses.
2. **Nigerian Medicinal and Ordeal Plants (5 hrs.):** Enumerate some Nigerian medicinal and ordeal plants. History, superstitions and religious, rites etc. Significance of medicinal and ordeal plants in relation to community health, domestic and quack uses -cases of poisoning etc. Scientific bases for the uses of some the plants.
3. **Ayurvedic, Unani and Chinese healing methods(5 hrs.):** Manual manipulations, mind-body interventions, aromatherapy, hypnosis, acupuncture, diet, homoeopathy, herbal clinics: psychiatry, spiritual healing.
4. **Field Trips 1CU (45 hours):** Report on Traditional Medicine Practices in Nigeria

PCG 502: Drug Development from Plants

Credit Units = 2 (Pre-requisite = PCG 401 and PCG 402)

Lectures, 1CU-15 hours

- i. **Nutraceuticals and Herbal Cosmeceuticals (5 hrs.):** Sources, preparation, and marketing of food plants and other plants with medicinal and cosmetic properties.
- ii. **Herbicides, pesticides and molluscicides(5 hrs.):** Introduction (definition, chemical nature, properties, types, importance, relevance to pharmacy profession etc.). Types of pests requiring control (rodents, arthropods, weeds and microorganisms) their types, nature and possible areas of their activities (1hr.). Impact of attacks of pests on drug crops, stored crude drugs human health methods of pest control (mechanical, biological environmental and agricultural methods, chemical methods etc. their advantages and disadvantages) (1hr.), Chemicals used in pest control e.g. rodenticides, insecticides, herbicides, fungicide, anti-nematodes etc.; their chemical nature properties, types and dangers associated with their application, merits and demerits. Pesticides and law (rules and regulations controlling the sale, distribution and uses of pesticides (2 hrs.), Toxicity of pesticides (general knowledge of the toxic effects of pesticides on human and other animal health, precautions, first aid/emergency treatment of accidental poisoning by pesticide. Responsibilities of the Pharmacists e.g. in safe handling, use and distribution of pesticides (1 hr.).
- iii. **Forensic Pharmacognosy(5 hrs.):** Susceptibility of children and domestic herbivorous animals to wild and ornamental poisonous plants growing in neighborhood. Plants requiring legal control e.g. poisonous, narcotic, addict and hallucinating plants.
- iv. **Field Trips, 1CU (45 hours) :** Report on Industrial Pharmacognosy

PHM 502: Project in Pharmacognosy and Drug development 4 Units(180 hours)

Project involves research topics in Pharmacognosy and Drug development to be supervised by an academic staff. This research project must be hypothesis-driven and may involve laboratory work. Standard for presentation of Research projects in the Faculty must be adhered to. An oral examination of the project is required (both internal and external).

At the end of the course, the students are expected to:

- a. Know how to search the literature relevant to the topic of interest.
- b. Apply practical techniques used in Pharmacognosy and Drug development.
- c. Write a dissertation/project and develop presentation skills.

**Courses offered in the Department of Pharmaceutical and Medicinal Chemistry
First Semester 200 Level**

PCH 201: Pharmaceutical Inorganic Chemistry 2 Unit

Course Description

The course is designed to provide the fundamental of inorganic chemistry of relevance to Pharmacy

Course Objectives

- I. Discuss Hydrogen and its compounds, water, other hydrides and inert gases
- II. To describe the physical and chemical properties of various groups of element
- III. To understand the pharmaceutical applications of group I to VIII
- IV. To be able to understand the various classes of gastro-intestinal complexes and chelating agent and their importance in medicine

Course content:

Lectures, 1CU (15 hours)

1 Hydrogen and its compounds:

Water-chemical properties natural and official water.

Other hydrides, VIII element, and the inert gases.

02 Group properties of elements:

The alkali metals, the alkaline earth metals, IIIA, IVA, the nitrogen family, VIA, the halogen family, VIII element, and the inert gases

- ✓ Pharmaceutical Application of the Group I to VIII Elements
 - ✓ Transition Element and Their pharmaceutical Application
- The transition element and their compound- physical and chemical properties.

03 Biochemistry and medicinal application:

Iron and the hematinics –chemical properties, biochemistry and medicinal application compounds and preparations;

Mineral supplement-role of trace metals: copper, Zinc, magnesium, cobalt manganese and molybdenum, consideration preparation of minerals supplements

4 General gastrointestinal agents:

Acidifying agents, antacids examples of antacids products, protective adsorbents with examples, saline cathartics and their official preparations.

5 Complexes and chelating agents :

And their importance in medicine e.g calcium di-sodium edentate, sodium edentate, Dimercaprol, penicillamine.

Practical: Pharmaceutical inorganic Chemistry, 1CU(45 hours)

PCH 203: Introductory Pharmaceutical Organic Chemistry 1, 2 units (30 hours)

Pre requisite: CHEM 102

Course Description

The course is designed to provide student with the knowledge of organic chemistry with respect to their characteristics, it relation to other branches of chemistry and its relevance to pharmacy.

Course Objectives

- I. To describe the basis on which organic compound are classified
- II. To understand the concept of naming organic compounds using drugs as examples.

Course content:

Introduction

1. Characteristics of organic chemistry, its relation to other branches of chemistry and its relevance to pharmacy, physical properties of organic compound-melting point, boiling point solubility.

02. General classes of organic compounds:

Structural concepts, nomenclature, occurrence, reactions IR, physical and chemical properties with examples of some pharmaceutical agents

03. Hydrogen – alkenes, alkynes, aromatics and fused aromatics hydrocarbons

- Halogenated hydrocarbons
- Alcohols and phenols
- Aldehydes and ketoses

4 . Carboxylic acids and derivatives-esters, lactones amides anhydrides,

5 Nitrogenous compound amines, amides carbonates derivatives, nitro and nitrogen compounds.

Second Semester 200 Level

PCH 202: Pharmaceutical Analytical Inorganic Chemistry

3 Units

Pre requisite: CHEM 121

Course Description

It deals with the aspect of analysis in pharmaceutical inorganic chemistry with regards to sources of impurities, preliminary test, reaction of metal ion and cations, etc.

Course Objectives

- I. To understand the various inorganic impurities and their implication(s) in pharmaceutical product
- II. To be able to carry out analysis of metal ions and cations as they appear in their group

Course content:

Lectures, 2CU (30 hours)

01. Introduction:

Sources and implication of inorganic impurities in pharmaceutical products

2 . Preliminary analysis (dry tests):

Preliminary dry tests (action of heat, flame, coloration, charcoal block reductions, borax and phosphate bead reactions, and ammonium radical test). Preliminary tests for acid radicals, groups.

3 . Reaction of the Metal Ions or Cations:

- The silver group (group)
Reaction of lead, mercurous and silver ions.
Analysis of a mixture of the silver group.
- The copper and arsenic group (group III)
Reaction of mercuric, bismuth cupric and cadmium ions.
Analysis of a mixture of the copper group (Group IIA)
Reaction of arsenious, arsenic, antimonious, antimononic, stannous and stannic ions.
Analysis of a mixture of the arsenic group (group IIB)
- The iron and zinc group (group III)
Reaction of ferrous, ferric, aluminium and chromic irons.
Analysis of a mixture of the iron group (Group III)
Reaction of cobalt, nickel, manganese and zinc ions
Analysis of a mixture of the zinc group (group IIIB)
- The calcium group (group IV)
Reaction of barium, strontium and calcium ions.
Analysis of a mixture of the calcium group
- The alkali group (group)
Reaction of magnesium, sodium and calcium ions
Analysis of a mixture of the calcium group.

4 . Reaction of the Acid Radicals or Anions:

Scheme of classification.

Cyanides; thiocyanates, ferricyanides, ferrocyanides, hypochlorites, chlorides, bromides, iodides, fluorides, nitrates, borates, sulphates, silicates, arthophosphate, hypophosphites, arsenites, arsenates, chromates, permanganates, acetates, formates, arsenates, arsenates, chromates, dichromates, permanganates, acetates, formates. oxilatestartarates, citrates, salicylates, benzoates, succinates.

Practical: Qualitative inorganic chemistry, 1CU(45 hours)

First Semester 300 Level

PCH 301: Pharmaceutical Analysis I

2 Units

Course Description

The course is designed to provide student with various methods involved in pharmaceutical analysis e.g. Acid base titrations, REDOX titration, and Compleximetric among others.

Course Objectives

- I. Define acid and base indicators used in acid and base titration
- II. To be able to know the techniques and applications involve in various titration methods and calculations involved in the determination of the analysts in question
- III. To be able to know what are miscellaneous methods of analysis

Course Content

Lectures, 1CU(15 hours)

1. Acid base titrations:

Definition of acids and bases, acid base indication, experimental titrimetry. Techniques and applications. Calculation involved in acid base titrations

02. Non –aqueous acid base chemistry:

Solvent properties: dissociation, acid base character, dielectric constant the leveling and difference effects, ionization and dissociation measurement of acid base strength. Determination of bases, determination of acids.

03. Oxidation reduction titrations:

Help reaction balancing equations, redo equivalent weights. Titrations with permanganate and cerriusulphate: theory and applications. Iodometric titrations: direct and indirect titrations with permanganate and cerriusulphate: theory and application. Iodometric titrations: direct and indirect titrations, preparation and standardization of iodine and thiosulphate solutions. Detection of end point. Application of the iodometric method.

04. Compleximetric titrations:

Definition of ligands, complexes and chelates, formation and structure of EDTA complexes, their stability and conditional constants, titrations of metals with unidentate and multidentate ligands, PH indicators general principles involved in sodium edentate titration, masking and demasking agents.

5 . Gravimetric analysis:

Definition, techniques involved in procedures using precipitation. Techniques and apparatus used in filtration, washing the precipitate, drying and ignition. Practical examples of precipitation gravimetric analysis,

6 . Miscellaneous methods:

Geometric assays-carbon dioxide and oxygen, sodium nitrate titrations. Mercuric acetate titrations.

Practical: Pharmaceutical Analysis, 1CU(45 hours)

PCH 303: Introduction to Pharmaceutical Organic Chemistry II 1Unit (15 hours)

Pre-requisite: PCH 203

Course Description

The course is designed to provide knowledge on chemistry of neutral compounds and heterocyclic compounds.

Course Objectives

- I. To enable students know the importance of stereochemistry in pharmacy.
- II. Drugs and their enantiomers with their various configurations, and individual therapeutics use.

Course content

1. **Heterocyclic compounds:**
2. **Introduction to chemistry of natural products:**
Carbohydrates, steroids, alkaloids
3. **Stereochemistry:**
4. **Geometric:**
 - Molecular asymmetry and Chirality
5. **Optical isomerism- optical activity:**
Conformation of open- chain and ring systems (butane and cyclohexane).

Second Semester 300 Level

PCH 302: Pharmaceutical Organic Chemistry

3 Units

Pre-requisite: PCH 203

Course Description

The course is designed to provide students with the knowledge of different reaction mechanisms that are of great relevance to drug synthesis.

Course Objectives

- I. Introduction to different reaction mechanism
- II. Applications of different reaction mechanisms in drug synthesis
- III. Relevance of reaction mechanisms in pharmacy

Course content:

Lectures 2CU(30hrs)

1. **Chemistry structure and reactivity:**
 - Inductive resonance and hyper conjugation effects
 - Steric effects
 - Tautomerism
2. **Introduction to organic reaction mechanisms:**
 - Structure, stability, generation and reaction of carbonium ions, carbanions, free radicals and carbenes.
3. **Aliphatic and aromatic nucleophilic substitutions:**
 - Mechanism scope and limitation
 - Effects of solvent, entering and leaving groups
 - Synthetic applications.

4. Aliphatic and aromatic electrophilic substitutions:

- Mechanism, scope and limitations
- Reactivity – effect of substrate, orientation, effect of solvent and leaving groups
- Applications

5. Elimination Reactions:

- Mechanism, orientation, scope and limitations.
- Effect of substrate, attacking base, leaving group and medium on reactivity.
- Applications.

6. Introduction to addition reactions:

Mechanism –electrophilic, nucleophilic, free radical and cyclic addition.

Addition to carbon –carbon multiple bonds

- Orientation of addition reactions
- Synthetic application –hydration, hydroxylation

Addition to conjugate reaction diens

- 1,2 and 1.4 addition reactions
- Diel's alder reaction

Addition to other conjugated system

- Cyanoethylation
- Michael reaction.

7. Addition to carbon-hetero multiple bonds :

With special emphasis to C= O

- effect of pH and structure on addition
- Reaction –hydration, reaction with alcohols, mercaptals, cyanides amine derivatives.
- Reaction involving hydride ions (LiAlH_4), meerwein-ponnodorf reduction, cannizzro
- Reaction involving carbanions (Grignard reagent, aldol, perkin, claisen and benzoin reaction)
- Witting and mannich reactions
- Reaction of acid derivatves.

8. Rearrangement reaction:

- Mechanism
- Reactions- wagner- meerwein, pinacol, arndt-eister, hofmann, lossen, bechman, Baeyer-villinger, witting, curtius

9. Reduction:

- Catalytic hydrogenation
- Metal hydride reductions
- Dissolving metal reductions
- Hydrazine derivatives

10. Oxidation:

- General survey of oxidizing agents

- Peracid oxidation
- lead tetra-acetate oxidation

11. Halogenations:

12. Organ metallic compounds

Practical Organic Chemistry

1 Unit(45 hours)

First Semester 400 level

PCH 401: Pharmaceutical Analysis II

2 Units(30 hours)

Pre-requisite: PCH 301

Course Description

Designed to provide student with knowledge of photochemistry instrumentation, pharmaceutical application of various spectroscopic methods of analysis.

Course Objectives

- I. To be able to understand the laws of photochemistry (beer lamberts law).
- II. To be able to understand the various instrumentation of each spectroscopic method
- III. To know their applications in qualitative and quantitative analysis
- IV. To be able to understand the presentation and interpretation of data obtained in spectroscopic analysis.

Course content

1. Absorption spectrophotometer:

- Electromagnetic radiation-absorption of radiant energy and absorbing groups.
- Beer's Lambert law- graphical representation of data, reliability of measurement, derivations from Beer's Lambert law and analysis of mixtures.
- Molecular structures and electronic spectra; electronic transitions and spectra, absorbing groups, spectra of isolated chromophores and interpretation of a data in unknowns.
- Colorimeter – general requirements for the coloured substance and chemistry of colorimeter.
- Instrumentation-radiation sources, filter and monochromators, absorption cell radiation detectors and optical diagram,
- Pharmaceutical application –qualitative and quantitative analysis.

2. Infrared spectroscopy :

- Infrared region, energy changes and vibration modes.

- Examination of an infra-red spectrum-group frequencies, aromatic compound and interpretation of spectra of selected compounds
 - Instrumentation-radiation source, monochromatic, detector system, optical diagram and preparation of samples.
 - Pharmaceutical application-quantitative and qualitative analysis.
- 3. Fluorimetry:**
- Theory of fluorescence and phosphorescence
 - Factors affecting intensity of fluorescence
 - Fluorescence and chemical structure
 - Instrumentation-optical diagram
 - Pharmaceutical application
- 4. Atomic absorption spectroscopy:**
Introduction, instrumental and application
- 5. Mass spectrometer:**
- Mass spectrometer-ion formation, ion separation and ion detection.
 - Mass spectrum – data presentation
 - Fragmentation processes
 - Interpretation of mass spectra of selected compounds
- 6. Nuclear magnetic resonance spectroscopy:**
- Theory of NMR
 - Chemical effect in NMR spectra-chemical shift, spin coupling
 - Interpretation of NMR spectra of selected compounds.
 - Advances in NMR spectroscopy
- 7. Potentiometry:**
- Electromotive force (EMF) of chemical cells-, Nernst equation, electro-chemical conventions, potential of physical electrode and half-reactions.
 - Electrometric determination of pH, potentiometric titrations
- 8. Polarimetry**
- Origin of optical rotation
 - Molecular requirements for optical rotator power
 - Instrumentation
 - Pharmaceutical application
- 9. Palaeography**
- Current-potential curves
 - Factors governing diffusion current
 - Maxima and suppressors
 - Equations for reversible palaeographic waves
 - Palaeographic analysis
 - Amperometric titrations.

PCH 403: Pharmaceutical Analysis III (Analytical Quality Control)

2 Unit

Course Description

It deal with identification and standardization methods as specified in various official books

Course Objectives

- I. To understand the monographs and their importance in Pharmacy
- II. To know the official and non-official method of analysis as specified in BP and USP, (U.V-VIS Quality control)
- III. To know the various regulatory bodies in drug manufacturing process.

Course Contents

Lectures 1CU(15 hours)

01. Drug Products

02. Quality Control

- Objectives
- Requirement
- Quality Control Department
- Structure elucidation /identification
- UV Visible
- IR
- NMR
- AAS
- Problem of Quality Control

03. Standards

- Definitions
- Important/uses
- Storage Condition

04. Quality Assurances

- Method used by Manufacturers
- GMP
- Essentials of GMP

05. Monograph & specification:

- Main names of drugs, Description, Colours etc.
- Pharmacopeia BP, USP, WHO, AP
- Drug Regulatory Control (DRA) NAFDAC/FDA

06. Official method of drug analysis

- Selectivity; choice of method UV, fluorimetry
- Sensitivity; measurement of small concentration
- Reliability; method reproducibility
- Convenience; cheap/inexpensive method

07. Analytical quality control studies

- Physicochemical method I i.e. titration ,aquas, and non aquas, Compleximetric, Titration
- Physicochemical method II i.e. UV, IR AAS, AAS,NMR
- Biological method i.e. bioassay microbiology, stability
- Biopharmaceutical method i.e. particle size analysis
Disintegration, dissolution friability & bioavailability
- Statistical method; data analysis interpretation of data etc.

Practical Classes: Instrumentations, Analytical Quality Control and determination of drugs in biological samples 1CU(45 hours)

Second Semester 400 level

PCH 402: Introduction to Medicinal Chemistry

1 Unit(15 hours)

Course Description

The course deals with study of classes of drugs with respect to their nomenclatures, physical and chemical properties uses etc.

Course Objectives

- I. To learn the various classes of drugs base on their chemical moieties
- II. To understand the principle of structural activities relationship of different classes of drugs
- III. To know their medicinal uses mechanism of action and synthesis where necessary.

Course content:

01. A study of the following classes of drugs in respect to their nomenclatures, physical and chemical properties, uses and mechanism of action (brief), synthesis (where necessary).

02. Local anesthetic agents:

- Local anesthetic blocking agents.
- Structure activity relationship and classification of nerve- blocking agents

03. General anesthetic agents:

- Hydrocarbons and halogenated hydrocarbons
- Ethers and alcohols
- Ultra-short acting barbiturates

04. Sedative and hypnotic agents:

- Barbiturates
- Non- barbiturates, alcohols, aldehydes, acyclic hypnotics containing nitrogen, piperdinediones and quinazolinine, benzodiazepines and other

05. Tranquilizer:

- Rauwolfia alkaloids and synthetic analogs

- Benzoquinoline derivatives
- Phenothiazine derivatives and analogs
- Phenylmethane derivatives
- Buityrophenones
- Benzodiazepine

06. Anti convulsants:

- Barbiturates
- Hydantoins
- Oxazolidinediones
- Succinimides

7. Miscellaneous agents.

8. Adrenergic agents:

- Receptor concepts (briefly)
- Direct-acting sympathomimetics, structure favouring receptors
- Blocking agents.

9. Cholinergic agents:

- Acetylcholine-muscarinic receptor
- Acetylcholinesterase- mechanism of hydrolysis, receptor site for inhibition of 2-PAM and rationale for its synthesis

10. Antispasmodics-neurotic and musculotropicantispasmodics:

First Semester 500 level

PCH 501: Medicinal chemistry

2 Units (30 hours)

Pre-requisite: PCH 402

Course Description

It deals with the chemistry of analgesics, anti-histamines, vitamins, and chemotherapeutics agents among others.

Course Objectives

- I. To understand different classes of the analgesics and how modification of one leads to another analgesics (congeners)
- II. To understand various receptors and drugs that binds to them such as histaminic, insulin sympathomimetic. Involved in different pathological
- III. To learn some of the SAR biosynthesis and metabolic path ways of steroidal hormones
- IV. To be able to know the classes and members of chemotherapeutics and anti-microbial agents

Course content

1. Analgesics:

- Narcotic analgesics

- i. Peripheral modification of morphine and its congeners.
 - ii. Nuclear modification of morphines, benzomorphans, meperidine methadone derivative
 - iii. Receptors: hypotheses
- 2. Antipyretic, analgesics:-** salicylates, pyrazolones, aniline derivatives indomethacin, NSAIDs
- 3. Antihistamines:**
- Histaminic and other chemical mediator
 - Ethandiamine derivatives
 - Ethylenediamine derivatives
 - Propylamine derivatives
 - Piperazine derivatives
 - Phenothiazines
 - H₂-blockers
- 4. Hypoglycaemic agents:**
- Insulin
 - Sulfonylureas
 - Biguanides
 - Isoxazole and pyrazole derivatives
- 5. Anticoagulants:**
- Heparin
 - Coumarin derivatives
 - 1,3-indandione derivatives
- 6. Antihypertensive agents:**
- Rauwolfia alkaloids
 - Veratrum alkaloids
 - Secondary and tertiary amines and quaternary ammonium compounds
 - Monoamine oxidase inhibitors
 - Miscellaneous agents
- 7. Diuretics:**
- Osmotic diuretics
 - Acid-forming diuretics
 - Mercurials
 - Purine, pyrimidine and related heterocyclic compounds
 - Sulphonamides
 - Anti-hormone diuretics
 - Unsaturated ketones.
- 8. Vitamins:**
- Water soluble vitamins; thiamine, riboflavin, nicotinic acid and nicotinamide, pyridoxine, pantothenic acid, biotin, folic acid vitamin B₁₂ ascorbic acid
 - Lipid soluble vitamins A, D,E,K
- 9. Steroids and steroid hormones:**
- Stereochemistry and nomenclature
 - Biosynthesis and metabolism of selected steroids
 - SAR and brief uses of the following: adrenocorticoids, glucocorticoids and mineralocorticoids, female hormones, estrogens and progestins, male hormones, androgens.

10. Introduction to chemotherapy:

Sulphonamides and sulfones

1. Sulphonamides-N4-substituted compounds, miscellaneous sulphonamides.
2. Sulfones.

11. Antibiotics:

- Penicillins
- Cephalosporins
- Tetracyclines
- Other antibiotics-the polypeptides, the aminoglycosides. The macrolides the polyenes, the itnocomycins, anti-tubercular and antineoplastic antibiotics

12. Anti-malarials:

- Cinchona alkaloids
- 4-aminoquinolines
- 9-aminoquinolines
- 8-aminoacridines
- Biguanines
- Sulphonamides and sulfones

13. Amoebicides: Trypanocides and anthelmintics

- Amaebiasis and chemotherapeutics agents
- Trypanosomiasis and chemotherapeutics gents
- Helminthiasis and chemotherapeutics agents
- Schistosomiasis and chemotherapeutic agents

14. Antineoplastic and antiviral agents:\

- Antineoplastic agents-alkylating agents, vinca alkaloid antimetabolites.
- Antiviral agents.

Second Semester 500 Level

PCH 502: Physicochemical principles of medicinal chemistry

2 Units (30 hours)

Course Description

Effect of physicochemical properties on biological activities, bio-isosterism, QSAR, Pharmacological effect of moieties

CourseObjectives

- I. To know the role played by physicochemical in biological activity of some drugs
- II. To know historical development basic concept of bioisosterism and its application in drug design
- III. To know the method followed in search for leads and its modification in drug design.
- IV. To know the role played by inductive, resonance, electro negativity due to some functional groups and how its affect bio functional moieties.

Course content:

1. Influences of physicochemical properties on biological activity:

- Physicochemical properties affecting accessibility of drugs: pH partition theory, effects of dissolution rate and surface active agents.
- Distribution-effects of partition coefficient
- Metabolism-interconversion of functional groups
- Physicochemical properties affecting drug action at the active site.
- Structurally- non-specific drugs-Ferguson principles and Hansch QSAR
- Structurally specific drugs.
- Drugs receptor interaction –steric and stereo-chemical consideration, covalent ionic, hydrogen bonding, ion-dipole, dipole-dipole, van der waal's and hydrophobic forces

2. Bioisosterism (some basic concepts):

- Historical development
- Grimm hydride displacement rules
- New concept of bioisosterism
- Application in drugs design

3. Procedures followed in drugs design:

- Search for leads
- Molecular modification
- Design of suitable dosage forms
- Clinical evaluation

4. Structure and action:

- Approaches to SAR interpretation
- Group or moiety approach, integral approach
- Apparent lack of SAR
- True SAR
- Quantitative SAR

5. Pharmacological effects of specific moieties:

- Substituents-electronegativity, inductive effect and resonance effect of substituents, pharmacological effects of halogens, alkyl groups, acid and basic groups, acylating agents, hydroxyl groups, thiols and disulfides, ethers and sulphides, unsaturation and chelating agents

6. Bio functional moieties

1. Moieties involved in pharmacokinetics (carrier and vulnerable moieties)
2. Moieties involved in drug-receptor interaction (haptophoric and pharmacophoric moieties).

PCH 504: Chemical Aspect of Drug Metabolism

1Unit (15 hours)

Course

This course describes the various phases of drug metabolism and detoxification leading to termination of action of drug.

Description

Course Objectives

- I. To be able to know what drug metabolism is and the two phases of drug metabolism

II. To be able to know metabolic scheme of some selected drugs

Course content:

1. Phase I reaction:

General pathway of metabolites
Drug oxidation, reduction, and hydrolysis
Metabolism of pesticides and other chemicals
Metabolism of steroid and sterols
Enzyme induction
Enzyme stimulation

2. Phase II reaction:

Introduction
Types of conjugation
Factors affecting conjugation
Relationship of phase I and II reactions

3. Metabolic schemes of some selected drugs:

Amphetamine, propranolol, methadone trimethoprim, diazepam imipramine

4. Stereo chemical aspects of drugs metabolism:

Substrate stereochemistry
Product stereochemistry
Substrate product selectivity

5. Biochemistry aspect of drugs metabolism:

Drug metabolism enzymes, enzymes operative in phase I reaction
Conjugation systems.

PHM 502 Project in Pharmaceutical Chemistry

4 Units(180 hours)

Prerequisites: All PCH courses from 200 to 500 levels

Project will involve simple research topics of interest and to be supervised by an academic staff. The research project must be hypothesis-driven and must involve laboratory work. It is to be presented on typewritten A4 paper (Font size 14, Time new Romans and Justified) and in a paper bound form. An oral examination of the project is required. It will be undertaken throughout the final year.

At the end of the course, the students are expected to:

- a Know how to search the chemical and biological literature relevant to topical Interest
- b Apply practical techniques used in Pharmaceutical Chemistry research
- c Write a dissertation/project and develop presentation skill.

Courses offered in the Department of Pharmacology and Therapeutics

300 Level Courses

PCL 301: General Pharmacology (First Semester)

Credit Units = 2 (30 hours) (Prerequisites: HYP 209, 212, Biochemistry)

Course Description: Introduction to pharmacology

Course Objectives

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

- (a) Sources of drugs
- (b) The various routes of drug administration and how these influence the onset of drug action in the body
- (c) The distribution, metabolism and excretion of drugs in/from the body
- (d) Principles of Pharmacodynamics
- (e) Understanding the basic concept of drug development

Course Content

1. Introduction **(2hrs)**: Definition of the relevant terms (Pharmacology, Pharmacodynamics, Pharmacokinetics, Drugs, Pharmacotherapy, Clinical Pharmacology, Chemotherapy and Toxicology), Sources of drugs (plants, animal, microbial, mineral, synthetic, semi-synthetic and genetic engineering).
2. Drug discovery and development **(2hrs)**: Introduction /definition of terms (pharmacogenetics, biotechnology, pharmacoepidemiology, pharmacoconomics, pharmacogenomics), drug discovery models (accidental, structural modification, purely synthetic etc.) and stages of drug development (preclinical and clinical trial of drugs).
3. Factors modifying drug action **(1hrs)**: Physiological factors, physicochemical properties of the drug and the formulation factors.
4. Routes of administration **(2hrs)**: Special emphasis with relevant examples on oral, intravenous, subcutaneous, intramuscular and intraperitoneal routes. Brief mention of less commonly used routes (sublingual, pulmonary, rectal and topical routes of drug applications (eyes, nose, ear, vagina and skin), brief mention of target delivery system (stent).
5. **Pharmacokinetics**
 - i. Introduction **(2hrs)**: Biological membrane (structure and function), Types of transport system (passive diffusion, filtration, specialized transport (carrier mediated or by pinocytosis).
 - ii. Absorption of drugs **(4hrs)**: Mechanisms of drug absorption, Factors affecting drug absorption (Aqueous solubility, Concentration, Surface area of absorption site, Vascularity of absorption surface, Route of drug administration, Factors affecting bioavailability (Route of drug administration, Presence of food/ other drugs, Pre-systemic elimination and entero-hepatic recycling, Drug distribution and plasma protein binding, Physicochemical factors of drug, dosage forms etc).
 - iii. Distribution of drugs **(2hrs)**: Discussion on plasma proteins (albumin, α_1 -acid glycoprotein and globulin) binding, Competitiveness of drugs for binding sites and the consequent therapeutic implication. Distribution of drugs across special barriers the CNS (into CSF) and placental transfer of drugs, Determination of apparent volume of distribution (Vd).
 - iv. Drug Metabolism **(4hrs)**: Definition of biotransformation and sites of drug metabolism, Phases (I and II) of drug metabolism with examples, Microsomal enzyme induction and inhibition, consequences of microsomal enzyme induction and inhibition, First pass metabolism and attributes of drugs with high first pass metabolism.
 - v. Excretion of drugs **(2hrs)**: Definition of excretion, routes drug excretion, Factors affecting excretion of drugs, Kinetic of elimination: Fundamental pharmacokinetic parameters

(bioavailability (F), volume of distribution (Vd) and clearance (Cl)), Determination of plasma half-life ($T_{1/2}$), Brief mention of loading dose, maintenance dose and Role of P-glycoprotein.

6. **Pharmacodynamics (5hrs)** Definition of terms, Brief introduction to how drugs produce their effects (Enzymes, Ion channels, Transporters), Receptors, Receptor theories, effects (agonist, inverse agonist, partial agonist, antagonist and ligand) and characteristics (specificity, selectivity, sensitivity), Types of antagonist (competitive and non-competitive), Concept of spare receptors and factors affecting drug action, Chronopharmacology (Psychological state (believe and attitude), Disease and other pathological states, Genetic factors and Other drugs, Dose-response curve to evaluate LD_{50} , ED_{50} , TD_{50} and therapeutic index (TI), Tolerance and tachyphylaxis, Illustration of drug potency and efficacy, Bioassay, adverse drug reaction and pharmacovigilance.
7. **Pharmacogenetics and idiosyncrasy (2hrs)**
8. **Tutorial and Revision (2hrs)**

PCL 303: Autonomic Pharmacology (First Semester)

Credit unit = 3 (Prerequisites: Physiology, Biochemistry)

Course Description: The course introduces students to the pharmacology of the autonomic nervous system / somatic (motor) nervous system and autacoids.

Course Objectives

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

- (a) The pharmacology of drugs acting on the parasympathetic and sympathetic system.
- (b) The pharmacology of drugs acting on the autonomic ganglia and NMJ
- (c) The pharmacological functions of autacoids and their antagonist/receptor blockers.

Course Content

Lectures, 2CU-30hours

1. **Introduction (1hr):** Review of the anatomy and physiology of the autonomic and somatic nervous systems, Neurotransmitters and Receptors including adrenergic cholinergic receptors (M_1 - M_5 , N_n , N_m , N_{nCNS}), subtypes and their G-proteins/second messengers.
2. **Parasympathetic system (6 hrs):** Cholinergic transmission, Biosynthesis, Storage, Release, and Degradation of Acetylcholine (ACh). Muscarinic and nicotinic actions of ACh, Choline esters, Cholinomimetic alkaloids and synthetic analogues, Anticholinergic agents, Reversible and irreversible anticholinesterases including therapeutic uses, toxic effects and treatment.
3. **Ganglion Stimulants/Blockers (1 hrs):** Mechanisms of action, pharmacological actions, pharmacokinetics, uses, side effects, therapeutic uses, contraindications.
4. **Neuromuscular Junction (NMJ) Blockers** including toxicity and management (2hrs).
5. **Sympathetic nervous system (10 hrs):** Adrenergic transmission, Biosynthesis, Release, Storage and Inactivation (including neuronal and extra neuronal uptake mechanisms) of Noradrenaline and possible drug targets, adrenergic receptors (α_1 , α_2 , β_1 , β_2 and β_3) subtypes and their G-proteins/second messengers, adrenergic receptor agonists, adrenoceptor blocking drugs.
6. **Adrenergic neuron blocking drugs (1 hr).**

7. Histamine and antihistamine (4 hrs): Synthesis, storage, release and degradation of histamine, Receptor distribution (H₁, H₂, H₃, H₄), Pharmacological effects of histamine on various systems/organs (CVS, smooth muscles, nerve terminal and exocrine glands etc.), general mechanisms of action of antihistamines, classification/examples of each receptor type, therapeutic and diagnostic uses, toxic reactions/side effects and drug interactions.

8. 5-Hydroxytryptamine (serotonin) and antagonists (5 hrs): Serotonergic transmission, source, synthesis, storage and degradation of 5-HT and drug targets, Physiological roles and Pharmacological actions (CNS, CVS and smooth muscles), Classification of 5-HT receptors and distribution, 5HT antagonists, Ergot alkaloids.

9. Prostaglandins, thromboxanes and leukotrienes(2 hrs):Sources, synthesis and metabolism of prostanoids and leukotrienes, enzymes and enzyme inhibitors of biosynthesis of prostanoids and leukotrienes.

10. Revision/ tutorials (2hrs)

Practical Pharmacology, PCL 303 (1 Credit Unit, 45 hours)

- (i) Instrumentation, Animal Handling and Dose calculations in Pharmacology,
- (ii) Influence of the routes of administration of drugs on pharmacological responses.
- (iii) Enzyme induction and Inhibition (Animal model).
- (iv) Relationship between drug concentration and magnitude of response, Schild plot (PA₂).
- (v) Effects of agonists on GIT smooth muscles (rabbit jejunum and Guinea pig ileum preparations).
- (vi) Cholinesterases and anticholinesterase agent (reversible and irreversible).
- (vii) Effect of NMJ blockers on the rat phrenic nerve diaphragm preparation.
- (viii) Assay of agonists & antagonists (Dose-Response curve and ED₅₀).
- (ix) Effects of histamine and antihistamine on skin swelling and ileum

PCL 302: Systemic Pharmacology I

(Second Semester)

Credit units = 2 (30 hours) (Prerequisites: PCL303)

Course description: Pharmacology of drugs acting on the respiratory and cardiovascular systems

Course objectives:

The students are expected to understand the pharmacology of drugs acting on specific systems/organs and the principles of therapy.

Course Content

1. Pharmacology of the Respiratory System (4hrs)

- (a) Asthma, cough and COPD:** Aetiology of asthma, cough and COPD, Classification, Mechanism(s) of action, therapeutic uses, dosage form, side effect and contraindications/cautions of Antiasthmatic agents (bronchodilators (β adrenergic agonist, xanthines, anticholinergics), Corticosteroid (systemic and inhalational), Mast cells stabilizers, Leukotriene antagonists, Anti-

- IgE, Possible future therapy (monoclonal antibodies, protease inhibitors, immune modulators), Combination therapy in asthma, Expectorants, Antitussives, Mucolytics.
2. **Toxic Gases and Vapours (2 hrs);** Chemistry, toxicokinetics, toxicity features and treatment of poisoning of gases and vapours (carbon monoxide, hydrocyanic acid, benzene, kerosene, gasoline, carbon tetrachloride, propylene, refrigerant gas, ammonia, nitrogen oxide)
 3. **Pharmacology of Cardiovascular Drugs**
 - i. **Introduction (4hrs):** Regulation of cardiovascular system function (Autonomic/CNS, Kidney, Autacoids or hormones), Cardiac electrophysiology;
 - ii. **Renin-angiotensin system (3 hrs)**
 - iii. **Hypertension and Antihypertensive drugs (4hrs):** Definition of hypertension (W.H.O), Determinants of blood pressure (cardiac output, peripheral resistance, stroke volume etc.), Aetiology and predisposing factors of high blood pressure, mechanisms of action, pharmacokinetics, side effects, contraindications and caution of antihypertensive drugs (diuretics, ACE-inhibitors, ARBs, calcium-channel blockers, β -adrenergic blockers, $\alpha + \beta$ -adrenergic blockers, α -adrenergic blockers, central sympatholytic, vasodilators, Ganglionic blocking agents, Adrenergic neurone blocking agents), Combination therapy in the management of hypertension.
 4. **Drug therapy of cardiac failure (4hrs):** cardiac glycosides and other inotropic agents (dobutamine, bipyridine, diuretics, nitrates etc.).
 5. **Drugs used for the treatment of angina (myocardial infarction) (3hrs):** Pathophysiology of angina pectoris and ischaemia, pharmacological actions, formulation, pharmacokinetics, side-effects, and clinical status, interaction of antianginal drugs (nitrates, B blockers, Ca channel blockers, K channel openers etc.), drugs used in the management of myocardial infarction (aspirin, heparin, thrombolytics, ACEIs/ARBs, platelet inhibitors, β blockers).
 6. **Antiarrhythmic drugs (4hrs):** mechanisms of action, therapeutic uses, pharmacokinetics, side-effects and interaction of all classes of antiarrhythmic drugs.
 7. **Lipid Lowering Drugs(2hrs):** Lipid Metabolism and the roles of low and high-density lipoproteins, pharmacology of different classes of lipid lowering drugs (Statins HMG-COA reductase inhibitors, Fibrates, cholesterol absorption inhibitors, nicotinic acid, fish oil derivatives).
 8. **Revision/ Tutorials (2hrs),**

PCL 304: Systemic Pharmacology II (Renal& GIT)

(Second Semester)

Credit unit = 2 (Prerequisites: PCL 301; 303)

Course Description - The course introduces the students to the pharmacology of drugs acting on the renal and gastrointestinal systems.

Course Objectives:

The students are expected to understand the pharmacology of drugs acting on the renal and gastrointestinal system.

Course Content

Lectures, 1CU (15 hours)

1. **Renal Pharmacology**
 - i. **Introduction (1hr):** Anatomy, physiology and principles of diuresis

- ii. Comprehensive pharmacology of diuretics (Thiazide and thiazide-like diuretics, Loop diuretics (high ceiling diuretic), Potassium-sparing diuretics, aldosterone antagonists **(2hrs)**)
- iii. Brief mechanism of action of action, therapeutic uses, examples, adverse effects, contraindications and clinical status of inhibitors of carbonic anhydrase, water and osmotic diuretics, acid forming salt, mercurial diuretics, xanthines, primidines and triazines**(2 HRS)**.

2. Gastrointestinal Pharmacology

- i. Introduction to gastrointestinal acid diseases. Pathophysiology and causes of peptic ulcer disease (roles of Ach, Histamine, HCl, Gastrin, Prostaglandins and *Helicobacter pylori*) **(1hr)**.
- ii. Mechanisms of action, dosage forms, pharmacokinetics, clinical status, side effects, contraindications, caution and drug interaction of drugs (Antacids **(1hr)**, Proton pump inhibitors **(1hr)**, H₂ receptor blockers **(1hr)**, CCK receptor blockers **(1hr)**, Antimuscarinic, Others: Antibiotics, Prostaglandins, Cytoprotectives**(1hr)**) used in the treatment of peptic ulcer disease.
- iii. Purgatives, treatment of Irritable bowel syndrome and Cohn's disease **(2hrs)**.
- iv. Antiemetics and antidiarrheal and treatment of flatulence **(2hrs)**.

Practical Pharmacology 1 Credit Unit(45 hours)

Demonstration classes on:

- Finkleman preparation.
- Effects of cholinergic and adrenergic drugs on cat blood pressure
- The isolated perfused heart (Lagendoff) preparation.
- Effect of parasympathetic and sympathetic nervous system drugs on blood pressure in cat Tracheal Chain Preparation.
- Blood lipid profile
- Diuretics and Antidiuretics
- Aspirin- and Acetic acid-induced peptic ulcers models
- Copper sulphate-induced emesis study in chicks

400 Level Courses

First Semester

PCL 401: Central Nervous System Pharmacology

Credit units = 2 (30 hours) (Prerequisites: PCL 303)

Course Description

This course introduces students to the principles of neuropharmacology and drug therapies for disorders of the central nervous system. Psychotropic drugs such as the narcotic analgesics, anxiolytics, hypnotics, sedatives, alcohol uses and abuses. Neurological disorders, antidepressants, mood stabilising, anxiolytic, general and local anaesthetic, and anticonvulsant,

Course Objectives: At the end of the course students should understand

- (a) Neurotransmission in the Central Nervous System
- (b) Pathologies and treatment modalities of Parkinson disease, Alzheimer's disease, Epilepsy, Schizophrenia and Depression
- (c) The pharmacology of hypnotics and sedatives including alcohols, barbiturates, benzodiazepines and other non-barbiturates
- (d) The pharmacology of narcotics analgesics, basis and mechanisms of drugs of abuse, etc.

Course Content

1. **Review of the structural and functional organization of the CNS (1hr).**
2. **Hypnotics and Sedatives** (classification, chemical properties, mechanism(s) of action, pharmacokinetics, pharmacological actions, clinical uses, adverse drug reactions, Poisoning, management of poisoning where applicable) **(3hrs).**
3. **Drugs used in Anxiety disorders (1hr).**
4. **Aliphatic Alcohols (2hrs).**
5. **Narcotic analgesics and antagonists (3hrs).**
6. **Central nervous system stimulants (3hrs), Anticonvulsants (3hrs).**
7. **Drug Abuse (3hrs).**
8. **Centrally Acting Muscle Relaxants (2hrs).**
9. **Drugs used in neurodegenerative (Parkinson and Alzheimer's) diseases (3hrs).**
10. **Antipsychotics, Antidepressants and Antimanic drugs (5hrs)**
11. **Revision/ tutorials (2hrs)**

PCL 403: Anaesthetics and Non-Narcotic Analgesics

Credit units= 2 (Prerequisite: PCL 301)

Course description

The course will provide students with the knowledge of the role of the biogenic amines, peptides, lipid derivations in therapy and how they are influenced by other drugs.

Course Objectives

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

- (a) Describe the mechanisms of action and clinical uses of local and general anaesthetic drugs and contrast between local and general anaesthetics.
- (b) Know prostaglandin synthesis and consequences of its blockade by NSAIDS producing anti-inflammatory, analgesic and antipyresis
- (c) Understand the pharmacology of drugs used in the treatment of Gout and in veterinary pharmacy.

Course content

Lectures 1CU- 15 hours

1. **Local and General Anaesthetics (6hrs).**
2. **Non-narcotic Analgesics/Non-steroidal anti-inflammatory drugs (4hrs).**
3. **Drugs used in the treatment of Gout (2hrs).**
4. **Drugs used in the treatment of animal diseases (2hrs).**

5. Revision/ Tutorials (1hr)

Practical Pharmacology (1 Credit Unit, 45 hours).

- Animal Models of Analgesia (Hot Plate and Tail Clip and Chemical Methods).
- Animal Models of Epilepsy (Pentylenetetrazole (PTZ), Strychnine, 4-aminopyridine and Maximal Electroshock tests, MEST-induced models of epilepsy).
- Animal models of Anxiety.
- Induction of sleep with barbiturates and other sedative-hypnotics.
- Induction of psychosis in animals with amphetamine, apomorphine and its treatment with anti-psychotic agents.

400 Level Courses

Second Semester

PCL 402: Endocrine Pharmacology

Credit Units= 2 (30 hours) (Prerequisite: HPY 201, 202)

Course description- The course will provide the students with knowledge of the health sciences relevant to the use of drugs in endocrinology and reproductive endocrinology

Course objectives

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

- (a) Know the pharmacology of anti-thyroid drugs and inhibitors of adrenocortical steroids, synthetic analogues and inhibitors
- (b) Describe the pathophysiology/symptoms & treatment of the different forms of diabetes
- (c) Understand the pharmacology drugs acting on the reproductive system,

Course Content

1. **ACTH, Adrenal corticosteroids, synthetic analogues and inhibitors(5hrs).**
2. **Thyroid and Antithyroid drugs (4hrs).**
3. **Antidiabetic agents.**
 - i. Introduction to diabetes (1hr)
 - ii. Insulin and its analogues (4hrs).
 - iii. Oral Hypoglycaemic agents (5hrs).
 - iv. Glucagon (2hrs).
4. **Pharmacology of the reproductive system** (pituitary hormones, uterine stimulants and relaxants, Oestrogen and antioestrogens, Progestogens, Oral ContraceptivesandAndrogens (8 HRS).
5. **Revision/ Tutorials (2hrs).**

PCL 404: Haemostasis and Haemopoietic Pharmacology

Credit units = 2 (Prerequisite: HPY 201, 202)

Course Description – This course covers main features of coagulation, thrombosis and fibrinolysis. It also discusses different forms of anaemias and their treatment modalities.

Course Objectives

At the end of the course the students should have learnt:

- (a) The Composition of blood (Cells, Proteins and Plasma)
- (b) The different types of Anaemias and their treatment
- (c) Components of haemostasis and haemopoiesis

Course Content

Lectures, 1CU- 15 hours

1. **Anaemia**(types (iron deficiency, megaloblastic, haemolytic anaemia, aplastic anaemia etc.), acute iron poisoning and treatment), sources, synthesis, dietary requirements, metabolic functions, causes, signs and symptoms of deficiency and therapy, preparations and dosage, uses of Folic acid and Vitamin B₁₂ (**5hrs**).
2. **Coagulation, Coagulants and Anticoagulants (5hrs)**.
3. **Thrombosis and Fibrinolysis** (biochemistry, mode of action, clinical uses and side-effects of Antiplatelets and Antifibrinolytics) (**3hrs**).
4. **Revision/ Tutorials (2hrs)**.

Practical Pharmacology (1 CU. 45 hours)

- Alloxan and Streptozotocin-induced diabetes mellitus.
- Oral glucose tolerance test.
- Effect of drugs on the uterus.
- Blood composition (Cell Numbers and plasma volume).
- Bleeding and Coagulation times,
- Effect of heparin on coagulation time,
- Fibrin clot formation and dissolution

500 Level Courses

First Semester

PCL 501: Toxicology

Credit Units = 3 (Prerequisites: PCL 401)

Course Description – This course describes the adverse effects of drugs and chemicals in man and animals. It covers dosages, mechanisms, symptoms, detection and treatment of poisoning by these agents.

Course Objectives

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

- (a) The definition, mechanisms of chemical toxicity, management of acute poisoning, plant, bacterial and animal poisoning and pesticide toxicology.

- (b) Toxicology of common veterinary pharmaceuticals, heavy metals and their antagonists (chelating agents), food additives, solvent vapours and gases
- (c) Toxicology of cosmetics, radiation and radioactive materials.

Course Content

Lectures, 2CU-30 hours

1. **Introduction** (General definition, brief history, definition of terminologies used in toxicology, routes of exposure, types of toxicity, general mechanisms of toxicity and basic principles of management chemical poisoning) (2hrs).
2. **Toxicology of pesticides (4hrs).**
3. **Solvents, vapours and bases (3hrs).**
4. **Radiation and radioactive materials:** Sources, brief characteristics of products (types) and dose of radioactivity, exposure, uses. Physiological effects of ionizing radiation, radiation sickness & its treatment and radiation protection standards. (3hrs).
5. **Food Toxicology** (Food additives, food contaminants, Cyanide poisoning, Clostridium botulinum toxin and other minor bacterial toxins (salmonella, staphylococcus), Mycotoxins (aflatoxins) (3 hrs).
6. **Toxicology of Cosmetics** (Types, classes and long- term toxicity of commonly used and important cosmetic ingredients e.g. skin lighteners, hair straighteners, hair dying agents (2hrs).
7. **Heavy metals and their antagonists (4hrs).**
8. **Animal toxins:** Venomous animals (classification of venomous snakes, differences in types and nature of venoms produced, symptoms of bite). Management (general and specific) of snake bites; reptile toxins. (3hrs)
 - **Plant toxins (Phytotoxicology):** Toxic principles in plants, specific poisoning they produce and their treatment. (2hrs).
9. **Social poisons** (Definition and social considerations, CNS Stimulants, hallucinogens, CNS depressants) (2hrs).
10. **Revision/ Tutorials (2hrs).**

Practical Pharmacology (1 CU, 45 hours)

- Acute oral and dermal toxicity studies and determination of LD₅₀.
- Safety pharmacology – use of antidotes in cyanide intoxication, organ and animal toxicity experiments and the use of antidotes in organophosphate intoxication, heavy metal poisoning.
- Antidotal therapy studies.
- Heavy metal poisoning
- Anti-cancer Studies.

PCL503: Chemotherapy of Microbial/Neoplastic Diseases

Credit units= 2 (Prerequisites: PCL 401)

Course Description – The course covers the chemotherapy of bacterial, fungal, viral and neoplastic diseases. The chemical classes, pharmacological actions, biochemical mechanisms, dosages, indications, side effects, contra-indications and problem of drug resistance to medications used in the treatment of these diseases will be discussed.

Course Objectives

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

- a) Understand the different classes of drugs used in the treatment of microbial and neoplastic diseases.
- b) Understand the mechanisms by which pathogens acquire and express resistance to antibiotics.
- c) Understand rationale for the choice of a single and combination therapies in these disease states.

Course content

1. General Introduction

- i. Definitions of relevant terms (chemotherapy, antimicrobial drug, antibiotics, and chemotherapeutic agents); general features of antimicrobial drug (selective toxicity, activity spectrum, types of antibacterial action), general modes of action (inhibition of: cell wall formation, protein synthesis, Nucleic acid replication and transcription, general metabolic pathway) bacterial sensitivity and resistance types/mechanisms. **(2hrs)**

2. Antimicrobial drugs

- i. Sources, chemistry, mechanism of actions, pharmacokinetics, spectrum of activity, adverse effects, clinical uses and important interactions of Cell wall synthesis inhibitors **(1hr)**.
- ii. Inhibitors of general metabolic pathway **(1hr)**.
- iii. Protein synthesis inhibitors **(2hrs)**.
- iv. Miscellaneous antibacterial agents (lincomycin, clindamycin, polymyxins and bacitracin) **(1hr)**.

3. Drugs used for chemotherapy of tuberculosis (brief introduction of DOTs, first and second line drugs) **(6hrs)**.

4. Drug treatment of Leprosy (causative organism, leprosy types and features mechanisms of action, pharmacokinetics, adverse effects and indication of classes of antileprosy drugs and treatment of mixed infections) **(1hr)**.

5. Antifungal agents (types of fungal infection, mechanisms of action, pharmacokinetics, spectrum of activity, side effects, indications of and interactions with Agents acting against cell nucleus, cell wall, ergosterol biosynthesis) **(4hrs)**.

6. Antiviral agents (Definition, virus structure and replication, examples and diseases caused by RNA-containing and DNA-containing viruses, classification, mechanisms of action, pharmacokinetics, adverse drug reactions, drug interaction, contraindications other therapeutic indications of antiretroviral drugs, HIV/AIDS treatment) **(6hrs)**.

7. Chemotherapy of Neoplastic Diseases: Definition of relevant terms (cancer, neoplasm, carcinoma, metastasis, tumour, benign, malignant, sarcoma etc), cell-cycle-kinetics, classification of tumours, general toxicities and rationale for combination therapy of cytotoxic agents, chemistry, sources, classification/sub classification, mechanisms of action, adverse effects and clinical uses of antineoplastic agents. **(4hrs)**.

8. Revision **(2hrs)**.

500 Level Second Semester

PCL 502: Chemotherapy of Parasitic Diseases

Credit units= 3 (Prerequisites: PCL 401)

Course Objective

At end of the course the students should be able to understand and apply the general principles behind chemotherapy of parasitic diseases in human and animals.

Course Content

Lectures, 2CU-30 hours

1. **General Introduction** (types of parasitic diseases, routes of transmission, potential targets for the chemotherapy) (1hr).
Chemotherapy of:
2. **Malaria (5hrs).**
3. **Amoebiasis (4 hrs).**
4. **Trypanosomiasis (2hrs).**
5. **Leishmaniasis and Toxoplasmosis (4hrs).**
6. **Schistosomiasis (3hrs).**
7. **Fascioliasis (1hr).**
8. **Tapeworm infestations (4hrs).**
9. **Roundworm infestations (3hrs).**
10. **Revision/ Tutorials (3hrs).**

Practical Pharmacology 1 Credit Unit, 45 hours

- *In vitro* and *In Vivo* models of Malarial Parasites (Patient isolates and established parasites).
- Animal models of parasitic diseases.

PHM 502: Project in Pharmacology & Therapeutics

Credit units= 4 (185 hours) (Prerequisites: PCL 401)

Course Description

Project involves research topics in Pharmacology, Therapeutics and Toxicology under the guidance and supervision of an academic staff. The project must be hypothesis-driven and may involve hands-on training in laboratory methods and statistical analysis. It also provides training in written and oral communication (a bound thesis and oral defence).

Course Objectives

At the end of the course, the students are expected to:

- (a) Know how to conduct scientific literature search relevant to topic of interest.
- (b) Read, interpret and extract information from journal articles relevant to the project.
- (c) Apply practical techniques in Pharmacology, Therapeutics and Toxicology.
- (d) Write a dissertation/treatise and communicate the results orally to peers, internal and external examiners as well as other members of the scientific community.

Courses offered in the Department of Clinical Pharmacy and Pharmacy Practice

PCP 201: Introductory Pharmacy (First Semester)

Credit Unit = 1(15 hours)

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

- a. Discuss the history of pharmacy
- b. Outline the various arms of pharmacy profession and know the role of the pharmacists in each of these practice sectors
- c. Know the legal and ethical codes guiding the practice of pharmacy in the world in general and Nigeria, in particular.

Course Content

- 1 Definition (Pharmacy and Drug); Profession and its Characteristics; Relevant Health Professionals e.g., Pharmacist, Doctors, Laboratory Scientist, Nurses (
- 2 History of Pharmacy: Pharmacy in Ancient Times as practiced in different countries, pharmacy in Middle Age; Pharmacy in Modern Times; Pharmacy in Nigeria (10 hrs.).
- 3 Definition of Law (Ordinance, Act and Decree) and Ethics: Organizations that project Pharmacy and Pharmacy Practice; The Pharmaceutical Society of Nigeria (PSN), Pharmacist Council of Nigeria (PCN), NAFDAC, NDLEA, NIPRD and their functions.
- 4 Career Opportunities in Pharmacy (community pharmacy, hospital pharmacy, clinical pharmacy, industry, academia, government agencies, etc.)

PCP 301: Introduction to Clinical Pharmacy & Pharmaceutical Care (First Semester)

Credit Units = 2(30 hours)

Course Objectives: At the end of this course, students should understand:

- a. The concepts of rational drug use and Pharmaceutical Care
- b. Medical abbreviations and terminologies
- c. Clinical interpretation of laboratory values

Course Content

- a. Evolution, definition, functions and scope of Clinical Pharmacy: Rational drug use concept; Drug distribution in a hospital setting; Unit Dose Dispensing System (UDDS); Floor stock system.
- b. Medical abbreviations and medical terminologies.
- c. Clinical interpretation of laboratory values: microbiology, blood chemistry, haematology and immunochemistry.
- d. Pharmaceutical care concept: Definition, why pharmaceutical care? Principles of pharmaceutical care, the philosophy, the patient care process/ elements and the practice management system; Goals of pharmaceutical care, practice principles; Building a practice in pharmaceutical care (the CORE PRIME FARM approach); Barriers in developing pharmaceutical care; Future trends in pharmaceutical care; Developments and innovations in pharmaceutical care.

PCP 303: Principles of Pharmaco-economics

(First Semester)

Credit Units = 2(30 hours)

Course Objective: At the end of the course the students should be able to understand some basic economic concepts, economics as a tool for making choices, the private sector, government interaction with the private sector, economics and health, understanding the patient as a consumer; market and competition, ethics and business.

Course Content

- a. Evolution and definition of Pharmaco-economics: Economics as a tool for making choices, some basic economic concepts.
- b. Economics of the public sector: Goals of public expenditure, the financing of public expenditure, distribution issues and the use of subsidies.
- c. Understanding the private sector: Market and competition, ethics and business.
- d. Government interaction with the private sector: Market failure, economics of legislation, efficiency concepts, threat to government effectiveness, health policy in conditions of poverty, economics and health, understanding the patient as a consumer.
- e. Overview of Pharmaco-economics methodologies: Cost minimization analysis, cost effectiveness analysis, cost utility analysis, cost benefit analysis, marginal cost analysis.
- f. Components of pharmaco-economic evaluations: Cost determination and analysis, types of cost (fixed, variable, total, average, marginal, recurrent, capital, annualized, cost of illness and cost of therapy). Framework for determining costs.
- g. Outcomes: Economic, Clinical and Humanistic Outcomes (ECHO) model, comparison of costs and consequences, decision analysis and steps in conducting decision analysis; Steps for conducting cost effectiveness evaluation; Health Related Quality of Life (HRQL) in pharmaco-economics; Clinical trials in Pharmaco-economics (Pharmaco-economic trials).

PCP 302: Principles of Disease and Pathology (Second Semester)

Credit Units = 2 (30 hours)

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

- a. Understand the mechanism of cellular injury and death
- b. Understand the pathogenesis / path physiology of the disease states.

Course Content

1. Cell Injury: Processes involved in cell death, cell adaptation processes to injury, cell ageing and destruction of aged cell, inflammatory processes (acute and chronic), tissue repair and wound healing: fibrosis, scarring etc., cell growth and abnormal processes in cell growth that relate to disease.
2. Pathology: Thrombo-embolic disorders, immune disease processes, neoplasia (brief), pathological processes due to infection and infestation etc., environmental, nutritional and pathology of childhood disorders.
3. Organ/System pathology: heart, blood vessels and blood, liver, kidney, endocrine system, bones, joints and soft tissues.

PCP 304 Introduction to Public Health Pharmacy (Second Semester)

Credit Units = 1(15 hours)

Course Objective: At the end of the course students should understand the concept of public health pharmacy and pharmacoepidemiology.

Course Content

- a. Introduction to public health pharmacy; concept of health, Definition and scope of public health and public health pharmacy, Determinants of health. Health care (primary, secondary and tertiary health care): Principles and concept of the different levels of Health Centres, Provision of preventive, curative, rehabilitative services, Public health education in Primary Health Centres, Health indices and their importance
- b. Health policies (National Health Policies, National Drug Policies, Health System Reform globally, Sustainable Development Goals, Health care Financing, National Health Insurance Scheme, Drug Revolving Funds and Essential Drug List)
- c. Immunization: Basic principle of immunization, Preventable disease, Vaccine products, properties, dosage, administration and Vaccine schedules, Injection safety. Child care (Home and community): Screening methods, identifying children at risk, Recognizing possible health hazards and Parents' education on relevant topics
- d. General principle of Epidemiology (communicable diseases and non-communicable disease). Food water, animal and air borne diseases. Vector borne diseases. Emerging and re-emerging diseases); Concept and principle of pharmacoepidemiology, Nutrition and Health, Occupational Health and safety, Gender and age-related health care, mental health and oral health.

PCP 306 Externship practical training I

(Second Semester)

Credit Units = 2 (90 hours)

Course Description

This course is a supervised work-experience of a 3 month duration commencing at the end of second semester of 300 Level. Students shall be posted to some selected hospital and community pharmacies located in Gombe and environs. The students shall be jointly supervised by the pharmacists who are academic staff of the faculty.

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

- a. Understand the organization and services of community and hospital pharmacy practice
- b. Know the types of hospital organization and administration
- c. Understand hospital pharmacy set up and relationship to medical, nursing, laboratory and other hospital services
- d. Out-patient pharmaceutical activities

Assessment: Each student shall within two weeks of completion of the training, submit a report on the work-experience for assessment.

PCP 401: Pharmacotherapeutics I

(First Semester)

Credit Units = 2(30 hours) (Pre-requisite = PCP 201)

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

- a. Have a good understanding of the aetiology and pathophysiology of the disease states discussed
- b. Identify the signs and symptoms of a given disease state
- c. Understand the drug therapy of choice for a particular disease state and other drug therapy options
- d. Recognize the problems that may arise from drug therapy and be able to recommend appropriate measures
- e. Identify patient counseling areas in respect to drug use in some diseases

Course Content

Cardiovascular Disorders:

- a. Angina Pectoris and Myocardial infarction: signs and symptoms, risk factors, precipitating factors and classification, general principles of management, organic nitrates, beta adrenergic blockers, calcium channel blockers and others.
- b. Hypertension: prevalence, classification, etiology, pathophysiology, symptoms, organ effects, cardiovascular risk factors, patient education, plasma renin activity and therapeutic objectives. Non-drug and drug treatment, treatment of malignant hypertension.
- c. Congestive Heart Failure: epidemiology, etiology (high vs low output cardiac failure, cardiac contractility, drug induced, left heart failure vs right heart failure). Treatment, generalized overview, bed rest, sodium restriction, diuretics, digitalis, captopril and others.
- d. Arrhythmias, shock and CVA

Respiratory Disorders:

- a. Asthma: introduction and definition incidence, etiology, pathogenesis, diagnosis, and clinical findings, treatment (hypersensitization, symptomatic treatment) bronchodilators, corticosteroids, others, status asthmaticus.
- b. Chronic obstructive pulmonary disease: introduction and description, etiology, incidence, diagnosis, clinical features, pathophysiology, therapeutic measures and prognosis.
- c. Pneumonia and Lung abscess

Renal disease:

Overview of renal function tests and urinalysis, acute and chronic renal failure. Etiology, definition, complications and treatment. Principles, uses and complications of renal dialysis and transplantation. Nephrotic syndrome.

PCP 403: Clinical Pharmacokinetics

(First Semester)

Credit Units = 2 (30hours)

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

- a. Understand factors affecting absorption, distribution, metabolism and excretion of drugs
- b. Understand the basic concepts of pharmacokinetics
- c. To use of raw data to derive the pharmacokinetics models and parameters that best describe the process of drug absorption, distribution and elimination.

- d. To critically evaluate biopharmaceutical studies involving drug products bio-equivalency and bio-inequivallency
- e. To design and evaluate dosage regimen of drugs administered by intravascular and extravascular routes using pharmacokinetics and biopharmaceutical parameters.
- f. To use his/her knowledge of biopharmaceutics and pharmacokinetics to individualise drug dosage regimen for patients, for effective and rational drug therapy. State the rationale for using Therapeutic Drug Monitoring (TDM) to optimize drug therapy.

Course Content

- a. Basic pharmacokinetics (liberation, absorption, distribution, metabolism and elimination. Clinical significance of pharmacokinetics). Definition of clearance, volume of distribution, half-life, elimination rate constant and area under the curve. Based on mathematical models (concept of compartment models).
- b. Bioavailability and bioequivalence: Emphasis is placed on drug administration, fate of a drug after administration as well as on influence of the route of administration on bioavailability; fate of the drug after administration; Structure and properties of biological membranes, membrane models, pH-partition principles, blood-brain and blood-CSF barriers; physico-chemical properties and pharmaceutical (formulation)
- c. Routes of drug administration and influence of route of administration on drug bioavailability; drug protein binding, enzymology and enzyme kinetics.
- d. Pharmacokinetic variability due to physiologic and pathologic alterations; Specific dosage prescribing requirements/guidelines under certain conditions; Clinical pharmacokinetic in special population groups; Prescribing for the paediatric and elderly populations; Prescribing for renal and liver impaired patients; Prescribing for pregnant and lactating mothers; Pharmacokinetics in disease states modifying body perfusion; Pharmacokinetics in disease state modifying protein binding; Consideration of the clinical pharmacokinetics of selected drugs used in various disease states; Pharmacogenetics.

PCP 405: Pharmacy Jurisprudence

(First Semester)

Credit Units = 2(30 hours) (Pre-requisite = PCP 201)

Course Objectives: At the end of the course the students should be able to know:

- a. Pharmacy laws
- b. Drug rules and regulations
- c. Pharmacy and drug related decrees and Acts promulgated by the Federal Government of Nigeria

Course Content

- a. Introduction: General laws of contract, laws concerning employees and employers relationship, Pharmacists Council of Nigeria (Decree 1993).
- b. Registration and inspection of premises under the poisons and pharmacy act. Poisons: sales or dispensing, supply and distribution; labeling, containers, storage and transportation of poisons. Poisons in hospital and other healthcare institutions.

- c. Patent and Proprietary Medicines. Drug Advertisement, manufacture and sales of food. drugs, cosmetics, devices under the Food and Drug Decree 1974.
- d. Decree on Amphetamines and other drugs. International conventions, agreement and protocol on dangerous drugs. Dangerous drugs. Medicinal dangerous drugs. Trade in dangerous drugs. Power to control dangerous drugs in Nigeria. The decree on Indian hemp.
- e. The Schedules, General principles of professional ethics. General law of professional liability. NAFDAC Decree. NDLEA Decree. Decree on fake drugs and unwholesome foods. Decree on Essential Drug Lists.

PCP 402: Pharmacotherapeutics II

(Second Semester)

Credit Units = 2(30 hours)

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

- a. Have a good understanding of the aetiology and pathophysiology of the disease states discussed
- b. Identify the signs and symptoms characteristics of a given disease state
- c. Recommend the drug therapy of choice for a particular disease state and other drug therapy options
- d. Recognize the complications that may arise from drug therapy and be able to recommend appropriate measures
- e. Identify areas of patient education and counseling

Course Content

Endocrinologic Disorders:

- a. Diabetes mellitus- Definition, etiology, epidemiology, pathophysiology, classification, diagnosis, management (drug and non-drug therapy), prognosis with special reference to monitoring parameters of drug used, patient counseling and education.
- b. Diabetes insipidus-Definition, etiology, epidemiology, pathophysiology, classification, diagnosis, management (drug and non-drug therapy), prognosis with special reference to monitoring parameters of drug used, patient counseling and education.
- c. Thyroid Disorders
 - i. Hyperthyroidism (thyrotoxicosis) - Etiology, signs and symptoms, diagnostic criteria, treatment, thiamides, iodides, adrenergic antagonists, surgery, special consideration and complication.
 - ii. Hypothyroidism (myxedema) - Definition, etiology, clinical features and cause, laboratory parameters.
 - iii. Hypoparathyroidism - Treatment; various thyroid preparations.
- d. Cushing's syndrome and Addison's disease; introduction and definition, etiology, epidemiology, pathophysiology, classification, diagnosis, management (drug and non-drug therapy), prognosis with special reference to monitoring parameters of drug used, patient counseling and education.

Gastrointestinal Disorders:

- a. Peptic Ulcer; definition, etiology, pathophysiology, diagnosis and clinical findings, complications, Treatment and Surgery.
- b. Ulcerative Colitis- definition, etiology, pathophysiology, clinical manifestations and diagnosis, complications (pseudomembranous colitis) and treatment.
- c. Liver Disease (cirrhosis) and Pancreatitis; definition, aetiology, pathophysiology, clinical manifestations and diagnosis, complications and treatment.

Principles of antimicrobial therapy:

Introduction, aetiology, transmission, pathogenesis, prevention, management and care including prophylaxis; Bacterial (endocarditis, tuberculosis, leprosy, urinary tract infection (UTI), venereal disease, cerebrospinal meningitis).

Fungal (cryptococcosis, candidiasis and others).

Parasitic (malaria, filariasis, amoebiasis, helminthiasis, other parasitic diseases).

PCP 404: Pharmacy Management/Entrepreneurship Studies (Second Semester)

Credit Unit = 2(30 hours)

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

- a. Know the nature and functions of entrepreneurship, and the importance of management in pharmacy business
- b. Know how to start and manage pharmacy business
- c. Explain the role and function of a pharmacist in the management and administration of pharmacies.

Course Content

- a Introduction to management: Definition of management, Functions of management and Importance of good management.
- b Forms of Enterprise: Sole proprietorship, Partnership, Corporations Franchises.
- c Entrepreneurial Development: Understanding of the market place, managers' responsibilities, Generating and developing business ideas; conducting market surveys; preparing a business plan; selecting a business location including roads, water and electricity supplies, and appropriation technology for the business.
- d Management of time: Techniques for managing time, goalsetting in relation to time, delegation of responsibility to employee, using time of work effectively, elimination of time wasters.
- e System Management: Record Systems (importance of good records).
 - (a) Legal records; prescriptions, sale and recording of narcotics.
 - (b) Financial Records; profit and loss statement, balance sheet, cash flow statement.

- f Inventory Control: Goal of inventory management, method of inventory control, how to determine inventory, inventory turnover rate, return on investment, pricing policies, gross profit versus mark-up, short-term profit, other pricing consideration.
- g Personnel Management
Staffing: Establishing man power needs for a pharmacy business, sources of professional and non-professional staff, how to use the application for hiring of staff, how to organize an interview. Orientation and training of new staff; delegation; Motivation (Maslow's law, McGregors Theories K and Y, Hertzbergs Concept Job of Restructuring Participative management, how to motivate the Pharmacy employee); Performance Evaluation (Assessment of the employees output, Performance appraisal using job – description type or tract type, hiring and firing); Compensation (salary administration, fringe benefits); Fiscal Management.
- h Supply Chain Management: Introduction to logistics, management information system, assessing stock status, minimum inventory control system, health commodity procurement, monitoring and evaluation of supply chain, quantification of health commodities.

PCP 406: Externship Practical Training II

(Second Semester)

Credit Units = 2 (90 hours)

Course description

This course is a supervised work-experience of a 3 month duration commencing at the end of second semester of 400 Level. Students shall be posted to some selected hospital and community pharmacies located in Gombe and environs. The students shall be jointly supervised by the pharmacists who are academic staff of the faculty.

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

- a. Understand in-patient pharmaceutical activities.
- b. Have direct patient contact in general medicine and related pharmacy experience.
- c. Check prescriptions for completeness, dispensing and patient counseling under the supervision of the pharmacists.
- d. Understand rational drug use in patients.

PCP 501: Pharmacotherapeutics III

(First Semester)

Credit Units = 2(30 hours)

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

- a. Have a good understanding of the aetiology and pathophysiology of the disease states discussed
- b. Identify the signs and symptoms characteristics of a given disease state
- c. Recommend the drug therapy of choice for a particular disease state and other drug therapy options
- d. Recognize the drug-drug, drug-food interactions and complications that may arise from drug therapy and be able to recommend appropriate measures
- e. Identify areas of patient education and counseling

Course Content

- a. Psychiatric disorders: over view of mental illness, schizophrenia, affective disorders; major depression, mania, manic depression, drugs and alcohol abuse.
- b. Neurological disorders: Parkinsonism (paralysis agitans), headache, pain of migraine, myasthenia gravis, tropical neuropathy, seizures, insomnia, anxiety, epileptic disorders.
- c. Cancer chemotherapy
- d. Musculo-skeletal disorders –Rheumatoid Arthritis, Osteoarthritis, Gout, ankylosing spondylitis, etc

PCP 503: Biostatistics and Research Methodologies (First Semester)

Credit Units = 2(30 hours)

Course Description

This course is designed to enable the student to use and evaluate biostatistical and research methodologies in the practice of pharmacy. Students will gain knowledge of various health education problems and the statistics used to monitor and measure health outcomes.

Course Objective: At the end of the course, the student will be able to:

- a. Evaluate the appropriateness of the research methodology designed to answer a research question or to test hypotheses,
- b. Select an appropriate statistical test, analyzing data using a statistical computer package, explain and evaluate the results, and apply the results to decisions about research and practice.

Course Content

This will involve a review of basic statistics from measures of central tendency to paired sample hypothesis; parametric and non-parametric analysis, multi-sample hypotheses and multiple comparisons, two factors analysis of variance, data transformations, multi-way factorial analysis of variance; linear regression and comparing linear regression equations; simple linear correlation and multiple regressions; binomial distribution, testing for randomness; and analyzing data using statistical computer packages.

PCP 502: Clinical Ward Round and Clerkship (Second Semester)

Credit Units = 2(90 hours)

A Rotation objectives

These objectives are specifically to:

Serve as an opportunity for the students to interact with other members of the health care team and patients.

- 1 Provide instruction regarding how knowledge of pharmaceutical sciences such as pharmacology, medical chemistry, therapeutics and pharmacokinetics can be applied to selection and use of drugs in various disease states.
- 2 Instruct the student understanding significant adverse drug reactions so that he can recognize and differentiate between the symptoms related to a change in the patient's disease process and symptoms developing because of adverse effects of drugs.
- 3 Improve the ability to not only identify drug related problems but also to anticipate and prevent them whenever possible.
- 4 Familiarize the student with some diagnostic methods employed by the physicians for patient's condition.
- 5 Familiarize the student with major monitoring parameters" such as clinical laboratory test, their uses, how they signify response or lack of response to drug therapy, and how they themselves influence by drugs.
- 6 Improve the student understanding of drug therapy in clinical setting with regard to drug selection, disease duration of therapy and therapeutic objectives.
- 7 Improve verbal communication skills and the ability to apply knowledge to the basic physical, biological and pharmaceutical sciences to solving drug therapy problems through interaction with other health care practitioners and patients.
- 8 Proving the student with experience in responding to drug information requests by calling on his own knowledge or making use of the appropriate literaturesources.
- 9 Proving further in-depth consideration of selected disease states encountered in the clinical setting.

BFulfillment of objectives

These objectives will be fulfilled by the following processes:

- 1 Each student will be assigned to a teaching hospital ward (FTHG) for a period of six rotationsor weeks as shown on the student rotational schedule.
 - 2 During this rotational period, students will take active and dynamic role in the medical team in monitoring drug therapy. Each student will be assigned to one (1) bed in each ward.
 - 3 Student should monitor drug therapy for appropriateness as follows:
 - a The most appropriate form of therapy for the patient.
 - b The primary treatment or the drug of choice for the patient being utilized as a symptomatic treatment or to alleviate the patient's discomfort.
 - c Drug is being utilized as a symptomatic treatment or to alleviate the patient discomfort.
 - d The drug therapy for the patient can be improved
 - e If other forms of treatment can be moral useful for the patient (non medication).
 - fThe patient is receiving the most appropriate dose and dosage form of medication
 - g The patient condition is improving maintaining status quo, or deteriorating with respect to drug therapy.
 - 4 Each statement will discuss various aspects of drugs therapy with the team.
 - 5 Each student will present one or two clinical cases in 5 minutes by utilizing "SOAP" approach.
- S - stands for subjective data

O- stands for objective data

A - stands for assessment of patient

P - stands for plan of management

PCP 504: Literature Evaluations Communication Skills & Drug Info. Service (Second Semester)

Credit Unit = 2(30 hours)

Course Description

This course introduces the students to the concept of pharmaceutical care. It helps the students to develop the skills for communicating effectively with other health care professionals and the patient.

Course Objective: At the end of the above, the student should be able to:

- a. Rapidly retrieve, evaluate & effectively disseminate information on drug therapy
- b. Communicate effectively with other healthcare professionals and the patient
- c. Develop and maintain a patient medication profile for drug monitoring
- d. Counsel a patient on how to use his/her drugs

PHM 502: Final Year Project

(Second Semester)

Credit Units = 4 (180 hours)

Project will involve simple research topics of interest, supervised by academic staff. A project may involve literature review or literature and experimental work. It is to be presented typewritten (A4) and in a paper bound form. An oral examination of the project may be required.

At the end of the course, the students are expected to:

- a. Know how to search the chemical and biological literature relevant to topical interest
- b. Apply research techniques used in clinical and administrative pharmacy research
- c. Write a dissertation and orally present it.

Courses offered in the Department of Pharmaceutics and Pharmaceutical Technology

Synopsis of 200 Level Pharmaceutics and Pharmaceutical Technology Courses

PCT 201: General Dispensing and Pharmaceutical Calculations (First Semester)

Credit Units = 2 (30 hours) (Prerequisite = MATH 101)

Course Description: This course is designed to provide students with rudiments of Pharmaceutics and Pharmaceutical Technology.

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

- i. Know how to define Pharmaceutics and Pharmaceutical Technology.
- ii. Perform simple weighing, measuring and determine common errors.
- iii. Use official compendia and formularies in dispensing operations.

- iv. Calculate doses using various formulae.
- v. List and describe different types of pharmaceutical preparations.
- vi. Know laws governing solution and solubility.

Course Content

1. **Introduction (10hrs):** The dispensing balance and weighing operation, measuring and common errors in measuring (5hrs) Dispensing ethics and product presentation, prescriptions. Official compendia and formularies (5hrs)
2. **Pharmaceutical calculations (12hrs):** Abbreviations, Sensitivity of measure (2hrs). Ratios, proportions, percentages; weight by weight, weight by volume, volume by volume etc (1hr). Density, specific gravity, specific volume, dilutions and concentration (reducing and enlarging) (1hr). Allegation method, allegation alternate, dose and dosage calculations based on age, weight and body surface area (2hrs). Electrolyte solutions and expression of concentrations e.g milliequivalents, millimoles (3hrs). isotonicity and calculation of isotonic values; freezing point depression, sodium chloride equivalence etc (3hrs)
3. **General overview of types of Pharmaceutical preparations (8hrs):** Descriptions and properties of solids, semi solids, liquids (4hrs). Pharmaceutical solution and solubility; dissolution and dissolution rates, distribution law etc (4hrs).

PCT 202: Technology of Formulation

(Second Semester)

Credit Units = 2(30 hours)

Course Description: This course is designed to provide students with knowledge in solid particles morphology, unit operations and principles of drying, evaporation and distillation.

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

- i. Determine particle size, shape and draw distribution curves.
- ii. Know extraction techniques and methods of size reduction and mixing
- iii. Understand principles behind heating and heat exchange equipment
- iv. Describe drying, evaporation, distillation and mode of operation of equipment for various distillation processes.

Course Content

1. **Properties of Solid System (8hrs):** Introduction, particles size and shape (3hrs). Mean particle size, particle size distribution curves (3hrs). Methods of particle size determinations (2hrs).
2. **Unit Operations (5hrs):** Extraction, extraction methods and theories, etc (2hrs). Size reduction, mechanics of size reduction, size reduction equipment (3hrs).
3. **Mixing (5hrs):** Principles of mixing, mechanics of mixers (3hrs). Separation techniques (filtration and centrifugation), theories, equipment (2hrs).

4. **Heat transfer (6 hrs):** General principles (1hr). Thermal conductivity of materials, methods of heating (3 hrs). Design of heat exchange equipment, etc (2 hrs).
5. **Drying (2 hrs):** Introduction, principles of drying and types of dryers.
6. **Distillation (4 hrs):** General principles (1 hr). Theory of distillation (1 hr). Design and mode of operation of equipment for various distillation processes (2 hrs).

Synopsis of 300 Level Pharmaceutics and Pharmaceutical Technology Courses

PCT 301: Physical Pharmaceutics I

(First Semester)

Credit Units = 3(45 hours)

Course Description: The course is designed to provide students with the understanding of the basic concepts of Physical Pharmacy.

Course Objectives: At the conclusion of the course, the students should be able to understand:

- i. The important properties of solutions of electrolytes, the theory of electrolytes, the concepts of pH, pK and pOH and the relationship between hydrogen ion concentration and pH.
- ii. The concepts of acid-base equilibria and the ionization of weak acids and weak base.
- iii. The different types of interfaces, surface tension and interfacial tension and their application in Pharmaceutical sciences.
- iv. The mechanisms of adsorption on liquid and solid interfaces, classification of surface-active agents.

Course Content

1. Theory of Electrolytes, theory of Acid and Base Buffer solution, Phase equilibrium and phase rule (15 hrs).
2. Thermodynamics, thermochemistry, chemical equilibrium, chemical kinetics, catalysis (15 hrs).
3. Interfacial phenomena, Adsorption, Surface tension, Surface-active agents, Solubilization, stability (15 hrs).

The practical component of the course is as below:

- i Experiments on solubility of solids in liquids
- ii Phase rule
- iii Determination of rate constant for a chemical reaction
- iv Surface tension determination

PCT 303: Dispensing Practical I

(First Semester)

Credit Units = 1(45 hours) (Pre-requisite = PCT 201)

Course Description: The course is designed to provide students with basic knowledge in compounding of solid-oral and non-oral, liquid preparations, emulsions, pastes, suppositories and pessaries.

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

- i. Know how to weigh and measure materials.
- ii. Use official books and monographs in checking for composition and detecting errors.
- iii. Prepare and package extemporaneous and unofficial pharmaceutical formulations.

Course Content

1. **Introduction (3 hrs):** weighing, measuring, use of different classes of balances (3 hrs).
2. **Formulation of powders (3 hrs):** Divided, bulk, effervescent etc (2 hrs). Mixtures containing diffusible and non-diffusible solids (1 hr).
3. **Liquid preparations (6hrs):** Emulsions, Lotions, Mouth washes, gargles, Solutions, inhalations.
4. **Semi-solid preparations (3 hrs):** Ointments, creams, pastilles.

PCT 302: Physical Pharmaceutics II (Second Semester)

Credit Units = 3

Course Description: This course is designed for the understanding of basic concepts of Physical Pharmacy.

Course Objectives: At the conclusion of this course, the students should be able to:

- i. Differentiate between different types of colloidal systems and their main characteristics.
- ii. Define rheology, provide examples of fluid pharmaceutical products exhibiting various rheologic behaviours, pharmaceutical applications.
- iii. Describe what pharmaceutical suspensions are their roles in pharmacy, stability of suspension.
- iv. Understand semisolids thixotropic properties, syneresis and swelling
- v. Understand description of course dispensing with examples.

Course Content 2CU(30hrs)

- a. **Colloidal Dispersions and Properties (8 hrs):** types of colloidal systems, optical properties of colloids, kinetic properties of colloids, electrical properties of colloids, pharmaceutical applications of colloids.
- b. **Rheology (7 hrs):** Newtonian systems, Newtonian and non-Newtonian fluid flows, thixotropic system, determination of flow properties, viscometers, viso-elasticity creep testing, dynamic testing.
- c. **Coarse Dispersions (15 hrs):** Suspensions, interfacial properties of suspended particles, settling in suspensions, Formulation of suspensions, Physical stability. Emulsion types, theories of emulsification, stability, preservation, Rheologic properties semisolids-Gels, Drug kinetics in course disperse systems, Drug diffusion in course disperse systems.

Practical 1CU (45hrs)

The practical component of the course is as below:

- i. Viscosity of Newtonian and non-Newtonian liquids
- ii. Preparation and stability of colloids – effects of electrolytes, pH, and other factors.

PCT 304: Dispensing Practical II

(Second Semester)

Credit Units = 1(45 hours) (Pre-requisite = PCT 303)

Course Description: The course is designed to provide students with proficiency in preparation and compounding of emulsions, lotions, liniments, pastes, pessaries etc. Detection and correction of underdoses, overdoses, incompatibilities, calculations for children and geriatric doses.

Course Objectives: At the end of the course, the students should know how to:

- i. Prepare different types of emulsions and other liquid preparations.
- ii. Detect and correct overdoses and underdoses.
- iii. Detect and correct incompatibilities in formulations.
- iv. Calculate pediatric and geriatric doses.
- v. Use official books and monographs to check for overdoses, underdoses and incompatibilities in formulations.

Course Content

1. **Preparation of official formulations (6 hrs):** Emulsions, Lotions, Creams.
2. **Preparation and detection of overdoses, underdoses, incompatibilities (6 hrs).**
3. **Calculation of pediatric and geriatric doses in formulations (3 hrs).**

Synopsis of 400 Level Pharmaceutics and Pharmaceutical Technology Courses

PCT 401: Solid Dosage Technology

(First Semester)

Credit Units = 3(45 hours) (Pre-requisite = PCT 202)

Course Description: The Course is designed to provide students with knowledge of Solid dosage Technology in Industrial Pharmacy

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

- i. Study powder science and its technology.
- ii. Granulate powder and know its application in Pharmacy before compression.
- iii. Know the different types of tablets and capsules, standardization and quality control.
- iv. Understand how to coat a tablet as well as evaluate it.
- v. Identify what Nano products are in pharmacy.

Course Content

1. **Powder Science and Technology (14 hrs):** Definition and types of Powder (3 hrs). Summary of Solid state properties (3 hrs). Solid-state and Polymorphism (3 hrs). Hydrates and Solvates (3 hrs). Amorphous Surface nature of particles (2 hrs).
2. **Granulation and capsulation (15 hrs):** Powder characterization, particles size and size distribution (2 hrs). Methods of determining particle size and surface area (2 hrs). Bulk properties (Particle packing, densities, porosities) of powder, flow and its relevance to pharmacy (3 hrs). Granulation, methods, characterization and application of granules in pharmacy (3 hrs). Capsules, types and formulation (3 hrs). Characterization of capsules, microencapsulation and uses in Pharmacy (2 hrs).
3. **Tableting (16 hrs):** Definition of a tablet and tableting (1 hr). Manufacture of Tablets and tableting machines, types and advantages (2 hrs). Tablet additive and uses (2 hrs). Coating of a tablet and types (2 hrs). Standardization and quality control (Evaluation) of a tablet (2 hrs). Problems associated with the tableting process (2 hrs). Effects of tableting processes and additives on the quality of tablets (2 hrs). Definition of Nanoprodcts and their uses in modern medicine (2 hrs). Implication of Nanoprodcts and technology on Pharmacy Practice (1 hrs).

PCT 403: Biopharmaceutics and Pharmacokinetics

(First Semester)

Credit Units = 2 (30 hours)

Course Description: The Course is designed to provide the students with knowledge of drug design, its Pharmacokinetics and final evaluation.

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

- i. Study the principles of Biopharmaceutics in drug development.
- ii. Identify the various factors that could affect Pharmacokinetics of drugs.
- iii. Design a drug, identify its variables and evaluate it.

Course Content

1. **Biopharmaceutical Principles (15 hrs):** General definition of Biopharmaceutics (4 hrs). Application of Biopharmaceutical principles in drug development (4 hrs). Factors affecting drug product development (4 hrs). Drug design variables (3 hrs).
2. **Pharmacokinetics (15 hrs):** Overview of Pharmacokinetics (4 hrs). Factors affecting drug absorption, Physical chemical and Physical factors (4 hrs). Effects of these factors on product development and mechanical information (4 hrs). Biopharmaceutical product evaluation (3 hrs).

PCT 402: Solid Dosage Technology II

(Second Semester)

Credit Units = 3(45 hours) (Pre-requisite = PCT 202)

Course Description: The Course is designed to familiarize the students with various drug delivery systems

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

- i. Understand efficiency of drug systems
- ii. Know the philosophy behind their design and classification.
- iii. Understand the drawbacks of the conventional methods of drug administration.

- iv. Know the particulate material used in drug targeting and the disease for these targetable drug delivery.
- v. Formulate and evaluate phytomedicines and herbal products.

Course Content

1. **Specialized drug delivery system (15 hrs):** Definition, A brief review of the objectives of an efficient drug delivery system (3 hrs). Conventional methods of drug administration and their drawbacks (3 hrs). Definition and brief history of produg (3 hrs). Definition and formulation sustained release, repeat action, prolonged release dosage forms (6 hrs).
2. **Controlled release drug delivery system (7 hrs):** Definitions and brief history (2 hrs). The Philosophy behind their design (2 hrs). Classification of controlled release drug delivery system (3 hrs).
3. **Targetable drug delivery system (15 hrs):** The concept of drug targeting (3 hrs). Particulate material used in drug targeting (2 hrs). Passive and active drug targeting (3 hrs). The use of homing devices to increase tissue specificity (3 hrs). Disease for these targetable drug delivery system (4 hrs).
4. **Phytomedicines and herbal products (8 hrs):** Definition, formulation and evaluation (5 hrs). Validation of pharmaceutical processes (3 hrs).

PCT 404: Practical Solid Dosage Technology/ Industrial Pharmacy

(Second Semester)

Credit Units = 2(90 hours) (Pre-requisite = PCT 202)

Course Description: The Course is designed to familiarize the students with the practical knowledge of tableting, capsulation and standardization of solid dosage forms.

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

- i. Study powder science and its technology.
- ii. Practically form powder granules before compression or directly compressed the tablet and capsules.
- iii. Know how to evaluate the quality of a compressed tablet and capsules.
- iv. Apply the various techniques of coating a tablet and evaluate it as well.
- v. Physically identify the mechanical techniques of the various tableting, capsulation machines.

Course Content

Semester Practical Course (30hrs): Introduction to powder technology (Powder characterization) (3 hrs). Particle size and size distribution (3 hrs). Method of determining particle size and surface area (3 hrs). Powder flow (3 hrs). Bulk properties (3 hrs). Granulation and granule characterization (3 hrs). Manufacture of tablet and coating (3 hrs). Directly compress tablet (3 hrs). Encapsulation (3 hrs). Evaluation and quality control of compressed tablet (3 hrs). Evaluation and quality control of capsules.

Students are expected to go for field trip for industrial experience.

Synopsis of 500 Level Pharmaceutics and Pharmaceutical Technology Courses

PCT 501: Dosage Form Evaluation and Drug Stability (First Semester)

Credit Units = 2(30 hours) (Pre-requisite = PCT 202)

Course Description: The Course is designed to avail students with knowledge on dosage forms standardization, stability and packaging.

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

- i. Evaluate Solid, Semi-solid and liquid dosage forms.
- ii. Understand the need for stability testing studies of pharmaceutical products.
- iii. Choose the appropriate packaging material for various dosage forms.
- iv. Understand and conduct in-vitro and in-vivo correlation studies.

Course Content

1. **Introduction: Definitions:** Dosage forms (Solid, Semi-solid and liquid), Drug stability, Packaging. Research for dosage form evaluation and drug stability studies (2 hrs).
2. **Solid dosage form standard for tablets and capsule:** Shape, weight, content of medicaments diameter, crushing strength, (hardness) and friability of tablets and capsules formulation. Formulation factors affecting the dissolution rates of solid dosage form (2 hrs).
3. **Liquid dosage forms:** Labelling and packaging, description, content, appearance (colour, clarity, etc), pH, weight per ml, refractive index, etc (1 hr).
4. **Semi-solid dosage form:** Labelling and packaging, description, content, appearance, weight per ml (1 hr).
5. Product stability and accelerated stability studies (3 hrs).
6. **Incompatibilities in liquid dosage forms:** Chemical degradation of Pharmaceutical Products (hydrolysis, oxidation, isomerization, polymerization, decarboxylation and adsorption of carbon dioxide) (4 hrs). Physical factors influencing chemical degradation (temperature, moisture, light and radiation):
 - i. Factors influencing and methods of reducing chemical degradation.
 - ii. Physical degradation of pharmaceutical products e.g loss of volatile constituents, loss of water, absorption of water, crystal growth, polymorphic changes and colour changes.
 - iii. Microbiological degradations (6 hrs)
7. **Packaging Sciences and Technology**
Packaging materials – General principles of packaging (1 hr)
 - a. Material (e.g Tin, Iron and Aluminum) and plastics includes: solvent properties, toxicity, permeability and light transmission characteristics (2 hrs).
 - b. Glass – mechanical strength and resistance to thermal shock, flake and spicule formation (1 hr).
 - c. Paper and board (1 hr).
 - d. Closure testing – folded, bung and push – on seals, reasons for test failures (2 hrs).

8. Application of Bio-pharmaceutics in dosage form evaluation, including correlation of in-vitro and in-vivo tests (4 hrs).

PCT 503: Ethical Dispensing

(First Semester)

Credit Units = 2(90 hours) (Pre-requisite = PCT 304)

Course Description: The course is designed to provide students with the practical knowledge of dispensing ethics.

Course Objectives: At the end of the practical class, the students should be able to:

1. Handle/Interpret prescriptions of in-and out-patients.
2. Counsel patients appropriately.
3. Interact effectively with other health professionals.
4. Check incompatibilities and drug interactions.
5. Re-constitute solutions and suspensions.

Course Content

Handling of prescription (in-and out-patients)

Patient counseling

Pharmacists/other health professionals interaction

Re-constitution of solutions

IV admixtures and rates of flow

Interpretation of prescriptions or medication orders

Expiry date

Calculations associated with drug availability and pharmacokinetics

Patient safety (10 hrs)

Veterinary drugs and veterinary pharmacy practice

Generic substitution-Drug interaction

Drug supply to wards, clinics and other units

Emergency supplies – requisitions

Record keeping: Prescription books: Dangerous drug register, disposal of poisons and dangerous drugs with respect to their sale and supply

Use of computer in dispensing (10 hrs)

The art of interpreting, handling and filling prescription orders containing proprietary drug and or expotemporaneous prescriptions.

Checking for correctness of prescription orders in terms of its originating source (Qualification and address of prescriber), use, direction

Dosage regimen, individual dosage, daily paediatric dose etc

Incompatibilities, drug interactions etc

Legal requirements with regard to dose

Directions, date, address, signature etc (10 hrs)

PCT 502: Drug Delivery Design (Second Semester)

Credit Units = 2 (30 hours)

Course Description: This course is designed to expose the students to the various advancements in drug delivery and the application of biotechnology studies.

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

- i. Describe the various methods employed in drug delivery design.
- ii. Describe various novel drug delivery systems.
- iii. Apply various biotechnological studies to the delivery of drugs to target sites.

Course Content

1. **Introduction:** Definition of Terms (3 hrs)
Concept of Drug release mechanisms
 - a. Ocular
 - b. Transdermal
 - c. Trans-nasal delivery systems (4 hrs)
2. **Formulation and stabilization of biotechnology based therapeutic agents (4 hrs)**
3. **Aerosol Science and Technology (10 hrs):**
 - **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
4. **Application of aerosol in pharmacy (6 hrs)**
5. **Foams and cosmetics technology (6 hrs)**

**PHM 502: Project in Pharmaceutics and Pharmaceutical Technology
(180 hours)**

Credit Units – 4

Project involves research topics in Pharmaceutics and Pharmaceutical Technology to be supervised by an academic staff. This research project must be hypothesis-driven and may involve laboratory work. Standard for presentation of Research projects in the Faculty must be adhered to. An oral examination of the project is required (both internal and external).

At the end of the course, the students are expected to:

- d. Know how to search the literature relevant to the topic of interest.
- e. Apply practical techniques used in Pharmaceutics and Pharmaceutical Technology.
- f. Write a dissertation/project and develop presentation skills.

Courses offered in the Department of Pharmaceutical Microbiology and Biotechnology

200 Levels: First Semester

PMB 201: Fundamentals of Pharmaceutical Microbiology

Credit Units: 2 (30hrs)

Course Prerequisite: BIOL 101

Course Description: The course is designed to provide the students with the fundamentals of Microbiology

Course Objectives: At the end of this course, the students are expected to be conversant with the basis in the field of Microbiology; understand the interrelationship between human, microorganisms (bacteria, viruses, fungi and protozoa) and their environment; exposed to microbial characteristics, morphology, growth, culture and nature of propagation.

Course Content

1. **History of Microbiology (3hrs):** Introduction to Microbiology (1hr) and their relevance to the practice of Pharmacy (1hr), a brief history to microbial discovery (1hrs)
2. **Bacteria (15hrs):** General structure of the bacteria cell, gram positive and gram negative pathogenic bacteria (2hrs). Systematic classification of bacteria and characteristics of major groups (Taxonomy) (2hrs). Nutritional requirements and growth of bacteria, bacterial growth curve, introduction to genetics (2hrs). Bacteria spores, structure and resistance to inactivating agents (2hrs). Theory of spontaneous generation and germ cell theory (2hr). Protoplasts, spheroplasts and L- forms – their significance in Microbiology and chemotherapy (1hr). Enumeration of microorganisms and bacteria culture technique (2hrs). Rickettsia and Chlamydia (2 hrs).
3. **Fungi (4hrs):** introduction to fungi and moulds (1hr), characteristics and growth condition (1hr), their importance in pharmacy and medicine (2hrs).
4. **Virus (4hrs):** HIV/AIDS and viral replication.
5. **Introductory parasitology (4hrs):** protozoa parasites of public health importance.

200 Level: Second Semester

PMB 202: Pharmaceutical Microbiology Practical I

Credit Unit: 1 (45 hrs)

Course Prerequisite: PMB 201

Course Description: The course is designed to prove/appreciate some of the principles and techniques which are unique to the theoretical concept of PMB 201

Course Objective: At the end of this course, the students should be acquainted with good laboratory practices, the course should also provide the students with hand on practical's and evidences supporting microbial existence, culture techniques, microbial isolation, identification and biochemical characteristics.

Course Content:

1. **Aseptic techniques:** Aseptic techniques, good laboratory practices, transfer with inoculation loop, Pasteur and graduated pipettes (3hrs).
2. **Microbial ubiquity and survival:** Exercise on ubiquity of microorganisms, effect of environmental factors on growth and survival of microorganism (3hrs)
3. **Microscopy:** Microscopy, simple, differential and Gram staining, microscopic examination of bacteria, and fungi (3hrs)
4. **Culture of microorganism:** Culture methods, nutritional requirements of microorganism, enumeration of bacteria: total and viable count (3hrs)

Microbial characterization: Biochemical properties of some selected enterobacterial, anaerobiosis (McIntosh) (3hrs)

300 Levels: First Semester

PMB 301: Sterilization and Chemical Disinfection

Credit Units: 3 (45 hrs)

Course Prerequisite: PMB 201

Course Description: This course is designed to provide students with basis on sterilization techniques.

Course Objectives: At the end of this course, the students are expected to:

- i. Define sterilization, understand the different methods of sterilization and the principles behind them
- ii. Define, classify, understand the principles, properties and application of disinfectants,
- iii. Aseptic processing and sterility testing

Course Content:

1. Principles of Sterilization (18hrs): Definition of sterilization, Methods of sterilization: physical (dry heat and boiling using autoclave, pasteurization, freezing, filtration, desiccation, osmotic pressure, plasmolysis, radiation) and chemical (ethylene oxide, Nitrogen dioxide, Ozone, Glutaraldehyde, formaldehyde, Hydrogen peroxide, Peracetic acid, their efficiencies and limitations) (9hrs). Filtration methods (ultrafiltration, membrane filters, Paper, Vacuum filtration, Testing of filters) (2hrs). Radiation (ionization radiation, ultraviolet light, microwave, gaseous sterilization) (2hrs). Factors affecting microbial death (2hr). Aseptic techniques: principles of aseptic techniques, the design and structure of aseptic room and provision of clean air (2hr). Sterility testing involving aqueous preparations, powders, sutures and ligatures (2hrs)

2. Disinfection and types of Disinfection (17hrs): Disinfection and antiseptics (Phenols and Phenolics, Halogens, alcohols, Heavy metals, Quaternary Ammonium Compound, Aldehydes, Peroxygens (Oxidizing agents)); factors affecting their activity, major groups, their properties, storage and uses (9hrs). Mechanism of action of disinfectants (3hr). Solubilized systems of disinfection process. Effect of concentration, the concentration exponent and its significance (3hr). The temperature co-efficient, effect of PH, organic matter, inoculum size etc (2hr).

3. Evaluation of Disinfectants (10hrs): Evaluation methods of disinfectants e.g. Ridiel walker, chick martin, kelseysyketc (3hrs). Qualitative and quantitative methods. Factors effecting minimum inhibitory values. (2hrs). Evaluation of bacteriostatic activity, minimum inhibitory concentration, minimum bactericidal and fungicidal concentration (MBC and MFC), rate of kill studies (3hrs).

300 Levels: Second Semester

PMB 302: Pharmaceutical Microbiology Practical II

Credit Unit: 1 (45 hrs)

Course Prerequisite: PMB 202

Course Description: The course is designed to augment and enhance the understanding of the principles studied in PMB 301.

Course Objectives: At the end of this course, the students are expected to:

- i. Methods of sterilization using autoclave, dry oven and the principles behind them
- ii. Simple techniques relating to inhibition and destruction of micro-organisms,
- iii. The preparation of simple sterile forms and evaluation of potency of antibacterial agents.
- iv. Determination of phenol coefficient value etc.
- v. The preparation and handling of pharmaceutical products that required the adoption of techniques aimed at minimizing or complete eliminating the possibility of contaminations by microorganisms.

Course Content:

1. Principles of Sterilization (8hrs): Eradication of microorganisms: sterile preparations, relevance of microbial eradication in pharmacy (1hr). Microbial contamination of pharmaceutical products, potential hazards, sources of contamination, microbial death (1hr). Sterilization by moist (Autoclave) and dry heat (hot air oven) (3hrs). Sterilization by use of bacteriological filter, gaseous and irradiation (3hrs).

2. Factors Affecting Disinfectant Activity (4hrs): Disinfectant and preservative evaluation (2hrs). Effects of temperature, time and bacteria type on the death of bacteria exposed to moist heat (2hrs).

3. Evaluation of Disinfectant (3hrs): Determination of the potency of antibacterial agents: Phenol coefficients, Rideal walker test, chick Martian Test (3hrs).

400 Levels: First Semester

PMB 401: Sterile Pharmaceutical Products Formulation

Credit Units: 2 (30 hrs)

Course Prerequisite: PMB 301

Course Description: The course is designed to showcase good manufacturing procedures in the formulation of pharmaceutical products

Course Objectives: At the end of this course the students are expected to:

- i. Understand the need for sterility in pharmaceutical products
- ii. Route of administration of pharmaceutical products and their effect
- iii. Formulation and preparation of pharmaceutical products.

Course Content:

1. Introduction to sterile formulation (10hrs): Types of sterile pharmaceutical products (3hrs). Parenteral and ophthalmic products (4hrs). Route of administration of parental products (3hrs).

2. Vehicles and containers used in the formulation of sterile products (10hrs): Water and Non-aqueous types of vehicles (4hrs). Pyrogens, tests for pyrogen, apyrogenic water (3hrs). Types and properties of containers and closures used in sterile products (3hrs).

3. Preparation of sterile products (10hrs): Formulation and preparation of eye drops and lotion (3hrs). Formulation and preparation of injections (single and multiple dose) and infusions (2hrs). Adjustment to isotonicity of sterile products (3hrs). Conversion to g/100ml, milliequivalent, percentage, w/v and millimole (2hrs).

400 Level: Second Semester

PMB 402: Pharmaceutical Microbiology Practical III

Credit Unit: 1 (45 hrs)

Course Prerequisite: PMB 302 and PMB 401

Course Description: The course is designed to focus on the practice of aseptic techniques in formulation preparation.

Course Objectives: At the end of this course the students are expected to understand:

- i. The importance of the aseptic techniques employed in the formulation of some sterile products
- ii. Steps in formulating some pharmaceuticals

Course Content:

1. Preparation of Sterile Pharmaceutical Products: Formulation and preparation of eye drops, multiple dose injections and single-use parenteral large volume injections and lotion (4hrs). Formulation and preparation of injections and infusions (2hrs). Adjustment to isotonicity of sterile products. Conversion to g/100ml, milliequivalent, percentage, w/V and millimole (2hrs). Techniques in aseptic filling and capping of vaccine bottles (2hrs).

2. Microbial Contamination of Pharmaceuticals and Preparation of Sterile Media: Microbiological examination of water for indicator organisms (1hrs). Contamination of pharmaceutical preparations, identification of common contaminants, testing for indicator organisms (2hrs). Difference between the preparation of nutrient agar and nutrient broth. Preparation and aseptic transfer of growth media (2hr).

PMB 404: Infection, Immunology and Immunological Products

Credit Units: 2 (30 hrs)

Course Prerequisite: PMB 201, PMB 202

Course Description: The course is designed to provide the students with the fundamentals of microbial pathogenesis, interaction with the host and host survival.

Course Objectives: At the end of this course the students are expected to understand:

- i. The principles behind transmission of infection, pathogenesis
- ii. Antigens, Antibodies and their reactions
- iii. Exploitation of the phenomenon of antigen-antibody reaction in the production of various types of immunizing agents.

Course Content:

1. Host-Parasite Relationship (9hrs): Infection, host-disease/parasite relationship, transmission of diseases, the host response to infection and pathogenesis (6hrs). Koch and river postulates (3hrs).

2. Immune Response (8hrs): Component of immune system (2hrs), Specific defense mechanism of the body: Antigens-antibody reaction (3hrs). Hypersensitivity, allergy atopy and other outcome of antigen-antibody reactions (3hrs).

3. Immunological products (13hrs): Production and quality control of immunological products (3hrs). Types of bacterial and viral vaccines (official vaccines e.g. cholera typhoid BP, BCG BP, Toxoids e.g. Diphtheria vaccine BP, Viral vaccine, Rickettsial) (3hrs). Toxoids and immunosera (2hrs). Diagnostic reagents e.g. Schick, Dick and Tuberculin testing reagents (3hrs). Antibodies types and their characteristics (2hrs).

PMB 406: Pharmaceutical Biotechnology

Credit Units: 2 (30 hrs)

Course Prerequisite: BCH 211, PMB 201

Course Description: The course is designed to provide the students with the fundamentals of Biotechnology and its application in the production of pharmaceutical.

Course Objectives: At the end of this course the students are expected to understand:

- i. Basic tools used in Biotechnology, their application and principles
- ii. The use of biotechnology in the production of vaccines and treatment of diseases.

Course Content:

1. Basic techniques in Biotechnology (6hrs): Cutting and joining of DNA molecules, cloning techniques and gene manipulation (3hrs). Polymerase chain reaction (PCR) (3hrs).

2. Plant Biotechnology (9hrs): History and scope of Plant Biotechnology, application of plant biotechnology (1 hrs). Somatic embryogenesis and Organogenesis (1hr). Plant genetic variation, genomics, proteomics, metabolomics (1hr). Plant made pharmaceuticals with their production host, mode of delivery systems and stability (1hr). Classical and non-classical techniques for secondary metabolite production in plant cell culture and their relevance to pharmaceutical sciences (2hrs). Edible vaccines (1hr). Plant tissue culture, micropropagation, gene transfer and biosynthesis (2 hrs).

3. Biopharmaceutical (15 hrs): Biotechnological products manufacturing process including cell banking systems, stabilization and formulation in to final products (2hrs). Clinical importance of recombinant proteins (1hrs). Gene therapy (2hrs). Biotechnology in vaccines development (1hrs). Engineering antibodies for therapy – predicting of monoclonal antibodies, recombinant antibodies and antibody fragment (3hrs). Identification of potential biotechnological products (3hrs). Plants and transgenic animals as potential sources of recombinant biotechnological products (3hrs).

500 Levels: First Semester

PMB 501: Microbial Chemotherapy, Bacterial Genetics and Drug Resistance

Credit Units: 2 (30 hrs)

Course Prerequisite: PMB 404

Course Description: The course is designed to focus on the fundamental principles of chemotherapeutic, bacterial genetics and mechanism of microbial resistant to antibiotics.

Course Objectives: At the end of this course the students are expected to understand:

- i. The etiology and function of the different classes of antibiotics
- ii. Their mechanism of actions
- iii. Bacterial adaptation and resistant

Course Content:

1. Microbial Chemotherapy (22hrs): Brief historical perspective of chemotherapy (1hr). Fundamental principles of chemotherapeutic agent selectivity and toxicity (2hrs). Classification of antimicrobial agents with special reference to mechanism of action and chemical structures (2hrs). Biochemical basis of drugs inhibiting cell wall synthesis- betalactam antibiotics (2hrs). Inhibitors of protein synthesis – amino glycosides, macrolides, tetracyclines (2hrs). Drugs which interfere with cell wall membrane integrity, inhibitors of RNA and DNA synthesis- rifampicin and quinolones, miscellaneous antimicrobials e.g. Sulphonamides, trimethoprim (4hrs). Fusidic acid, clindamycin, lincomycin, chloramphenicol (2hrs). Antifungal agent interferon inducers and antiviral agents (4hrs). Chemotherapy of some parasitic infections (3hrs).

2. Drug Resistance (6hrs): Development of resistance to antibiotics by microorganism: plasmid mediated, biochemical basis and pattern of resistance (3hrs). Control of emergence of resistance (3hrs).

3. Bacterial Genetics (2hrs): Introduction to bacterial genetics and genetic engineering (2hrs).

PMB 503: Pharmaceutical Microbiology Practical IV

Credit Units: 1 (45 hrs)

Course Prerequisite: PMB 402

Course Description: The course is designed to evaluate the antimicrobial activity of different antimicrobial agents and aseptic techniques in the preparation methods.

Course Objectives: At the end of this course the students are expected to:

- i. Carryout antibiotic susceptibility test using the agar diffusion method
- ii. Determine the susceptibility of microbial contaminants of pharmaceutical products
- iii. Isolate and identify test for indicator organism

Course Content:

1. Antibiotic susceptibility profile (9hrs): Evaluation of antibiotic activity assay procedures, agar diffusion methods, turbidometric assays (3hrs). MFC and MIC and MBC (3hrs). Antibiotics sensitivity of microbial contamination of pharmaceutical, preparations, sources, identification common pathogens, test for indicator organisms, e.g. *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and candida etc (3hrs).

2. Screening for plant extract activity (3hrs): Screening and testing for the antimicrobial activity of different chemicals plant extracts on bacterial and fungal (3hrs).

3. Inoculation preparation (3hrs): The culture medium and its proper formulation and sterilization (3hrs).

500 Level: Second Semester

PMB 502: Fermentation Technology, Principle of Microbial Spoilage and Preservation against Biodegradation

Credit Units: 2 (30 hrs)

Course Prerequisite: PMB 404

Course Description: The course is designed to focus on different sources of microbial contamination of pharmaceuticals.

Course Objectives: At the end of this course the students are expected to understand:

- i. Water and raw materials used in pharmaceutical preparations as the major source of microbial contamination of Pharmaceuticals
- ii. Principles of preservation of pharmaceutical products.
- iii. Use of microorganism in the production of pharmaceutical

Course Content:

1. Fermentation Technology (19hrs): Fundamentals of industrial fermentation (1hr). The design of the fermenter factors affecting antibiotic yields and control (2hrs). Method of recovery and purification (2hrs). Use of microorganism in biotechnology (2hrs). Search for cultures, approaches in strain developments genetic/enzymatic engineering techniques (2hrs). Selective isolation of mutants (1hr). Fermentation and product recovery (2hrs). Primary and secondary metabolites (1hr). Production of some pharmaceutically important products such as organic acids, and hormones via fermentation (1hrs). The production of antibiotics: penicillin, streptomycin and tetracycline (2hrs). Production of microbial food (1hr). Yeast, microbiological transformation steroids (1hr). Media development and processing (1hr).

2. Principle of Microbial Spoilage (6hrs): Raw materials quality (1hr). Water and its purity (1hr). Microbiology controls; quality assurance of finished products, limiting number of viable organisms (2hr). Factory and hospital hygiene (1hr). Code of good pharmaceutical manufacturing practice (GMP) (1hr).

3. Preservation against Biodegradation (5hrs): Principles of preservation of multiphase system (1hr). Maintenance and preservation (1hr). Clinical trials, registration of intellectual property and patent, biotechnological facilities assurance (QO) in production (1hr). Biosafety of biotechnological product and pharmaceutical care – an over view of relevant information service to patient on storage, reconstitution, stability antigenicity, safe administration (2hrs).

PHM 502: Project in Pharmaceutical Microbiology and Biotechnology

Credit Units: 4 (180 hrs)

Course Prerequisite: All PMB courses from 200 – 500 level

Course Description: The project is designed to focus on different areas of Pharmaceutical microbiology and Biotechnology.

Course Objectives: At the end of this project the students are expected to:

- i. Be exposed to the use of laboratory
- ii. Independent ability to carry out Scientific research
- iii. Develop good writing skills
- iv. Develop confidence in public speaking

Course Content:

The project will involve simple research topics of interest and benefit to the university community and State, and should be supervised by an academic staff. The research work should be hypothesis driving and must involve laboratory work. The most contain a title page, introduction, statement of research problem, justification of research, hypothesis, aim, specific objectives, detailed literature review, methodology to achieve the objectives, results, discussion, summary, conclusion, recommendation, contribution to knowledge, references not less than 10 years from when the research was carried out and appendices. It must be presented on typewriting A4 paper (with font size 14 and Times new romans and justified) and in a paper bound form. An oral examination of the project is required (both internal and external). It must be undertaken throughout the final year.

PHJ 302: Student Industrial Work Experience Scheme (SIWES) Second Semester

Credit units- 3

Course description: This course exposes students to the basic training in the different fields/areas of Pharmacy Practice.

Course objectives: At the end of course the students are expected to:

- i. Be exposed to the basic principles of Practice in the different areas of Pharmacy.
- ii. Acquire practical skills in Pharmacy Practice in these areas.
- iii. Train in at least two of the different Pharmacists Council of Nigeria (PCN) approved registered premises which include; hospital pharmacy, community pharmacy, industrial pharmacy and Pharmaceutical research centers.

Course content

1. **Coordination:** The Faculty shall appoint a SIWES Coordinator (Pharmacist) who is to be in charge of coordinating all aspects of the SIWES program/training.
2. **Posting:** Students shall select any PCN approved registered premise where they wish to do their training and submit an acceptance letter to the Faculty SIWES Coordinator.

3. **Duration:** The duration of the SIWES training shall be for six (6) months. Three (3) months each at the end of 300L and 400L Second Semester.
4. **Supervision:** All students shall work under the supervision of Pharmacist Preceptor at their training centers who shall closely monitor their progress. Students will also be supervised by the SIWES coordinator or other staff from the Faculty on regular basis.
5. **Report:** A presentation of report (Log Book) from the SIWES training shall be done by each student on submission of their Log books.
6. **Evaluation and Assessment:** Evaluation and Assessment of the course shall be based on the student's Log Book report/presentation, Preceptors comments and Lecturers evaluation during visit(s).

Recommended Textbooks

Department of Pharmacognosy and Drug Development

Pharmacognosy- 16th Edition, Trease, G. E. and Evans, W.C ... Imprint: Saunders Ltd.

Pharmacognosy-13th edition, C.K. Kokate, A. P. Purohit, S.B. Gokhale, NiraliPrakashan, 2005.

Practical Pharmacognosy, A. P. Purohit, C. K. Kokate, S. B. Gokhale NiraliPrakashan.

Textbook of Pharmacognosy, 5th Edition (9798123908860) By Wallis T.E. (New Delhi, Delhi, Cbs Publishers&DistributorsPvt. Ltd., 2005. Softcover.

Pharmacognosy, 9th ed., Tyler, V.C., Brady, L.R. and Robers, J.E. Lea &Febiger, Philadelphia.

The practical evaluation of phytopharmaceuticals, Brain, K. R., &Turner, T. D. Bristol: Wright-Scientehnica, 1975.

Essentials of Pharmacognosy, Ansari, S.H. Birla publications pvt limited, 2011.

Test Book of Pharmacognosy, Ayurvedic Formulations, IST edition, Gupta, M.K and Sharma, P.K.. PragatiPrakashan Meerut Vol II, 2007.

A Textbook of Pharmacognosy and Phytochemistry, Biren Shah and A.K Seth 2010.

Department of Pharmaceutical and Medicinal Chemistry

S/ N	Title of Book	Author
1.	Quantitative Analysis of Drugs in Pharmaceutical Formulations Third Edition	P.D Seth

2.	Essential Medicinal Chemistry Third Edition	Ajibola A. Olaniyi
3.	Principles of Drug Quality Assurance and Pharmaceutical Analysis	Ajibola A. Olaniyi
4.	Principles of Medicinal Chemistry Sixth Edition	Foyes
5.	Experimental Pharmaceutical Chemistry	Ajibola A. Olaniyi
6.	Organic Chemistry Seventh Edition	Robert Thornton Morrison, Robert Ner and Saibal Kanti, Bhajjcharjee
7.	Physicochemical Principles of Pharmacy 4 th Edition	Alex and T. Florence and Dvid Attwood
8.	Quantitative Pharmaceutical Chemistry 6 th Edition	Glenn lo Jenkins, Adelbert M.Knevel, Frank E. Digangi
9.	Pharmaceutical Chemistry	David G. Watson
10.	Pharmaceutical Drug Analysis	Ashuttosh Kar
11.	A Text book of Pharmaceutical Chemistry	Dr. Abhilashar Asthana, Reetesh Kumar Asthana
12.	Medicinal Chemistry 3 rd Edition	Alfred Burger
13.	Practical Pharmaceutical Chemistry 4 th Edition	A.H Beckett, J.B Stenlake
14.	Review of Organic Functional Groups	Thomas L. Lemke
15.	Analytical Chemistry: Methods and Applications	Trima, Harold
16.	Application of Spectroscopy	Muthu,Sona K
17.	Chemistry of Natural Products Vol 1&2	Igbal, Syed Aftab
18.	Experimental Organic Chemistry 4 th Edition	Gilbert, Johson C.
19.	Organic Spectroscopy: An Introduction 2 nd Edition	Dyke, S.F
20.	Organic Synthesis: Concepts, Methods, Starting Materials	Fuhrhop, J.
21.	Principles of Organic Synthesis 3 rd edition	Noman, R.O.C
22.	TextBook of Analytical Chemistry	Igbal, Syed Aftab
23.	Development of Herbal Medicinal Products in Nigeria	Mohammed Garba Tom
24.	Healthcare Management in Nigeria	Mohammed Garba Tom, Mohammed Isa Bazza

25.	Essential Inorganic and organic Pharmaceutical Chemistry	Ojibola A. Olaniyi et al.
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List of Recommended Books for the Department of Pharmaceutical Microbiology and Biotechnology

1. An introduction to Molecular biotechnology: fundamentals, methods and applications, 2nd edition by Michael Wink 2011.
2. Textbook of Biotechnology, 4th Edition by H.K. Das, 2010.
3. Plant metabolism and Biotechnology. By Hiroshi Ashihara, Alan Crozier and Atsushi Komamine, 2011.
4. Pharmaceutical biotechnology: fundamentals and Applications. By Crommelin Daan J. A, Sindelar Robert D., Meibohm Bernd, 2013.
5. Hugo and Russell's Pharmaceutical Microbiology, 8th edition 2011.
6. Pharmaceutical biotechnology second edition by Michael J. Groves.
7. Medical Biotechnology (Oxford handbooks) by Nallari P. And Rao V. V., 2010.
8. Pharmaceutical Microbiology, by Ashutosh Kar, 2008.
9. Human Microbiology, by Simon P. Hardv, 2002.

List of Recommended Books for the Department of Clinical Pharmacy and Pharmacy Practice

S/N	TITLES	AUTHORS
1	Applied Clinical Pharmacokinetics 2 nd edition	Bauer, Larry A
2	Basic and Clinical Pharmacology 11 th and 12 th edition	Katzung, Bertram
3	British National Formulary	Martin, John
4	Clinical Pharmacokinetics	Dhillon, Soraya
5	Clinical Pharmacology 10 th edition	Benett, PN
6	Clinical Pharmacy and Therapeutics 5 th edition	Walker. Roger
7	Clinical Pharmacy Development In Nigeria: A Historical Account	Brown, AA
8	Clinical Research Made Easy	Bhandari, Mohit
9	Compilation of Pharmacy, Drugs and Related Laws and Rules in Nigeria, 1935-2000	PCN

10	Emdex: the Complete Drug Formulary for Nigeria's Health Professionals	Chris, Obi C.
11	Goodman and Gilman's Pharmacological Basis of Therapeutics 12 th edition	Brunton, Laurence
12	Pharmaceutical Practice 4 th edition	Winfield, AJ
13	Pharmacy in Nigeria	Adenike, Fred
14	Remington: The Science and Practice of Pharmacy 21 st & 22 nd E Vol. 1&2	Allen, Loyd V
15	Stokley's Drug Interactions 9 th edition	Baxter, Karen
16	Pharmacotherapy	G.P Georg, M. Prakash
17	Step By By: Hospital Designing & Planning	Dr. Malhotra's Series
18	Applied Therapeutics: The Clinical Use Of Drugs	Koda-Kimble & Young
19	Pharmacotherapy Principles & Practice	Crisholm-Burns
20	Pharmaceutical Compounding And Dispensing	
21	Martindale: The Complete Drug Reference 38 th edition	Vol. A & B

List of Recommended Books for the Department of Pharmacology and Therapeutics

S/ N	NAMES	EDITORS/ PUBLISHER S	AUTHORS
1	Basic and Clinical Pharmacology	13 th Edition. Publisher- Lange	Bertram G. Katzung (Editor)
2	Clinical Pharmacology	10 th Edition	Beneth PN
3	Goodman and Gilman Pharmacological Basis of Therapeutics	13 th Edition Published by McGraw-Hill Education / Medical	by Laurence Brunton , Bjorn Knollman , RandaHilal-Dandan
4	Lippincott's Illustrated Review: Pharmacology	6 th Edition Publisher - Lippincott Williams & Wilkins	Richard A. Harvey , Richard D. Howland , Mary J. Mycek , Pamela C. Champe
5	Rang & Dale's Pharmacology	8 th Edition. Publisher- Churchill Livingstone	H. P. Rang, J. M. Ritter, R. J. Flower, and G. Henderson
6.	Pharmacological Classifications of Drug with Doses and	5 th Edition. Publisher- JD	Tripathi KD

	Preparations	Medical Publishers.	
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Some Recommended Textbooks for Pharmaceutics and Pharmaceutical Technology

- 1) An Introduction to Clinical Pharmaceutics by Alexander T. Florence
- 2) Aulton's Pharmaceutics: The Design and Manufacture of Medicines by Michael E. Aulton
- 3) Pharmaceutical Calculations by Howard C. Ansel
- 4) Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems by Loyd V. Allen Jr
- 5) Handbook of Pharmaceutical Excipients by Raymond C. Rowe
- 6) Modern Pharmaceutics: Basic Principles and Systems by Gilbert S. Banker
- 7) Martin's Physical Pharmacy and Pharmaceutical Sciences by Patrick J. Sinko
- 8) Physicochemical Principles of Pharmacy by Florence and Artwood
- 9) Cooper and Gunn's Tutorial Pharmacy edited by S. J. Carter
- 10) Pharmaceutical Practice by Arthur J. Winfield, Judith Rees, Ian Smith
- 11) Cooper and Gunn's Dispensing for Pharmaceutical Students edited by S. J. Carter
- 12) The Theory and Practice of Industrial Pharmacy by Leon Lachman, Herbert A. Lieberman, Joseph L. Kanig
- 13) Pharmaceutical Dosage Forms - Tablets: Manufacture and Process Control edited by Larry L. Augsburger and Stephen W. Hoag
- 14) Bentley's Textbook of Pharmaceutics by Harold Davis
- 15) The British Pharmacopoeia (BP) by British Pharmacopoeia Commission
- 16) Martindale: The Complete Drug Reference
- 17) British Pharmaceutical Codex (BPC)
- 18) Physical Pharmacy by Mohammed Garba Tom PhD

List of Journals

1. International Journal of Pharmaceutics
2. International Journal of Pharmacy and Pharmaceutical Research
3. Journal of Pharmaceutical Sciences
4. European Journal of Pharmaceutics and Biopharmaceutics
5. European Journal of Pharmaceutical Sciences
6. Drug Development and Industrial Pharmacy
7. Pharmaceutical Technology
8. Powder Technology
9. Starch/Starke
10. Expert Opinion on Drug Delivery
11. Journal of Controlled Release
12. Molecular Pharmaceutics
13. Journal of Excipients and Food Chemicals
14. Asian Journal of Pharmaceutical Sciences
15. Asian Journal of Pharmaceutical Sciences and Technology
16. Acta Poloniae Pharmaceutica Journal
17. Pharmaceutical Research Journal
18. AAPS PharmSciTech Journal
19. Pharmaceutical Development and Technology Journal
20. Journal of Drug Delivery Science and Technology
21. African Journal of Pharmaceutical Research and Development
22. Nigerian Journal of Pharmaceutical Sciences
23. Nigerian Journal of Pharmaceutical Research
24. Journal of Pharmacy and Bioresources
25. International Journal of Pharmaceutical Development and Technology

Alphabetical List of Some Other Recommended Books

Basic Medical Genetics, Pal, G.P.

Bentley's textbook of Pharmaceutics, 8th edition. London, Bailliere Tindall E.A Rawlins, (1980).

Biochemistry and molecular biology, 3 ed, Oxford University Press, 2004. ISBN 0199271992 (Elliot, W.H. & Elliot, D.C.).

Biochemistry, 5 ed. Brooks/Cole, 2005. ISBN 0534405215 (by Campbell, M.K &Farrel, S.O)

British pharmacopoeia (2013), MHRA.

Calculations for Pharmaceutical Sciences. Elsevier, 2005. (By Winfield, A.J &Edafiogho, I.) ISBN 0443100195.

Clinical pharmacy and theurapeutics, 3 ed. Churchill Livingstone. 2002. ISBN 0443071373 (Walker, R. & Edwards, C.)Essentials of Drug Product Quality. The C.V. Mosby Company (Abdel-Monem, M.M. and Henkel, J.C)

Comprehensive Pharmacy Review 7th edition, Shargel, Leon

Conversation of Medicinal Plants Pati, RN

Cooper And Gunn's Tutorial Pharmacy Carter, SJ

Dispensing For Pharmaceutical Students 12th edition, Carter, SJ

Emdex: The Complete Drug Formulary for Nigeria's Health Professionals Chris, Obi C.

Essentials of Pharmaceutical Chemistry 4th edition, Cairns, Donald

Fundamentals of anatomy and physiology, 7 ed. Pearson Education, 2005. ISBN 0321315227 (by Martini, F. with Ober, W.C., Garrison, K.W., K. & Hutchings, R.T.).

Harborne, J.B., (1973). Phytochemical methods, 2nd edition. Chapman and Hall, London, pp. 91-92.

Integrated Pharmacology, 2ed. Mosby. ISBN 072343221X 3rd edition due to be published April 2006. ISBN 0723433631. (Page, C.P et al.)

Martin's Physical Pharmacy And Pharmaceutical Science 6th edition, Sinco, Patrick J

Medicinal Plants And Traditional Medicine In Africa 3th edition, Sofowara, Abayomi

Microbiology And Immunology: An Encyclopedic Approach, Majumdar, M. K

Organic Chemistry, 2 ed. Jones and Bartlett Publishers, 1997. ISBN 0763701785 (by Fox, M.A & Whitesall, J.K).

Pharmaceutical Analysis 3th edition, Watson, David

Pharmaceutical Calculations, Ansel, Howard C

Pharmaceutical Codex: Principle And Practice Of Pharmaceutics, Lund, Walter

Pharmaceutics: the science of dosage form design (By U. Aulton, M.) Churchill Livingstone, 2001. ISBN 0443055173.

Pharmacology, 5 ed. Churchill Livingstone, 2003. ISBN 0443071454. (by U. Rang, H.P., Dale, M.M & Ritter, J.M.).

Pharmacy Practice. Taylor and Francis, 2001. ISBN 0415271592 (Tbyaylor, K.M.G & Harding, G.).

Pharmacy in Nigeria, Adenike, Fred

Physical chemistry for the chemical and biological sciences, 3 ed. University Science Books, 2000. ISBN 1891389068. (By Chang, R.).

Physiochemical principles of pharmacy, 3 ed. Macmillan, 1998. ISBN 0333690818 (by Florence, A.T. & Attwood, D.).

Physiology, 2nd Edition. W.B. Saunders Co., 2002. ISBN: 072- 169- 5493 (by Costazo, Linda,)

Physiology, 4th Edition, Mosby, 1998. ISBN: 081-510-9520.

Plant Products Pharmaceuticals, Prasad, Kant Shiv

Practical Manual of Forensic Medicine and Toxicology, Bhaisora, C.P.

Principles of Essential Drug Management, Adenika, Fred

Principles of Physiology, (Berne, R.M., & Levy, M.N.) 4 ed. Mosby, 2005 ISBN 0323008135.

Quantitative Analysis of Drugs 3rd edition, Garratt, DC

Short Textbook of Medical Microbiology (Including Parasitology), Gupte, Satish

Trease and Evans Pharmacognosy 16th edition, Evans, Williams C

Textbook of Pharmacognosy. 5th Edition, J&A Churchill Limited, London pp (by Wallis, T.E)

The Practical Evaluation of Phytopharmaceuticals. Wright Sciencetechnica. Bristol. Pp. 81-82. (By Brain K.R and Turner T.D 1975.).

Trease and Evans Pharmacognosy 16th edition by Evans, Williams C

Full list of recommended text books in the different professional areas are available in the Six Departments

Some Useful Learning Resources in the Internet

International Pharmaceutical Abstracts

<http://gateway.ovid.com/ovidweb.cgi?T=JS&MODE=ovid&PAGE=main&NEWS=n&DBC=y&D=ipad>

This Indexes pharmaceutical science and health related literature from 1970 Medline:

<http://www.ncbi.nlm.nih.gov/entrez/>. the premier biomedical database (via PubMed)

Full Text Database

Blackwell Scientific: <http://www.blackwell-synergy.com/>- full text of Blackwell Scientific journals via Synergy

Science Direct – <http://www.sciencedirect.com/science/journal> online access to 290 Elsevier, Harcourt and Academic Press journals

Wiley Interscience - <http://www3.interscience.wiley.com/index.html> full text of Wiley journals

Electronic journal

Free Medical Journals- <http://www.freemedicaljournals.com/> links to free online full-text journals, including pharmacy and pharmacology titles

Professional Organizations, Associations and Societies

WWW Virtual Library: Pharmacy Page of Associations – <http://pharmacy.org/association.html> most complete list available on the web

American Association of Pharmaceutical Scientist (AAPS)

<http://www.aapspharmaceutica.com/> appears online as AAPS Pharmaceutica with rich resource content.

American Pharmaceutical Association APhA – <http://www.aphanet.org/> promotes the appropriate use of medications, devices and services to achieve optimal therapeutic outcomes- another content-rich site with a massive list of pharmacy web links

National Australian Pharmacy Students' Association <http://www.napsa.org.au/>

Pharmacy-Related Academic Institutions on the Internet – <http://www.pharmweb.netpwmirror/pw8pharweb8.html>

World Wide

Listing of Pharmacy Schools from PharmWeb

<http://www.cf.ac.uk/phrmy/WWW-WSP/SoPListHomePage.html>

Jobs/Career Opportunities

Pharmacy related jobs

<http://www.cpb.uokhsc.edu/pharmacy/jobs.html> links to world-wide sites offering jobs in pharmacy

Pharmaceutical Companies

International Federation of Pharmaceutical Manufacturers Associations IFPMA – <http://www.ifpma.org/> represents the world-wide research-based pharmaceutical industry

Pharmaceutical Company list A-Z –

<http://www.pharmacy.org/comapny.html> another good compilation of links to company websites [part of the WWW Virtual Library-Pharmacy]

Other Useful Resources on the Internet

Martindale: the Virtual Pharmacy center-

<http://www.martindalecenter.com/Pharmacy.html> drug, pharmacy&pharmacology courses, resources and database: too huge to even start to describe, this is a site you must visit to get an inkling of the treasures it stores [Jim Martindale]Medacape for Pharmacist-

<http://www.medscape.com/Home/network/pharmacists/pharmacists.html>Peer-reviewed, practice-oriented information including a large library of drug information, resource links, education materials and full text journal articles and journal

Clinical Drug Investigation

World Health Organization (WHO) Essential Drugs and Medicines Policy (EDM) – <http://www.who.int/medicines/> information related to essential drugs, National Drugs Policies, traditional medicine and other health related matters with selected articles from recent issues of essential Drugs Monitor

News

Reuters Health- <http://www.reutershealth.com/> latest world-wide health news – also try

CNN Health News: <http://cnn.com/HEALTH/>

BBC health News: <http://www.bbc.co.uk/hi/english/health/>

ABC Health Matters: <http://abc.net.au/health/>

US Pharmacopeias – <http://www.usp.org/> the organization which establishes officially recognized standards for the use of medicines

WHO Guide to Good Prescribing: a Practical Manual- <http://www.who.int/medicines/library/par/ggprescribing/begin.html> covers the process of prescribing drugs, understanding standard treatment guidelines, suitability of drugs, writing prescription, basic pharmacology, essential references etc.

History of Pharmacy

The Apothecary Shoppe- <http://www.collectmedicalanques.com/apothecary.html>

Illustrates the spread of Pharmacy from the Middle East, plus snake oils and show globes

History of Pharmacy- <http://www.pharmacy.wsu.edu/History/Index.html> in 40 pictures taken from *Great Moments in Pharmacy*

Search Engines

Google- <http://www.google.com/> simple, fast with excellent result

I quick Meta search – <http://www.ixquick.com/> gets selected result from 12 search engines simultaneously

Searching the Internet – <http://www.library.jcu.edu.au/Resources/Internet/searchtools.shtml> check out some other good search engines (and how to use them)

Staff of the Faculty

Office of the Dean

S/ N	Name	Rank/Designation	Qualifications with dates
1	Prof. Abdulkadir U. Zezi	Prof/Dean	B. Pharm (1989), MSc(1999), PhD (2006)
2	Jamila M. Boy	Faculty Officer	B. A. English (2009)
3	Pononyamba I. Garba	Admin. Officer	B. A. English (2011)
4	Aishatu Adamu	Executive Officer	N.C.E (1992) (BSc in view)
5	Alhassan Hamza	Secretary	ND, Computer Science (2014)

Department of Pharmaceutics and Pharmaceutical Technology

S / N	Name	Rank/Designation	Qualifications with dates
Academic Staff			
1	Dr. Ifeanyi Victor Emenike	Senior Lect HOD	BSc. Pharm. (1979), M.Sc.(1987),Ph.D (2005). FPSN(2006)
2	Prof. Hassan Musa	Professor	B. Pharm.(1986), M.Sc.(1999), Ph.D(2002)
3	Prof Ignatius S. Okafor	Professor	B. Pharm.(1985), M.Sc.(1991), Ph.D(2005)
4	Dr. Elijah Irmiya Nep	Senior Lecturer	B. Pharm.(1993), M.Sc.(2005), Ph.D(2010)
5	Dr Stephen O. Majekodunmi	Senior Lecture	BSc(Chem)1983,B.Pharm(1990),PhD(2012)
6	James Akila Bwala	Assist. Lecturer	B. Pharm.(2009), M.Sc.(in view)
7	Zarumai Umar Faruq Gaza	Assist. Lecturer	B. Pharm.(2011), M.Sc.(in view)
8	Safiyanu Adamu Maikifi	Assist. Lecturer	B. Pharm.(2012), M.Sc.(in view)
Technical Staff			
1	Aaron Emmanuel Ewaoche	Chief Technologist	B.Sc. (2014),
2	Mamuda Bappah Ali	Asst. Lab. Tech.	ND (2011)
3	Usman Isah Ali	Lab Attendant	SSCE (2011)
Administrative Staff			
1	Nuhu Abdullahi Auwami	Secretary	ND(2011)

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Department of Pharmaceutical and Medicinal Chemistry

S/ N	Name	Rank/Designation	Qualifications with dates
Academic Staff			
1	Dr Muhammed Garba Tom	Senior Lecturer/ HOD	BSc. Pharm.(1980), M.Sc.(2009), Ph.D(2014)
2	Prof. Magaji Garba	Professor	BSc. Pharm.(1980), M.Sc.(1986), Ph.D(1992).
3	Prof. Ibrahim Adamu Yakasai	Professor	B. Pharm.(1986), M.Sc.(1994), Ph.D(2001)
4	Prof. Abdullahi Yunusa Idris	Professor	BSc. Chem.(1986), M.Sc.(1996), Ph.D(2008)
5	Prof. Ibrahim Iliya	Professor	BSc. Pharm(1986), M.Sc.(1998), Ph.D(2003)
6	Dr. Musa Abubakar Usman	Reader	BSc. Biochem(1992), M.Sc.(1998), Ph.D(2006)
7	Mrs Maria Managa Mailafiya	Lecturer II	B. Sc. Pure Chem(1992), M.Sc.(2015), Ph.D (in view)
Technical Staff			
1	Mamuda Alhaji Magaji	Chief Lab Technologist	HND (2007)
2	Umar Farouk	Princ. Lab. Technology	ND (1980)
3	Audu Mohammed Auwal	Science Lab. Technologist II	ND (2012)
4	Nasiru Hammayo	Assistant Lab. Technologist	ND (2012)
5	Muhammad A. Muhammad	Lab attendant	SSCE (2013)
Administrative Staff			
1	Muhammad Yahaya	Secretary	OND (2008)

Department of Pharmacognosy and Drug Development

S/ N	Name	Rank/Designation	Qualifications with dates
Academic Staff			
1	Prof. Kabir Musa Yusuf	Professor/HOD	BSc.Chem(1986), M.Sc.(1995), Ph.D, Pharmacognosy(2005)
2	Dr. Habib U. Danmalam	Reader	BSc.App.Chem(1996), MSc(Pharmacog), 2002, PhD (Pharmacog) 2011
3	Usman Mohammed Jajere	Lecturer II	BSc Botany (2008), M.Sc. Pharmacognosy (2014), Ph.D (in view)

4	Samagoro Tindak Cynthia	Lecturer II	BSc Botany(2005), M.Sc. Pharmacognosy(2011), PhD (in view)
5	Musa Tabitha Lubo	Lecturer II	B. Pharm.(2010), M.Sc.(2017)
6	Ibrahim Sabo	Assistant Lecturer	BSc Botany(2010), M.Sc.(2015), Pharmacognosy Ph.D (in view)
7	Vallada Atinga	Assistant Lecturer	B. Pharm(2012), M.Sc.((in view),
Technical Staff			
1	Iliya Lamido	Science Lab Technology I	ND(2008), HND(2012)
2	Usman A. Manzo	Science Lab. Technology II	ND (2011)
Administrative Staff			
1	Ibrahim Saleh	Computer operator/ Secretary	ND (2007)

Department of Pharmacology and Therapeutics

S/ N	Name	Rank/Designation	Qualifications with dates
Academic Staff			
1	Prof. O.A. Salawu	Professor/ HOD	BSc(1977,)B.Pharm(1989), M.Sc.(1984), Ph.D(1996)
2	Prof. Abdulkadir U. Zezi	Professor	B. Pharm.(1989), M.Sc.(1999), Ph.D(2006).
3	Dr. Abdullahi Hamza Yaro	Reader	BSc. Pharm(1993), M.Sc.(2006), Ph.D (2011)
4	Dr. Tola Anuhu Stephens Midala	Senior Lecturer	BSc. Pharm(1976), M.Sc.(1986), Ph.D(1993)
5	Dr. Wazis H. Chama	Senior Lecturer	BSc. Pharm.(1979), M.Sc.(1987), Ph.D(2015)
6	Dr. Timothy S. Yerima	Reader	B. Pharm.(1994), M.Sc.(2004), Ph.D(2011)
7	Dr Yau Jamilu	Senior Lecturer	B. Pharm(2003), M.Sc.(2008), Ph.D (2013)
8	Dr Garba U. Sadiq	Reader	B.Pharm(1991), MHPM(1997), MSC(2004), FPCPharm(2005),PhD(2011)
9	Dr Builders M. Iretiola	Senior Lecturer	B.Pharm(1992), MSc(2008), PhD(2013)
10	Dr. Oyepata Simeon Joseph	Lecturer I	B. Pharm(2007), M.Sc.(2012), Ph.D (2016)
11	Asma'u Isma'il Junaidu	Lecturer II	B. Pharm.(2007), MSc.(2013), PhD (in view)
12	Raph Elon Isaac	Lecturer II	B.Pharm (2009), MSc.(2015)

13	Sabastine Zubairu Aliyu	Lecturer II	B.Pharm (2009), MSc.(2016)
Technical Staff			
1	Ibrahim Adamu	Chief Technologist	C & G-I (1990), C & G-II (1991)
2	Umar S. Kalshingi	Technologist I	Cert (2000) ND (2003), HND (2005)
3	Yohanna Ibrahim Elisha	Assistant Lab. Technologist	Diploma
Administrative Staff			
1	Mazadu Muhammad Abubakar	Comp. Operator/ Secretary	Diploma

Department of Pharmaceutical Microbiology and Biotechnology

S/ N	Name	Rank/Designation	Qualifications with dates
Academic Staff			
1	Dr. AdeBola Aderemi Onanuga	Senior Lecturer/HODS	B. Pharm.(1992), M.Sc.(2006), Ph.D (2012)
2	Dr. James Chibueze Igwe	Lecturer I	BSc. Biotech(2008), M.Sc.(2013), Ph.D(2016)
3	Dr Peter Oladosu	Senior Lecturer	BSc(1989), MSc(1991), PhD(2012)
4	Prof. Yakubu Boy Ngwai	Professor	B. Pharm(1993), MSc(1999),PhD(2004)
5	Pharm Patrick O. Olorunfemi	Reader	BSc Pharm(1980), Msc(1985)
6	Ocholi Jonathan Adamu	Lecturer I	B. Pharm.(2005), M.Sc.(2011), Ph.D (in view)
7	Abdulwahab Aliyu	Asst. Lecturer	B.Pharm(2012), M.Sc. (in view)
Technical Staff			
1	Samuel O. Origbo	Chief Technologist	AIMLS(1987),FIMLS(1997), MSc(2003),MHPM(2004)
2	Ali Haruna	Lab Tech II	ND(2006), HND(2008), PGD(2004)
3	Ali Isah	Science Lab Technologist II	ND(2011), HND(in view)
4	Lukman Mohammed	Lab Assistant	SSCE (2006), OND(2010)
Administrative Staff			
1	Khaija Umar Yuguda	Computer Opt/ Secretary	NCE (2016)

Department of Clinical Pharmacy and Pharmacy Practice

S/ N	Name	Rank/Designation	Qualifications with dates
1	Dr. Tola Anuhu Stephens	Senior Lecturer HOD	B.Sc Pharm (1976) M.Sc(1986) Ph.D (1993)

	Midala		
2	Dr. Yakubu Sani Ibn	Reader	B.Sc Pharm(1976) M.Sc(1981) Ph.D(2009)
3	Dr. John Ohieku David	Reader	B.Pharm(1993), MSc(2004), Pharm D(2008), FPCPharm (2006), PhD (2013)
4	Dr. Maxwell Patrick Dapar	Senior Lecturer	B. Pharm(1995) M.Sc(2006) Ph.D (2012)
5	Mr Idris M Maje	Senior Lecturer	B.Pharm (2000), MSc(2009), PhD(2016)
6	Pharm(Mrs) Doris I Amlai	Lecturer I	BSc.(Pharmacy), 1978, MHPM(1992)
7	Abdurrahman Nasir	Asst Lecturer	B. Pharm(2011) M.Sc (In View)
Technical Staff			
1	Abubakar Sadiq	Science Lab. Tech II	ND(2012) HND(In View)
2	Abdulkarim Usman	Lab. Attendant	SSCE(2010)
Administrative Staff			
1	Sadiqa Shuaibu	Computer Operator/ Secretary	Computer Certificate(2014)

Staff of Cognate Courses

S / N	Name	Rank/Designation	Qualifications with dates
Directorate of General Studies			
1	Dr Sani Ahmed Yauta	Senior Lecturer / Director	NCE, B.Sc.(Ed), M.Ed., PhD
2	Dr. Rasheed Abdulganiy	Senior Lecturer	BA,2001, MA, 2005, PhD, 2011
3	Dr. Lazarus Mbaya	Senior Lecture	NCE, 1986,B.TECH,1995, MSc, 2004, PhD,2012
Department of Biological Sciences			
1	Dr. D. M Umar	Senior Lecturer	BSc., 1987, MSc., 1990, PhD. 2013
2	Dr. K. P. Yoriyo	Senior Lecturer	BSc., 1991, MSc., 1997, PhD. 2015
3	Dr. Halima Abba M.	Senior Lecturer	BSc., 1987, MSc., 1998, PhD. 2014
Department of Chemistry			
1	Dr. E. Karu	Senior Lecturer/HOD	BSc(1975) MSc(1980) PhD (1991)
2	Dr. Rejoice Atiko	Senior Lecturer	BTech(1996) MSc(2005)(2015)
3	Dr. W. L. Danbature	Senior Lecturer	BSc(1991)MSc(2002) PhD(2016)PGDE (2007)
Department of Mathematics			
1	Dr. Ahmadu Bappah Muhammad	Senior Lecturer/HOD	B. Ed,1981, MSc.,1986, PhD., 2013
2	Dr Muhammed Usman	Senior Lecturer	BSc.,1997, MSc.,2007, PhD., 2014
Department of Physics			
1	Dr. Hankouraou Seydou	Senior Lecturer/HOD	BSc., 1992, MSc., 1998, PhD. 2014

2	Dr. Abubakar D. Bajoga	Senior Lecturer	B.Sc. (Hon)1995; M.Sc.2005; PhD 2016.
Department of Anatomy			
1	Dr. Usman Bala	Lecture I /Ag. HOD	BSc., 2007, MSc., 2013, PhD, 2017
2	Dr. Sani H. Garba	Senior Lecturer	BSc.1998, MSc.,2004, PhD, 2012
3	Dr. Wilson O. Hamman	Senior Lecturer	BSc.1992, MSc.,2007, PhD, 2009
4	Mahmud B. Maina	Lecture II	BSc.2007, MSc.,2013
5	Onesimus Mahdi	Lecture II	BSc.2007, MSc.,2013
6	Tarfa M.Peter	Lecture II	BSc.2006, MSc.,2013
7	Yunusa M. Garba	Lecture II	BSc.2007MSc.,2013
8	Miss Khadijat A.Bobbo	Assistant Lecturer	BSc.2007, MSc.,2013
9	Zubair S. Rayyanu	Assistant Lecturer	BSc.2006, MSc.,2014
10	Sulaiman K. Hamidu	Assistant Lecturer	BSc.2011, MSc.,2017
Department of Medical Biochemistry			
1	Dr. Fatima U. Maigari	Senior Lecturer/ HOD	BSc.2004, MSc.,2009, PhD, 2014
2	Dr. Yusuf Yunusa	Senior Lecturer	BSc.2000, MSc.,2006, PhD, 2014
3	Dr. Abdullahi Imam	Senior Lecturer	BSc.2004, MSc.,2009, PhD, 2014
4	Dr(Mrs) M. Nadro	Reader	BSc.1988, MSc.,1992, PhD, 2011
5	Prof H. Hamza	Professor	BSc.1985, MSc.,1999, PhD, 2015
6	Prof. Abubakar Gidado	Professor	BSc.1991, MSc.,1998, PhD, 2008
7	Prof. Modu Sheriff	Professor	BSc.1986, MSc.,1995, PhD, 2003
8	Prof I. H. Garba	Professor	BSc.1992, MSc.,1998, PhD, 2006
Department of Human Physiology			
1	Dr. Ibrahim Lai	Lecturer 1 /HOD	BSc.1995, MSc.,2008, PGDE, 2011,PhD, 2015
2	Prof Aliyu Muhammad	Professor	MBBS, 1989, MSc, 2005, PhD, 2009
3	Dr. Yakubu Sadau	Senior Lecturer	BSc.1997, MSc.,2008 ,PhD, 2015
4	Dr. Abdulsalam I. Aliyu	Lecturer I	MBBS 2010, MSc.,2015
5	Dr. Kabilis D. Elkanah	Lecturer II	MBBS 2008, MSc.,2012, PGDE,2015
6	Mal Mustapha Muhammad	Lecturer II	BSc.2009, MSc.,2013(PhD in view)

Summary of Credit Units per level

100 Level First Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status
BIOL 101	General Biology I	45	-	3	Cognate
BIOL 107	Practical Biology I	-	45	1	Cognate
CHEM 101	General Chemistry I	45	-	3	Cognate
CHEM 103	General Chemistry lab. I	-	45	1	Cognate
PHYS 101	Mechanics, Properties of	45	-	3	Cognate

	Matter, Thermal Physics and Waves				
PHYS 107	General Physics Lab. I	-	45	1	Cognate
MATH 101	General Mathematics I	45	-	3	Cognate
GENS 101	Communication in English	30	-	2	Cognate
GENS 103	Communication in French/Arabic	30	-	2	Cognate
COSC 101	Introduction to Computer Science	30	-	2	Cognate
Total CU		18	3	21	

BIOL= 4, CHEM=4, PHYS=4, MATH=3, GENS = 4, COSC=2.

100 Level Second Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status
BIOL 102	General Biology II	45	-	3	Cognate
BIOL 108	Practical Biology II	-	45	1	Cognate
CHEM 102	General Chemistry II	45	-	3	Cognate
CHEM 104	General Chemistry II practical	-	45	1	Cognate
PHYS 102	Electricity, Magnetism and Modern Physics	45	-	3	Cognate
PHYS 108	Physics Lab. II	-	45	1	Cognate
MATH 102	General Mathematics II	45	-	3	Cognate
GENS 102	Communication in English II	30	-	2	Cognate
GENS 104	Use of Library, Study Skills and Information communication Technology	30	-	2	Cognate
GENS 106	Logic, Philosophy and Human Existence	30	-	2	Cognate
Total CU		18	3	21	

BIOL=4, CHEM=4, PHYS=4, MATH= 3, GENS=6

200 Level First Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status	Prerequisite
PCG 201	Introduction to Pharmacognosy	15	-	1	Core	BIOL101, BIOL102
		-	45	1		

PCH 201	Pharmaceutical Inorganic chemistry 1	15	- 45	1 1	Core	
PCH 203	Introductory Pharmaceutical Organic Chemistry 1	30		2	Core	CHEM 102
PMB 201	Fundamentals of Pharmaceutical Microbiology	30	-	2	Core	BIOL 101
PCP 201	Introductory Pharmacy	15	-	1	Core	
PCT 201	General Dispensing and Pharmaceutical Calculation	30	-	2	Core	MATH 101
BCH 211	Medical Biochemistry I	30	45	2 1	Cognate	
ANA 207	Anatomy and Histology I	30	45	2 1	Cognate	
HPY 209	Physiology I	30		2	Cognate	
GENS 201	Entrepreneurship Studies	30	-	2	Cognate	
GENS 203	History and Philosophy of Science	30	-	2	Cognate	
Total CU		19	4	23		

PCG= 2, PCH=4, PMB = 2, PCP=1, PCT=2, BCH =3, ANA= 3, HPY=2, GENS=4

200 Level Second Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status	Prerequisite
PCG 202	Organized and Unorganized Vegetable Drugs	30	45	2 1	Core	BIOL 101, BIOL 102
PCH 202	Pharmaceutical Analytical Inorganic Chemistry	30	- 45	2 1	Core	CHEM 121
PCT 202	Technology of Formulation	30	-	2	Core	
PMB 202	Pharmaceutical Microbiology Practical I	-	45	1	Core	PMB 201
ANA 212	Anatomy and Histology II	30	45	2 1	Cognate	
HPY 212	Systemic Physiology II	30	45	2 1	Cognate	
BCH 212	Medical Biochemistry II	30	45	2 1	Cognate	
GENS 202	Peace Studies and Conflict Resolution	30	-	2	Cognate	

GENS 204	Nigerians People, Culture and Community Service	30	-	2	Cognate	
Total CU		16	6	22		

PCG=3, PCH=3, PCT=2, PMB=1, ANA=3, HPY=3, BCH=3, GENS= 4

300 Level First Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status	Prerequisite
PCG 301	Extraction Processes and Separation Techniques	15	45	1 1	Core	PCG 202
PCH 301	Pharmaceutical analysis I	15	-- 45	1 1	Core	
PCH 303	Introduction to pharmaceutical organic chemistry II	15	-	1	Core	PCH 203
PCL 301	General Pharmacology	15 -	- 45	1 1	Core	HPY, BCM
PCL 303	Autonomic Pharmacology	30 -	- 45	2 1	Core	HPY, BCM
PCP 301	Introduction to Clinical Pharmacy & Pharmaceutical Care	30	-	2	Core	
PCP 303	Principle of Pharmaco-economics	30	-	2	Core	
PCT 301	Physical Pharmaceutics I	45	-	3	Core	
PCT 303	Dispensing Practical I		45	1	Core	PCT 201
PMB 301	Sterilization and Chemical Disinfection	45		3	Core	PMB 201
GENS 301	Introduction to Entrepreneurship Scheme	30	-	2	Cognate	
Total CU				23		

PCG=2, PCH=3, PCL=5, PCP=4, PCT= 4, PMB 301=3, GENS=2

300 Level Second Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status	Prerequisite
PCG 302	Phytochemical Methods in Drug Analysis	30	45	2 1	Core	PCG 201 and PCG 202

PCH 302	Pharmaceutical organic chemistry	30	- 45	2 1	Core	PCH 203
PCL 302	Systemic Pharmacology I	30	-	2	Core	PCL303
PCL 304	Systemic Pharmacology II	15	- 45	1 1	Core	PCL 301, PCL303
PCP 302	Principles of Disease and Pathology	30	-	2	Core	
PCP 304	Introduction to Public Health Pharmacy	15	-	1	Core	
PCP 306	Externship practical training I		90	2	Core	
PCT 302	Physical pharmaceutics II	30	45	2 1	Core	
PCT 304	Dispensing practical II		45	1	Core	PCT 303
PHJ 302	SIWES		135	3	Core	
PMB302	Pharmaceutical Microbiology Practical II		45	1	Core	PMB 202
Total CU				23		

PCG=3, PCH =3, PCL=4, PCP=5, PCT=4, PMB=1, PHJ=3

400 Level First Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status	Prerequisite
PCG 401	Evaluation of Crude Drugs	15	45	1 1	Core	PCG 302
PCH 401	Pharmaceutical analysis II	30	-	2	Core	PCH 301
PCH 403	Pharmaceutical analysis III (Analytical Quality Control)	15	45	1 1	Core	
PCL 401	Central Nervous System Pharmacology	30	-	2	Core	PCL 303
PCL 403	Anaesthetics and Non-narcotic Analgesics	15 -	- 45	1 1	Core	PCL 301
PCP 401	Pharmacotherapeutics I	30	-	2	Core	PCP 201
PCP 403	Clinical Pharmacokinetics	30	-	2	Core	
PCP 405	Pharmacy Jurisprudence	30	-	2	Core	PCP 201
PCT 401	Solid dosage Technology I	45	-	3	Core	PCT 202
PCT 403	Biopharmaceutics	30	-	2	Core	

PMB 401	Sterile Pharmaceutical products formulation	30	-	2	Core	PMB 301
Total CU				23		

PCG=2, PCH=4, PCL=4, PCP=6, PCT=5, PMB=2.

400 Level Second Semester

Course Code	Course Title	Lecture (hrs)	Laboratory (hrs)	Credit Unit	Status	Prerequisite
PCG 402	Plant Tissue Culture, Genetics and Chemotaxonomy	15	45	1	Core	PCG 202
PCH 402	Introduction to medicinal chemistry	15	-	1	Core	
PCL 402	Endocrine Pharmacology	30	-	2	Core	HPY 201, 202
PCL 404	Haemostasis and Haemopoietic Pharmacology	15	45	1	Core	HPY 201, 202
PCP 402	Pharmacotherapeutics II	30	-	2	Core	
PCP 404	Pharmacy Management/ Entrepreneurship Studies	30	-	2	Core	
PCP 406	Externship Practical Training II		90	2	Core	PCP 306
PCT 402	Solid Dosage Technology II	45	-	3	Core	PCT 202
PCT 404	Practical solid dosage Technology/Industrial Pharmacy		90	2	Core	PCT 202
PMB 402	Pharmaceutical Microbiology III		45	1	Core	PMB 302, PMB 401
PMB 404	Infection, Immunology and Immunological Products	30		2	Core	PMB 201, PMB 202
PMB 406	Pharmaceutical Biotechnology	30		2	Core	BCH211, PMB 201
Total CU				23		

PCG =2, PCH=1, PCL=4, PCP= 6, PCT=5, PMB=5

500 Level First Semester

Course Code	Course Title	Lecture (hrs)	Laboratory / Clinical (hrs)	Credit Unit	Status	Prerequisite
PCG 501	Traditional and Complimentary/Alternative Medicine	15	45	1 1	Core	PCG 401and 402
PCH 501	Medicinal chemistry	30	-	2	Core	PCH 402
PCL 501	Toxicology	30 -	- 45	2 1	Core	PCL 401
PCL503	Chemotherapy of Microbial/Neoplastic Diseases	30	-	2	Core	PCL 401
PCP 501	Pharmacotherapeutics III	30	-	2	Core	
PCP 503	Biostatistics and Research Methodologies	30		2	Core	
PCT 501	Dosage form evaluation and drug stability	30		2	Core	PCT 202
PCT 503	Ethical Dispensing		90	2	Core	PCT 304
PMB 501	Microbial chemotherapy, bacterial genetics and Drug Resistance	30	-	2	Core	PMB 404
PMB 503	Pharmaceutical Microbiology Practical IV		45	1	Core	
Total CU				20		

PCG=2, PCH=2, PCL=5, PCP=4, PCT= 4, PMB=3

500 Level Second Semester

Course Code	Course Title	Lecture (hrs)	Laboratory / Clinical (hrs)	Credit Unit	Status	Prerequisite
PCG 502	Drug development from plants	15	45	1 1	Core	PCG 401and PCG 402
PCH 502	Physico chemical principles of medicinal chemistry	30		2	Core	
PCH 504	Chemical aspect of drug metabolism	15		1	Core	
PCL 502	Chemotherapy of Parasitic Diseases	30	- 45	2 1	Core	PCL 401
PCP 502	Clinical Ward Round and Clerkship	60	-	4	Core	
PCP 504	Literature Evaluations	30	-	2	Core	

	Communication Skills & Drug Info. Service					
PCT 502	Drug delivery design and pharmaceutical biotechnology	30	-	2	Core	
PMB 502	Fermentation Technology, Principle of Microbial Spoilage and Preservation against Biodegradation	30	-	2	Core	PMB 404
PHM 502	Project in Pharmaceutical and Medicinal Chemistry	-	180	4	Core	
PHM 502	Project in Pharmaceutical Microbiology and					
PHM 502	Biotechnology					
PHM 502	Project in Clinical Pharmacy and Pharmacy Practice					
PHM 502	Project in Pharmaceutics Pharmaceutical Technology					
PHM 502	Project in Pharmacognosy and Drug Development					
PHM 502	Project in Pharmacology and Therapeutics					
Total CU				22		

PCG=2, PCH=3, PCL=3, PCP=6, PCT=2, PMB= 2, PHM= 4

