NATIONAL COUNCIL FOR HIGHER EDUCATION

MINIMUM STANDARDS FOR THE BACHELOR OF PHARMACY AND PHARMACEUTICAL SCIENCE EDUCATION IN UGANDA

National Council for Higher Education

Plot M834, Kigobe Road, Kyambogo,

P.O. Box 76 Kyambogo

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Preamble

In this document, the Benchmarks and Minimum Standards for the education and training of students studying for the Bachelor of Pharmacy Degree Programme in Ugandan Universities are prescribed. Institutions are expected to use these standards as the minimum guidelines in the innovative design, delivery and management of their own specific programmes. It is expected that the minimum standards as described here will enable higher education institutions channel out graduates who have sufficient theoretical and practical knowledge, skills and altitudes

The overall objective of these benchmark standards is to provide minimum operating standards expected of the institutions that offer training programmes, in terms of governance, staffing, infrastructure, financial and human resources, together with competency standards in terms of the curriculum content and expected learning outcomes from the training programmes themselves.

Specific objectives are:

1. To set the National Council For Higher Education (NCHE) standard for approval of new a programmess and accreditation of existing pharmacy programmess in Uganda, as required under Section 5(d)(ii) of The Universities and Other Tertiary Institutions (Amendment) Act 2006.
2. To assist institutions in preparation of program documents and information as would be required for assessment of compliance, accreditation and re-accreditation of programmes by the National Council for Higher Education.
3. Act as as a reference guide for potential schools of pharmacy in setting up of management and infrastructure, as well as developing human resources and curriculum as necessary for recognition of any training programme in phamacy.
4. To assist training institutions in self-evaluation and maintaining of the standards
5. As a clear, unambiguous reference and guideline document for other prospective users (staff, students, policy makers, etc).

STRUCTURE

This document is structured in a manner that identifies the **benchmark standard** and then highlights some **guidelines** for achievement of the standard. The minimum operating standards are geared towards the assessment of governance and management, expected financial and human resources, physical infrastructure, teaching resources, research and innovations, as necessary for the training programme

STANDARD 1: GOVERNANCE AND MANAGEMENT

1.1 Background Information

Benchmark Standard

a. *There shall be an introductory statement about the Pharmacy School/Department and how it fits into the structure of the mother institution.*
b. *There shall be a justification for setting up the Pharmacy School/Department*

Guideline

The justification should be evidence based and involves a needs assessment/situation analysis/survey.

1.2. Vision, Mission, Philosophy/Core Values

Benchmark Standard

a. *The Pharmacy School/Department shall have Vision & Mission statements, Philosophy and objectives, which clearly and succinctly indicate its strategic direction.*
b. *The Pharmacy School/Department shall have an approved Strategic Plan.*

Guidelines

a. *The Vision statement shall clearly outline what the school/department desires to be*
b. *The vision statement shall be relevant to the training of pharmacist in line with the values of*

the mother institution.

c. *The vision statement shall be in tandem with the vision of the mother Institution.*
d. *The Mission statement shall incorporate elements of the Pharmacy School/Department business purpose and values, succinctly describing why it exists and what it does to achieve its vision.*
e. *The mission statement should address quality of Pharmacy education and training with respect to acquisition of professional competence.*
f. *Statements of Vision and Mission should be displayed at all strategic places in the Pharmacy School/Department and should appear in key documents of the School/Department.*
g. *The Philosophy of the Pharmacy School/Department shall be clearly stated.*
h. *The values guiding the Pharmacy School/Department towards achieving its goals shall be clearly stated. The values should be consistent with the philosophy of the mother institution*
i. *The Pharmacy School/Department shall have a strategic plan that inter alia outlines its overall development including, but not limited to academic programmes, physical facilities, student enrolment, staff and staff development, ICT Research and Community Service.*
j. *The strategic plan shall have been approved by the relevant organs of the higher education institution.*

1.3 School/Department Administration and Organization

Benchmark Standard

a. *There shall be a clearly articulated management and organizational structure for the Pharmacy School/Department.*
b. *The structure shall be filled with qualified and competent academic and administrative staff.*

Guidelines

a. *The Pharmacy School/Department shall have clear organizational and administrative structures charts showing the inter- relationships of the various units.*
b. *The management structure shall ensure that pharmacy expertise is central to decision-making relating to the design, content and delivery of degree programmes, for managing resources and for appointment of staff and supporting professional activity of Pharmacy School/Department.*
c. *There shall be documented policies that include but not limited to admissions policy, research policy, ICT policy, curriculum development policy, examinations policy, a policy on student conduct, among others.*
d. *The Management Team shall comprise of a dean of the Pharmacy School/Department who shall fulfill the following requirements.*

- *Shall fulfill all the requirements of a senior lecturer or above as indicated in Table 1.*
- *Have a minimum of five (5) years teaching experience in a Pharmacy School/Department*
- *Shall be registered with the Pharmaceutical Society of Uganda(PSU)*

1.4 Core Units in the Pharmacy School/Department

Benchmark Standard

Every Pharmacy School/Depart shall have the following core units

1. Pharmaceutics and Pharmaceutical Technology
2. Pharmacognosy and Alternative Systems of Medicine
3. Pharmaceutical Microbiology
4. Clinical Pharmacy and Pharmacy Practice
5. Pharmaceutical Chemistry
6. Pharmacology

NB: Veterinary Pharmacy shall be housed where Pharmacy Practice is i.e included under the department of Clinical Pharmacy and Pharmacy Practice.

STANDARD 2: Financial Resources and Management

Benchmark Standard

a. The Pharmacy School/Department shall have adequate financial resources to meet its obligations.
b. The Pharmacy School/Department shall show evidence of long and medium term plans to ensure sustainability and continuous improvement.

Guidelines

a. *The Pharmacy School/Department shall demonstrate evidence of financial resources to support her programmes.*
b. *The Pharmacy School/Department shall demonstrate evidence of financial management systems with clear policies and procedures.*
c. *The Pharmacy School/Department shall have mechanisms for generation of financial resources from external sources in order to support the Pharmacy School/Department and carry out research.*

STANDARD 3: Human Resources

The Pharmacy School/Department shall have adequate, qualified and competent academic staff to ensure the effective delivery of all study programmes. Staff should be drawn from the various disciplines in order to cover all the courses in the curriculum. Where the relevant courses already exist in the mother institution, the students should benefit from lectures with their counterparts in that discipline.

Staff in Pharmacy School/Department should also

- Be involved in research work as evidenced by participation in national and international conferences and publishing in refereed journals.
- Be appraised on their involvement in community service.
- Be involved with industry through consulting and ongoing industry-led research,
- Have pedagogical skills for teaching Pharmaceutical programmes and not just the skill of a Pharmacist.

In addition, the Pharmacy School/Department should have adequate number of administrative, technical and laboratory staff to ensure that there is a satisfactory level of technical support in Pharmaceutical laboratories. The Pharmacy School/Department should recruit very competent senior technical staff to maintain teaching and research equipment.

Benchmark Standard

a. *The Pharmacy School/Department shall have adequate and competent academic staff to carry out effective delivery of the programmes.*

b. *Academic staff in any Pharmacy School/Department shall be appraised on teaching, research and their involvement in community service.*
c. *There shall also be sufficient, qualified and experienced technical and administrative staff to provide adequate support to the educational programmes.*
d. *The minimum academic qualifications of any academic staff for an undergraduate degree in any Pharmacy School/Department shall be a relevant Masters degree. The qualifications and other criteria necessary for appointment and/ or promotion of academic staff at the various levels of the career structure are set out in the table below.*

Table 1: Minimum Criteria for Appointment/Promotion of Academic Staff in Health Related Disciplines

S/N	*Academic Rank*	*Minimum Academic and Professional Requirements for Appointment/Promotion*
1.	**Teaching Assistant**	• This rank is to facilitate identification of outstanding holders of first degrees for academic positions in the Pharmacy School/Department • Teaching Assistants shall hold a relevant degree or its equivalent with a CGPA of at least 3.0 • Teaching Assistant shall assist seniors staff in academic work
2.	***Assistant Lecturer***	Shall • Have a Bachelor's degree or equivalent qualification in a relevant Pharmaceutical science discipline and a Masters degree or equivalent qualification in a relevant Pharmaceutical science discipline; all from a recognized/accredited institution. • Have evidence of certified pedagogical skills training at a university level. Where such skills are lacking, the university or concerned person should make mechanisms to acquire such skills within the shortest time possible. • Have a good record of community and academic service as per the institutional standards and guidelines.

- Be registered with the Pharmaceutical Society of Uganda(PSU) or any other relevant professional body where applicable.

3. Lecturer Shall

- Have a Bachelor's degree or equivalent qualification in a relevant Pharmaceutical science discipline and a Masters degree or equivalent qualification in a relevant Pharmaceutical science discipline; all from a recognized/accredited institution.
- Have at least three years post Masters experience in teaching or practice.
- Have at least three (3) peer-reviewed publications in journals of pharmaceutical significance.
- Have evidence of certified pedagogical skills training at a university level.
- a good record of community and academic service in accordance with the institutional standards.
- be registered with the Pharmaceutical Society of Uganda(PSU) or any other relevant professional body where applicable.

4. ***Senior Lecturer*** Shall

- Have a Bachelor's degree or equivalent qualification in a relevant Pharmaceutical science discipline and a Masters degree or equivalent qualification in a relevant Pharmaceutical science discipline; all from a recognized/accredited institution.
- Demonstrate evidence of certified pedagogical skills training at a university level.
- Have at least three years post-masters experience in teaching at a university level or practice.
- Supervised at least four (4) postgraduate students to completion.
- Have at least six (6) post Masters peer-reviewed publications in journals, conferences of Pharmaceutical significance.
- Have a good record of community and academic service in accordance with institutional standards.
- Be registered with the Pharmaceutical Society of Uganda(PSU) or any other relevant professional body where applicable.

Note:

- One published book of Pharmaceutical significance shall be rated as equivalent to three refereed journal articles.
- Three chapters in a published book of Pharmaceutical significance shall be rated as equivalent to one refereed journal article.
- One patent shall be rated as equivalent to two peer reviewed journal publications.
- One scholarly grant worth 100, 000 USD shall be rated as equivalent to two-refereed journal articles. (The project shall be accompanied by a project report).
- Two conference-reviewed papers shall be rated as equivalent to one peer reviewed article in a journal.

5. ***Associate Professor*** Shall

- Have a Bachelor's degree or equivalent qualification in a relevant Pharmaceutical science discipline and a Masters degree or equivalent qualification in relevant Pharmaceutical science discipline; all from a recognized/accredited institution.
- Demonstrate evidence of certified pedagogical skills training at a university level.
- Have at least five years post-masters experience in teaching at university level or practice.
- Supervised at least six postgraduate students to completion, four of which within the previous five years as the main supervisor.
- At least six (6) post senior lecturer peer-reviewed publications in journals, conferences of Pharmaceutical e significance within the last five years, three (3) of which must be the principal author.
- a good record of community and academic service.
- be registered with the Pharmaceutical Society of Uganda(PSU) or any other relevant professional body where applicable.
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Note:

- One published book of Pharmaceutical significance shall be rated as equivalent to three refereed journal articles.
- Three chapters in a published book of Pharmaceutical significance shall be rated as equivalent to one refereed journal article.
- One patent shall be rated as equivalent to two peer reviewed journal publications.
- One scholarly grant worth 200,000 USD within the last ten years shall be rated as equivalent to two-refereed journal articles. (The project shall be accompanied by a project report).
- Two conference-reviewed papers shall be rated as equivalent to one peer reviewed article in a journal.

6. ***Professor*** Shall

- Have a Bachelor's degree or equivalent qualification in a relevant Pharmaceutical science discipline and a Masters degree or equivalent qualification in relevant Pharmaceutical science discipline; all from a recognized/accredited institution.
- Demonstrate evidence of certified pedagogical skills training at a university level
- Have at least ten years post-masters experience in teaching or practice.
- Have supervised at least eight postgraduate students to completion within the last five years, four of which as the main supervisor.
- Have at least eight (8) post Assoc. Professor peer-reviewed publications in journals, conferences of Pharmaceutical significance within the last five years, three (3) of which must be the principal author.
- a good record of community and academic service.
- be registered with the Pharmacutical Society of Uganda(PSU) or any other relevant professional body where applicable.

Note:

- One published book of Pharmaceutical significance shall be rated as equivalent to three refereed journal articles.
- Two chapters in a published book of Pharmaceutical significance shall be rated as equivalent to one refereed journal article.
- One patent shall be rated as equivalent to two peer reviewed journal publications.
- One scholarly grant worth 200,000 USD within the last ten years shall be rated as equivalent to two-refereed journal articles. (The project shall be accompanied by a project report).
- Two conference-reviewed papers shall be rated as equivalent to one

peer reviewed article in a journal.

Guidelines

a. *The academic staff devoted to the programme is sufficient to cover, in terms of experience and interest, all relevant subjects.*
b. *The following Full time Academic Staff: Student Ratios shall apply*
    - *Ideal Practice 1:7*
    - *Good Practice: 1:10*
    - *Acceptable: 1:12*
c. *Majority of academic staff shall be permanent (The ideal percentage is 70%).*
d. *The workload for academic staff shall include teaching; preparation of examination papers; marking of examination scripts; tutorials; preparation of teaching; supervision of academic work; community engagement, administrative work; and research/research assignments. The teaching load per week staff shall be as follows:*
    - *Ideal Practice 8 hours*
    - *Good Practice: 10 hours*
    - *Acceptable: 15 hours*
e. *The Pharmacy School/Department shall have adequate number of technicians to manage all Pharmaceutical science labs. It is recommended that each technical staff be in charge of one laboratory. All technicians shall have requisite qualification in their areas of operation.*
f. *The Pharmacy School/Department shall have adequate administrative staff to support the education functions. All administrative staff shall have requisite qualification in their areas of operation.*
g. *The Pharmacy School/Department shall have Academic Staff Review Committee composed of senior members of the academic staff. The Academic Staff Review Committee shall be charged with reviewing the performance of staff members in accordance with the institutional rules and regulations.*

STANDARD 4: PHYSICAL INFRASTRUCTURE

Pharmacy School/Department shall have appropriate physical teaching facilities for the number of staff, students and programme. These shall include

a. Administrative offices
b. Staff offices
c. Lecture rooms and tutorial rooms
d. Appropriately equipped Technical and Skills Laboratories
e. Library
f. Information technology services
g. Teaching hospital
h. Recreation and cafeteria
i. Halls of residence especially for students.

4.1 State and Safety of Buildings

Benchmark standard

a. *Every building used or intended to be used as part of the Pharmacy School/Department physical facility shall comply with the requirements of the Building Code of the Republic of Uganda and provisions of the Public Health and Safety, NEMA and any other statutory requirements.*
b. *Every university shall operate in facilities and structures that are safe for the public as provided for in the Building Code of the Republic of Uganda.*

Guidelines

- *All Pharmacy School/Department premises shall meet minimum requirements for health and safety of the public as prescribed by the relevant Laws and by-laws.*
- *Any building designed and constructed for use as university building or any building altered or extended so as to be used as a university building or any building which has undergone material change of use into university building must be approved by the relevant authorities.*
- *All buildings and other physical facilities used by the Pharmacy School/Department shall have:*

a. *Approved architectural and structural drawings of the complete and proposed buildings;*
b. *Approval for alterations or extensions, if any;*
c. *Certificate of occupation for the newly constructed or altered buildings;*
d. *Impact Assessment certificate by National Environment Management Authority;*
e. *Any other statutory approval as may be required.*

- *All buildings and other physical facilities used by the Pharmacy School/Department for teaching and learning shall be serviceable and functional;*
- *The buildings shall be kept in a good state of repair and maintenance;*
- *The buildings shall be free from structural failures, excessive deflection, cracking or dilapidation of building material fabric and components.*
- *All buildings shall be secure for users from such hazards as falling, slipping, tripping; and*
- *All buildings shall have in place mechanisms to minimize or avoid security risks associated with users.*
- *Health and safety policies and practices in practical teaching spaces shall satisfy legal requirements.*

4.2 Provisions for Persons with Physical Disabilities

Benchmark standard

a. *All buildings used for teaching and learning shall have adequate provisions to cater for the physically challenged.*

Guidelines

a. *A ramp, a lift or other means shall be provided to enable access to the facilities by the physically challenged; and*
b. *Modified toilets shall be provided for the physically challenged and shall be gender-sensitive.*
    a. *Good: One WC for 10 persons.*
    b. *Ideal Practice: One WC for 5 persons.*

4.3 Fire Safety

Benchmark standard

a. *All buildings and other physical facilities used by teaching and learning shall provide for adequate fire safety.*

Guidelines

a. *All buildings and other physical facilities shall conform to the requirements of the Building Code of the Republic of Uganda, the Public Health Act and other standard practices with*

regard to fire resistance, means of fire escape, access for fire escape and fire- fighting equipment

b. *All buildings used for teaching and learning shall be provided with adequate, reasonable and easily accessible means of escape in the event of fire;*
c. *All means of fire escape shall be properly maintained and kept free from any obstruction;*
d. *Doors for lecture rooms, lecture theatres and other large rooms for public use shall open outwards;*
e. *Large lecture rooms, lecture theatre/halls shall have two doors;*
f. *Adequate and appropriately placed fire-fighting equipment such as hose reels, portable fire extinguishers, fire buckets, dry risers, fire hydrants, sprinkles, and water storage tanks shall be provided in every building.*

4.4 Public Health

Benchmark Standard

a. *The Pharmacy School/Department shall provide and maintain clean, adequate and suitable sanitary facilities for students and staff.*

Guidelines

a. *Where students or other persons of both genders are accommodated or are expected to be accommodated the conveniences shall afford proper separate facilities for persons of each gender.*
b. *Places of convenience shall provide for the following:*

Washrooms-Males

c. *Good: One WC for 20 males*
d. *Ideal Practice: One WC for 10 Males*

Urinals-Males

e. *Good: One WC for 30 males*
f. *Ideal Practice: One WC for 25 Males*

Washrooms-females

g. *Good: One WC for 16 females*

Ideal Practice: One WC for 8 females.

Sanitary Disposal Facility-females: *One in every WC.*

Hand wash Basin

h. Good: One for 20 persons.

i. Ideal: One for 10 persons.

4.5 Lecture Rooms

Benchmark Standard

- *The Pharmacy School/Department shall have appropriate physical teaching facilities for the number of staff, students and programme, as stipulated by the NCHE*
- *All lecture rooms should be spacious with adequate illumination, ventilation, and wired for Internet connections, audio-visual presentations.*

Guidelines

a. A minimum of two lecture rooms is required for each intake.

b. There shall be at least two small discussion rooms (with a capacity of 15 to 20 students) for each year of the curriculum.

c. *The following ratios shall apply for lecture room space.*

- *Acceptable: 1.0 sqm per student*
- *Good: 2.0 sqm per student*
- *Ideal Practice 2.5 sqm per student.*

d. *Every lecture room shall have audiovisual facilities.*

e. *Every lecture room shall have appropriate and adequate chairs and tables*

f. *Every lecture room shall have Adequate lighting and ventilation*

4.6 Staff Offices

Benchmark Standard

1. *The Pharmacy School/Department shall provide adequate office space to accommodate academic and non-academic staff.*
2. *Staff offices shall be located within the school and shall be accessible to all stakeholders*

Guidelines

a. *The following requirements shall apply for office space.*

- *Acceptable: 2.0 sqm per person*
- *Good: 3.0 sqm per person*

- *Ideal Practice: 4.0 sqm per person*

- *The Pharmacy School/Department offices shall comprise of the following minimum number of offices;*
    - *One office for of at least 24 sqm for dean.*
    - *One office of at least 15 sqm for the dean's secretary/administrator.*
    - *One office for of at least 18 sqm for every head of department.*
    - *Staff Common room for staff.*
    - *Shared offices; at least 9 sgm per staff. Not more than four (4) members of academic staff shall share an office.*

4.7 Resources

A Pharmacy School/Department should have at least 5,000 volumes of Pharmaceutical books, and at least 50 current journals covering the various specialties and including local Pharmaceutical publications. Provision should also be made for photocopying services for the students and for inter- library book loan.

Benchmark Standard

The Pharmacy School/Department shall have adequate library resources to cater for the interest of all the course units in the programmes.

Guidelines

- *A Pharmacy School/Department should have with at least 5,000 volumes of Pharmaceutical books, and at least 50 current journals covering the various specialties*
- *The Library shall have adequate e-resources to support the programme.*
- *The library shall have adequate Information and Communication Technology infrastructure to support e-resources.*
- *The library should also have photocopying services for the students and for inter- library book loan*
- *The following requirements shall apply for library space.*
    - *Acceptable: 1.0 sqm per student*

- *Good: 2.0 sqm per student*
- *Ideal Practice: 2.5 sqm per student.*

4.7 Information and Communications Technology (ICT)

A basic knowledge of the principles of ICT shall be required. Students should be taught to use computers for the quantitative analysis, simulation, solution and communication of Pharmaceutical.

Benchmark Standard

The Pharmacy School/Department shall ensure availability and adequacy of technical, and ICT infrastructure and appropriate technical support staff for the infrastructure.

Guidelines:

i) The Pharmacy School/Department shall have an ICT policy.

ii) The Pharmacy School/Department shall provide access to regular and fast Internet to students and staff.

STANDARD 5: STUDENT AFFAIRS

Benchmark standards

1. *The Pharmacy School/Department should have facilities to cater for the welfare of students.*
2. *All Pharmaceutical students shall be accommodated in decent and secure hostels.*
3. *There shall be hostel accommodation in the hospital or in close proximity to hospital for clinical students.*
4. *The Pharmacy School/Department shall make provision for the following:*

1. *Needy and disadvantaged students*
2. *Students with disabilities*
3. *Students with Pharmaceutical/ social challenges*

Guidelines:

i. There shall be a policy on student welfare, which should address the following among others:

i. *Support and counseling*
ii. *Mentoring*
iii. *Academic support*
iv. *Career guidance*
v. *Healthcare*
vi. *Financial matters*
vii. *Student organisations*
viii. *Rules and regulation on conduct and discipline of students.*
ix. *Dress code*
x. *Recreational, cultural and spiritual support*

iii) *The Pharmacy School/Department shall provide accessible recreational facilities including outdoor and indoor facilities. These could be shared with others in the institution.*

i. *The following requirements shall apply for outdoor sports space.*
- *Acceptable: equivalent of 1 football pitch for 700 student*
- *Good: equivalent to 1 football pitch for 600 student*
- *Ideal Practice: equivalent to 1 football pitch for 500 student*

ii. *The following requirements shall apply for outdoor variety of games.*
- *Acceptable: two different games.*
- *Good: three different games*
- *Ideal Practice: five different games*

iii. *The following requirements shall apply for indoor variety of games.*
- *Acceptable: two different games.*
- *Good: three different games*
- *Ideal Practice: five different games*

ii. *The Pharmacy School/Department shall provide avenues for cultural and spiritual support.*

STANDARD 6: RESEARCH AND INNOVATION

Benchmark Standard

1. *The School/Department shall encourage, promote, and engage in innovative research consistent with its policies and strategic plans, in order to address national, regional, continental, and international needs.*
2. *There shall be in place i*ntegrated research laboratories for staff.

Guidelines

a. The Pharmacy School/Department shall show evidence of promoting quality research and innovation
b. The Pharmacy School/Department shall have thematic research areas in line with its institutional research policy and aligned to the national research policy.
c. The Pharmacy School/Department shall a budget for research.
d. The Pharmacy School/Department shall facilitate its staff to carry out research
e. The Pharmacy School/Department shall have mechanism of providing incentives to members of staff who undertake research, attract research funds, innovate and/or patent
f. The Pharmacy School/Department shall document and disseminate its research outputs.

STANDARD 7. COMMUNITY ENGAGEMENT

A higher education institution is not only responsible for teaching, learning and research but also for serving the society. The department/school should ensure that community engagement activities are conducted within institutional policies and strategies that facilitate collaboration between the institution and its larger communities (local, national, regional, continental and global) for a mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity.

Benchmark Standard

The Pharmacy School/Department shall have mechanisms to promote engagement in community outreach programmes as part of its social responsibility.

Guidelines

Community engagement should:

a) Enrich scholarship, research, and creative activity;
b) Enhance curriculum development, teaching and learning;

c) Facilitate preparation of educated and engaged citizens;
d) Strengthen democratic values and civic responsibility;
e) Address critical societal issues and contribute to public good; and
f) Ensure there are mechanisms for partnering with other stakeholders in the community for sustainable development.

STANDARD 8. COLLABORATION, STAFF AND STUDENT MOBILITY

Standard

The Pharmacy School/Department/ shall have mechanisms that promote collaboration with other Institutions, professional bodies, research institutions and relevant social actors at national, regional, continental and international levels in order to facilitate mobility of students and staff.

Guidelines

The institution should have policies that promote the mobility of academic staff, researchers and students on the programme, both locally and internationally

STANDARD 9: THE BACHELOR OF PHARMACY DEGREE PROGRAMME

9.1. Programme Name, Award, Duration and Graduation Load

Programme Name	Bachelors of Pharmacy
Award	*Bachelor of Pharmacy degree.*
Duration of study	Five years
Graduation Load	600 CUs. One Credit Unit is equal to ten notional hours.

9.2 Competencies

Pharmacy practice is for optimising goods and services for people and other aninals. The optimization can be for individuals or for groups of individuals. The goods and associated services are: *pharmaceuticals, drugs, medicines, herbs, diagnostics, surgicals, devices, nutraceuticals, hygiene products, foods, drinks, cosmetics and other health supplies*. Conversely, the services are for individuals or for groups of individuals.

The following Table shows the desired competencies for pharmacists in Uganda

Table of summary of domains and competencies

No.	Domains	Competencies
1	**Patient Care**	*This is about healthcare of an individual patient (Human or other animals).* 1.1 Provision of pharmacist initiated therapy. Including diagnosis, prescription and formulation of healthcare plan. 1.2 Monitoring medicines and other healthcare needs. 1.3 Provision of alternative/optimal treatment regimen, prescription and healthcare plan. 1.4 Compunding Extemporaneous preparations. 1.5 Administering medicines, remedies and other therapies. 1.6 Dispensing and optimization of use of *pharmaceuticals, drugs, medicines, herbs, nutraceuticals, medical & veterinary devices, foods, drinks, cosmetics and other health supplies*. 1.7 Clinical trials. 1.8 Counselling on and in relation to health.

1.9 Provision of information on and related to health.

1.10 Collaboration with other healthcare professionals and caretakers.

1.11 Making policies and guidelines.

2	**Supply Chain Management of Pharmceuticals and other Health Supplies**	*This is about direction for availing of:* *Pharmaceuticals, drugs, medicines, herbs, diagnostics, surgicals, devices, nutraceuticals, hygiene products, and other health supplies*. *For use on both humans and other animals.* 2.1 Organisation for procurement. 2.2 Selection and quantification for procurement. 2.3 Requisition and documentation. 2.4 Practicing Pharmacoeconmics. 2.5 Organising transportation. 2.6 Receipt and Storage. 2.7 Distribution and documentation. 2.8 Pharmacovigilance. 2.9 Product recall. 2.10 Disposal and destruction. 2.11 Record keeping of transactions and disposal. 2.12 Quality assurance. 2.13 Development and following policies and guidelines.

3	**Production of Pharmaceuticals and other Health Supplies**	*This is about the compounding and manufacturing of:* *Pharmaceuticals, drugs, medicines, herbs, diagnostics, surgicals, devices, nutraceuticals, hygiene products, and other health supplies.* *For use on both humans and other animals.* 3.1 Organisation for production. 3.2 Formulary development. Making, reducing and magnifying formulas. 3.3 Compounding. 3.4 Production the goods according to GMP. 3.5 Storage after production. 3.6 Disposal and destruction in production. 3.7 Distribution and documentation of supplies. 3.8 Product recall. 3.9 Production quality assurance, validation and inspection. 3.10 Development and following policies and guidelines.
4	**Community and Public Health**	*This is about the general collective group on health issues:* *For use on both humans and other animals.*

4.1 Promotion of health and wellness.

4.2 Information on *Pharmaceuticals, drugs, medicines, herbs, diagnostics, surgicals, devices, nutraceuticals, chemicals, hygiene products, foods, drinks, cosmetics and other health supplies*.

4.3 Professional and health advocacy.

4.4 Health economics.

4.5 Epidemic and disaster management.

4.6 Primary healthcare.

4.7 Community intervention trials.

4.8 Development and following policies and guidelines.

5	**Quality analysis and assessment on Pharmaceuticals and other Health Supplies**	*This is about fitness for purpose of:* *Pharmaceuticals (including biologicals), drugs, medicines (including biologicals), herbs, diagnostics, surgicals, devices, nutraceuticals, cosmetics, other health supplies, raw materials, in-process products, and packagings.* *For both humans and other animals.* 5.1 Organisation for Assessment. 5.2 Use of pharmacopoeia. 5.3 Handling reference standards and samples. 5.4 Handling animals for analysis. 5.5 Decision on analytical equipments, methods and techniques. 5.6 Validation of equipments, methods and techniques. 5.7 Application of various equipments, methods and techniques. 5.8 Quality assurance. 5.9 Development and following policies and guidelines.
6	**Forensic Investigation & Prosecution**	*This is about finding judicial information about death or injury or other crime involving use of:*

		Pharmaceuticals, chemicals, poisons, drugs, medicines, herbs, diagnostics, surgicals, devices, nutraceuticals, hygiene products, and other health supplies. *In both humans and other animals.* 6.1 Organisation for forensic investigation or prosecution. 6.2 Collection and preservation of forensic samples and sites. 6.3 Transportation of forensic samples. 6.4 Analysis of Samples 6.5 Correlation from administration to injury/death/commitment of crime. 6.6 Development and following policies and guidelines.
7	**Regulation of Products and Practice**	*This is about governance of practice/service and of these goods:* *Pharmaceuticals, drugs, medicines, herbs, diagnostics, surgicals, devices, nutraceuticals, hygiene products, and other health supplies*. *For use on both humans and other animals.* 7.1 Organisation for regulation. 7.2 Exportation, production, procurement (including importation), distribution (via

		wholesale and retail) and use of the goods. 7.3 Trials of these goods and services. 7.4 Pharmacovigilance. 7.5 Inspection and quality assurance. 7.6 Withdrawals from the market. 7.7 All services relating to health and use of these goods upholding ethical and legal practice. 7.8 Continuing professional development 7.9 Decision-making 7.10 Development and following policies and guidelines.
8	**Organisation and Management Skills**	This about institutional governance: 8.1 Leadership. 8.2 Self-management skills. 8.3 Workplace management skills. 8.4 Human resources management. 8.5 Financial management. 8.6 Pharmaceutical infrastructure management 8.7 Management of clinical trials.

		8.8 Quality assurance. 8.9 Change management. 8.10 Development and following policies and guidelines.
9	**Research**	This about systematic investigation of all aspects of the above competencies, goods and services.

9.3 Admissions

9.3.1 Admission Requirements

Benchmark Standards

Higher education institution desiring to offer the Bachelor of Medicine and Bachelor of Surgery Degree Programme *shall adhere to the following admission criteria.*

1 *A-level Entrants: Uganda Certificate of Education (UCE) or its equivalent and Uganda Advanced Certificate of Education (UACE) or its equivalent with a principal pass in Chemistry and a principal pass in Biology.*
2 *Mature Age Entrants: Mature Age Entrance Examinations Certificate in Health Sciences awarded to a person-aged at least 22 years and has passed with at least 50% marks. For purposes of admission the Mature Age Entrance Certificate shall be valid for no more than two years. The mature age entry examinations centre must have been authorized by NCHE;*
3 *HEC Entrants: Higher Education Certificate in Biological or Chemical Sciences with at least a credit.*
4 *Diploma Entrants:*

i. A Diploma in Science/ Science Education (Biological or Chemical Sciences),
ii. A diploma in a Clinical Health related discipline recognized by the National Council.

List of eligible Diploma cadres includes:

1	Clinical Medicine and Community Health	13	Advanced Diploma in Public Health Nursing
2	Anesthesia	14	Environmental Health Sciences
3	Clinical Psychiatry	15	Dental Technology
4	Pharmacy	16	Advanced Diploma in ENT
5	Clinical Ophthalmology	17	Advanced Diploma in Anesthesia
6	Public Health Dentistry	18	Pharmaceutical Laboratory Technology
7	Physiotherapy	19	Orthopedic Medicine
8	Occupational Therapy	20	Occupational Therapy
9	Orthopedic Technology	21	Nursing/Comprehensive Nursing/Mental Health Nursing/ Pead & Child. Health Nursing/midwifery/Public Health Nursing
10	Pharmaceutical Radiography	22	Orthopedic Medicine
11	Pharmaceutical Entomology & Parasitology	23	Clinical and Community Nutrition
12	Clinical Psychiatry		

5 *Bachelors Degree Entrants: A Bachelors Degree in any Clinical Related Discipline, A Bachelors Degree in Biological or physical Sciences* with a strong emphasis on Chemistry.

9.3.2 Credit Accumulation and Transfer and Exemptions

Benchmark Standard

a. *Credit transfers and exemptions shall be accepted for purposes of student mobility and recognition of prior learning.*

Guidelines

a. *The department/School shall have an approved credit transfer and exemptions policy, which is in line with NCHE requirements.*
b. *Transfer students shall meet the minimum admission criteria as set by the National Council.*

9.3.3 Student Enrollments

Benchmark Standard

The NCHE shall fix the number of students to be enrolled per year.

Guidelines

a. *The programme document should indicate proposed number of students the Department/School intends to enroll every year.*
b. *The enrollments shall match with the infrastructure, human resource requirements, placements and other requirements.*
c. *While determining enrollment, consideration should be given to a full cycle period when resources would be used by students in all years.*

9.4 Course Contents

9.4.1 Core Courses

Every institution offering a Bachelor of Pharmacy degree include the following **MUST KNOW** courses in its curriculum.

Course Matrix for Minimum Standards for Courses of Study

Code	Course
	1. Human Anatomy and Embryology
	2. Histology and Cytology
	3. Human Embryology

	4. Medical Biochemistry
	5. Medical Physiology
	6. Behaviour and social sciences (Anthropology, Sociology and Psychology)
	7. Nutrition and dietetics
	8. Communication skills for health workers
	9. Immunology and parasitology
	10. Pathology
	11. Pharmacognosy – Plant Identification and Processing
	12. Introduction to Pharmaceutics
	13. Biostatistics
	14. Epidemiology and demography
	15. First Aid and Nursing Process
	16. Pharmacy Practice – Evolution of Pharmacy, and the Healthcare Systems in Uganda
	17. Research methodology
	18. Pharmacognosy and Alternative Systems of Medicine Placement
	19. Community Health
	20. Basic Inorganic and Physical Chemistry
	21. Pharmacy Practice – Units of Measurements and Calculations in Pharmacy
	22. Organic Chemistry
	23. Applied Microbiology

	24. Pharmacognosy – Secondary Plant Metabolites
	25. Pharmaceutics – Technology of Unit Processes
	26. Basic Pharmacology
	27. Comparative Veterinary Anatomy and Physiology
	28. Industrial pharmacy and Pharmaceutical Production Placement
	29. Pharmaceutical Biotechnology
	30. Pharmaceutical Microbiology – Microbicides, Antibiotics and Applications
	31. Systemic Pharmacology
	32. Pharmacy Practice – Patient Care, Settings and Devices Management
	33. Therapeutics – Antineoplastics and Antiinfectives
	34. Clinical Pharmacy - Introduction to Pharmaceutical Care, Biopharmaceutics and Clinical Lab Data
	35. Pharmaceutics – Dosage Form Formulations
	36. ICT in Healthcare
	37. Quality Assessment and Standardisation of Biological Products (Human)
	38. Pharmaceutical Microbiology – Spoilage, Sterilization and Preservation
	39. Comparative Veterinary Pharmacology and Biopharmaceutics
	40. Clinical Pharmacy – Hospital Placement
	41. Clinical Pharmacy – Management of Infectious Diseases
	42. Pharmaceutical Chemistry – Organic Pharmaceuticals, Drug Discovery and Design
	43. Pharmaceutical Cosmetology

	44. Pharmaceutical Analysis – Instrumentation and Methods
	45. Quality Assessment and Standardisation of Biological Products (Veterinary)
	46. Clinical Pharmacy – Systemic Non-Infectious Diseases
	47. Clinical Pharmacy - Junior Pharmacy Clinical Clerkships
	48. General Management, and Pharmaceutical and Health Supplies Chain Management.
	49. Agro-Veterinary Pharmacy – Poultry and Pet Animal Diseases Management
	50. Agro-Veterinary – Farm & Veterinary Clinic Placement
	51. Toxicology & Forensic Pharmacy – Placement
	52. Clinical Pharmacy – Non-Systemic &Non-Infectious Diseases
	53. Nuclear Pharmacy
	54. Pharmaceutics – Modified Release Dosage Form Technology and Clinical Pharmacy
	55. Pharmaceutical Microbiology – Pharmaceutical and Food Microbiological Quality Analyses, Assurance and Auditing
	56. Agro-Veterinary Pharmacy – Farm and Big Animal Diseases Management
	57. Pharmacognosy – Natural Products, Traditional Medicines and Complementary Systems of Medicines
	58. Pharmacy Professional Ethics and Law
	59. Pharmacoeconomics
	60. Pharmaceutical Chemistry – Limit Tests and Standardization of Organic and Inorganic Pharmaceutical Compounds
	61. Pharmaceutics – Quality Analysis of Dosage Forms
	62. Toxicology and Forensic Pharmacy

	63. Project Work

Institutions offering this programme shall add courses in order to achieve a graduation load of 600 credit units within a period of five years, in line with their vision and mission.

9.4.2 Project Work

The project work is a mandatory requirement for graduation. The purpose of the project work is to promote the development and application of critical thinking and problem solving skills that are fundamental to the integration of medical science and clinical care. Students gain an understanding of the research process, limitations and variability of data, and the translation of research and critical thinking skills to clinical practice. Students are expected to articulate a relevant research question, decide on appropriate methods to address the question, collect and analyze the data, reach proper conclusions and write a scientific report summarizing their work including implications for further inquiry and/or clinical practice.

9.4.3 Programme Structure

Year 1, Semester 1 (Basic Sciences/Multi-Professional Courses)

SN	Course Title
1	Human Anatomy
2	Community Health, Epidemiology and Statistics
3	Pharmacognosy – Plant Identification and Processing
4	Introduction to Pharmaceutics
5	Communication Skills for Health workers
6	Behaviour and social sciences (Anthropology, Sociology and Psychology)

Year 1, Semester 2 (Basic Sciences/Multi-Professional Courses)

SN	Course Title
1	Human Anatomy: Histology and Embryology
2	Biochemistry (Structure and catalysis)
3	First Aid and Nursing Process
4	Parasitology
5	Human Physiology: Cell, Blood and Body Fluids, Renal, Cardiovascular and Respiratory
6	Pharmacy Practice – Evolution of Pharmacy, and the Healthcare Systems in Uganda
7	University Unique Course

Year 1, Semester: Recess: (Pharmacognosy and Alternative Systems of Medicine Placement)

SN	Course Title
1	Pharmacognosy and Alternative Systems of Medicine Placement

Year 2, Semester 1 (Basic Sciences/Multi-Professional Courses)

SN	Course Title
1	Applied Immunology
2	Biochemistry (Metabolism & Metabolic Regulation)

3	Basic Inorganic and Physical Chemistry
4	Basic Microbiology: Bacteriology, Virology, and Mycology
5	Computer Applications
6	Human Physiology: Endocrine, Reproductive, Digestive, and Nervous Systems
7	Pharmacy Practice – Units of Measurements and Calculations in Pharmacy

Year 2, Semester 2 (Basic Sciences/Multi-Professional Courses)

SN	Course Title
1	Organic Chemistry
2	Applied Microbiology
3	Pharmacognosy – Secondary Plant Metabolites
4	Pharmaceutics – Technology of Unit Processes
5	Basic Pharmacology
6	Comparative Veterinary Anatomy and Physiology
7	University Unique Course

Year 2, Semester: Recess: (Industrial Pharmacy – Pharmaceutical Production)

SN	Course Title
1	Industrial pharmacy and Pharmaceutical Production Placement

Year 3, Semester 1

S/N	Course Title
1	Pharmaceutical Biotechnology
2	Pathology
3	Pharmaceutical Microbiology – Microbicides, Antibiotics and Applications
4	Systemic Pharmacology
5	Pharmacy Practice – Patient Care, Settings and Devices Management
6	Therapeutics – Antineoplastics and Antiinfectives

Year 3, Semester 2

S/N	Course Title
1	Clinical Pharmacy - Introduction to Pharmaceutical Care, Biopharmaceutics and Clinical Lab Data
2	Pharmaceutics – Dosage Form Formulations
3	Quality Assessment and Standardisation of Biological Products (Human)
4	Pharmaceutical Microbiology – Spoilage, Sterilization and Preservation

5	Comparative Veterinary Pharmacology and Biopharmaceutics
6	Nutrition for Health

Year 3, Semester: Recess: (Clinial Pharmacy – Hospital Placement)

SN	Course Title
1	Clinial Pharmacy – Hospital Placement

Year 4, Semester 1

S/N	Course Title
1	Clinical Pharmacy – Management of Infectious Diseases
2	Pharmaceutical Chemistry – Organic Pharmaceuticals, Drug Discovery and Design
3	Pharmaceutical Cosmetology
4	Pharmaceutical Analysis – Instrumentation and Methods
5	Quality Assessment and Standardisation of Biological Products (Veterinary)
6	Research Proposal Development

Year 4, Semester 2

S/N	Course Title
1	Clinical Pharmacy – Systemic Non-Infectious Diseases
2	Clinical Pharmacy - Junior Pharmacy Clinical Clerkships
3	General Management, and Pharmaceutical and Health Supplies Chain Management.
4	University Unique Course
5	Agro-Veterinary Pharmacy – Poultry and Pet Animal Diseases Management
6	Agro-Veterinary – Farm & Veterinary Clinic Placement

Year 4, Semester: Recess: (Toxicology & Forensic Pharmacy Placement)

SN	Course Title
1	Toxicology & Forensic Pharmacy – Placement

Year 5, Semester 1

S/N	Course Title
1	Clinical Pharmacy – Non-Systemic &Non-Infectious Diseases
2	Nuclear Pharmacy
3	Pharmaceutics – Modified Release Dosage Form Technology and Clinical Pharmacy

4	Pharmaceutical Microbiology – Pharmaceutical and Food Microbiological Quality Analyses, Assurance and Auditing
5	Research Implementation and Report Writing
6	Agro-Veterinary Pharmacy – Farm and Big Animal Diseases Management

Year 5, Semester 2

S/N	Course Title
1	Pharmacognosy – Natural Products, Traditional Medicines and Complementary Systems of Medicines
2	Pharmacy Professional Ethics and Law
3	Pharmacoeconomics
4	Pharmaceutical Chemistry – Limit Tests and Standardization of Organic and Inorganic Pharmaceutical Compounds
5	Pharmaceutics – Quality Analysis of Dosage Forms
6	Toxicology and Forensic Pharmacy
	Unique University Course

9.4.3 **Curriculum Linkage with pharmacy practice and health care systems.**

Benchmark Standard

Students shall be exposed to areas they will be expected to work in tertiary and primary care facilities upon completion. This supervised exposure should last a minimum of four weeks.

9.4.4 Detailed Courses

1. Human Anatomy

Course name: Human Anatomy

Course description: This pre-clinical course covers the gross structure of the human body. It should be offered in the first and second year of medical training. Emphasis should be put on enriching the students' knowledge of gross anatomy and clinical applications to medical, therapeutic and surgical interventions. Linkage should be made between the structure and function of the human body. The dissection of a cadaver is an important practical component of this course. Teaching methods for this course vary and each university may propose suitable methods for its delivery.

Expected learning outcomes: By the end of this course, the medical student should understand the normal structure and function of the human body and how to apply this knowledge to all aspects of medical practice and to recognize the abnormal structure or malfunctioning in pathological conditions.

Detailed course content: The course should cover the following minimum content

- General Introduction to Anatomy
- Upper and Lower Limbs
- Thorax and thoracic cavity
- Muscles, Nerves, Blood Vessels and Lymphatic Drainage
- The abdomen, Pelvis and Perineum
- Head and Neck
- Neuroanatomy

Study/information resources/ Needed Practicals

Dissection of Cadavers Ideal: 4 students per cadaver
Good: 6 students per cadaver
Acceptable: 8 students per cadaver

Bone specimens of articulated and non-articulated skeleton
Study of isolated cadaver specimens

2. Histology and Cytology

Course Name: Histology and Cytology

Course Description: This pre-clinical course should be offered in the first year of medical training. Students are introduced to the microscopic structure of normal tissue, the histological techniques used to obtain a histological specimen, and how to use a microscope to examine such a specimen. The course should give students expertise in recognizing the microscopic structure of normal tissue, hence forming the basis for recognizing abnormal tissue in histopathology

Expected learning outcomes: By the end of this course, students should

a. Know the microscopic structure of cells and basic tissues, blood & lymph vessels, glands, and organs constituting all body systems
b. Appreciate histology as the basis for understanding histopathological changes in disease states
c. Describe the various laboratory procedures undertaken in order to produce a histological tissue section
d. Use a microscope to examine a histological specimen

Detailed course content: The course should cover the following minimum content

- ✓ Introduction to histology and histological methods
- ✓ The cell and cytogenetics
- ✓ Basic tissues
- ✓ Heart and blood vessels
- ✓ Lymph tissue and organs
- ✓ The skeletal system
- ✓ The respiratory tract and lungs
- ✓ The male and female reproductive system
- ✓ The urinary system
- ✓ Integumentary system
- ✓ The endocrine system
- ✓ The central nervous system
- ✓ The gastrointestinal tract and associated glands
- ✓ Preparation of histological specimens

- ✓ Microscopic examination of histological slides

Study/Information resources/needed practicals

Microscopic slides of all types of tissues and cells
Preserved tissues
Microscopes
Digital images and videos

3. Human Embryology

Course name: Human Embryology

Course description: This pre-clinical course should be offered in the first year of medical training. The course covers intra-uterine development of an individual, right from fertilisation through to birth. Students should be taken through chronological steps involved in development of the organ systems of the embryo and foetus. Emphasis should be put on highlighting any congenital malformation that may arise from a defective process at any stage of development and clinical implications of such malformations.

Expected learning outcomes: By the end of this course, students should be able to

a) Recognise the origin of germ cells and the process of fertilization/twinning
b) Describe the subsequent developmental changes in the zygote/embryo/fetus
c) Recognise certain factors that may result in some congenital malformations seen at birth
d) Explain the physiological and anatomical changes that occur in the fetus at birth
e) Appreciate that knowledge of factors that may lead to certain congenital anomalies forms the basis for prevention of such anomalies
f) Appreciate the fact that certain developmental malformations may lead to disease conditions that may arise later in postnatal life

Detailed course content: The course should cover the following minimum content

- ✓ Introduction and definition of terms
- ✓ Cell Division
- ✓ Gametogenesis
- ✓ The Uterine Cycle

- ✓ Fertilization and Sex Determination
- ✓ Cleavage and Implantation
- ✓ Twins and Twinning
- ✓ Second Week of Development
- ✓ Third Week of Development
- ✓ Germ layers and their derivatives
- ✓ Development of Musculoskeletal system and its anomalies
- ✓ Development of skin and mammary glands and anomalies
- ✓ Development of Cardiovascular System and its anomalies
- ✓ Foetal Circulation and Changes at Birth
- ✓ Development of Respiratory System and its anomalies
- ✓ Development of the gastrointestinal tract and it anomalies
- ✓ Development of auxiliary glands and its anomalies
- ✓ The thoraco-abdominal diaphragm and its anomalies
- ✓ Development of the urogenital system & its anomalies
- ✓ Development of the endocrine glands
- ✓ Development of head and neck

Study/Information resources needed/practicals

- Graphic and digital images and videos

4. Medical Biochemistry

Course name: Medical Biochemistry

Course description:

This course describes the structures, chemical properties and functions of organic compounds from which most of the cellular materials are constructed, highlighting the structural hierarchy in the molecular organization of the cell, enzyme catalysis; and the relevance of biochemistry in explaining biological form and function in chemical terms is emphasized. The course also covers the storage and expression of genetic information, the mechanisms of regulation of gene expression, cancer and oncogenesis, and immunology, breakdown of biomolecules for generation of energy; the synthesis of molecules required in the body; regulation of metabolism and the diseases related to it

Expected learning outcomes

By the end of this course, students should be able to

a) Appreciate that the normal functioning of any organism, including humans, depends on chemical reactions involving biomolecules and ions using enzymes as biological catalysts
b) Develop the ability to work safely and effectively in a biochemistry laboratory
c) Analyze and interpret investigative data and identify consistent and inconsistent parameters
d) Recognize the importance of biochemistry in understanding the structure and function of molecular components within the human body, and its role in the practice of modern medicine.

Detailed course content: The course should cover the following minimum content

- ✓ Basic chemistry
- ✓ Structural biochemistry
- ✓ Amino acids and Proteins
- ✓ Fats and Lipids
- ✓ Carbohydrates
- ✓ Nucleotides and nucleic acids
- ✓ Enzymes
- ✓ Vitamins and coenzymes
- ✓ DNA replication, repair
- ✓ Transcription
- ✓ Translation
- ✓ Regulation of gene expression
- ✓ Diagnostic and clinical applications of DNA
- ✓ Molecular basis of cancer
- ✓ Molecular immunology
- ✓ Immunodeficiency
- ✓ Carbohydrate metabolism
- ✓ Metabolism of lipids and phospholipids
- ✓ Protein metabolism
- ✓ Metabolism of nucleotides

- ✓ Hormones
- ✓ Neurochemistry

Study/Information resources needed/practicals

- ✓ Introduction to basic devices used in the Biochemistry laboratory
- ✓ Preparative centrifugation and estimation of concentration of different solutions using colorimetric methods
- ✓ Detection and identification of amino acids and proteins
- ✓ Detection and identification of carbohydrate molecules
- ✓ Determination of blood glucose levels
- ✓ Separation of amino acids or proteins by paper chromatography
- ✓ Estimation of blood and urine ketone bodies
- ✓ Analysis of factors affecting enzyme activity
- ✓ Measurement of serum amylase activity in diagnosis of pancreatitis
- ✓ DNA extraction from onions
- ✓ DNA extraction from blood-spotted Whatman filter paper, or blood samples; amplification of DNA by PCR; electrophoresis of PCR products; estimation of size of DNA fragments

5. Medical Physiology

Course name: Medical Physiology

Course description:

This course introduces preclinical medical students to a strong foundation and basis of human physiology. Particular attention should be paid to understanding the link between structure and function of body cells, tissues, organs and systems.

Expected learning outcomes:

By the end of this course, students should be able to

a) Explain the functions of cells, tissues and organs relating them to the structure.
b) Interpret the different body system parameters
c) Understand the pathophysiologic basis of disease
d) Work safely and efficiently and use equipment in the physiology laboratory
e) Know the normal physiological ranges and some examples of deviations in disease

f) Use the different laboratory methods to determine normal parameters in various body systems.
g) Write a basic correct scientific report of work done in the laboratory.
h) Understand that human physiology is vital to the practice of modern medicine

Detailed course content: The course should cover the following minimum content

- ✓ General physiology
- ✓ Excitable tissues
- ✓ Blood and immunity
- ✓ Cardiovascular and lymphatic systems
- ✓ Respiratory physiology
- ✓ Gastrointestinal tract
- ✓ Renal physiology
- ✓ Nervous system (Central, peripheral, autonomic)
- ✓ Endocrine and reproductive physiology
- ✓ Temperature regulation
- ✓ Growth and aging
- ✓ Physiology of exercise and sports

Study/Information resources/needed practicals

Microscopes, hematological equipment, kymographs , stationary, text books, lab materials and reagents, gloves, syringes, Electrocardiograph, BP machine, colorimeter and centrifuge and other relevant equipment, EEG recordings, Journals, Tuning forks, Ishahara's charts, Patella hammer, computers, internet, flip charts, LCD projectors, markers, animals, black/white boards.

6. Behavioural and social sciences (Anthropology, Sociology and Psychology)

Course name: Behavioural and social sciences

Course description: Most salient issues of our society are linked in part to human attitudes, values, and behavior. This course aims to provide a broad introduction to the research, theory and methods of health psychology, sociology and anthropology. It includes a focus on Psychological, social and cultural influences on an individual's health and health behaviours. Introduction to psychology is designed to provide

students with a general understanding and application of the basic principles and theories of psychology that underlie human behavior and experiences. Students will gain an understanding of the complexities of human thought, emotions and behavior, as well as the factors related to the differences between people. The second section; Health psychology is concerned with understanding human behavior in the context of physical health and illness. It explores psychological influences on how people stay healthy, why they become ill, and how they respond when they get ill. Students will be introduced to the psychological theories and research on health and illness behaviors.

Expected learning outcomes: By the end of the course students should demonstrate

a) Familiarity with the major concepts, theoretical perspectives, empirical findings, and historical trends in psychology.
b) Critical appreciation of the differences between biopsychosocial and biomedical approaches to health and health care
c) Insight into their own and others' behavior and mental processes and apply effective strategies for self-management and self-improvement.
d) Ability to critically evaluate health psychology research and health psychological issues.
e) Use of various psychological and health models to explain the behaviors of their patients.
f) Ability to identify and critically analyze factors that affect health and disease.

Detailed course content

- ✓ Overview of Psychology and Health
- ✓ Personality and theoretical perspectives Human Growth and Development
- ✓ Social Psychology
- ✓ Cognitive Psychology
- ✓ Psychological disorders
- ✓ Biomedical and Biopsychosocial models of Health
- ✓ Health beliefs, attitudes and behaviors
- ✓ Illness beliefs
- ✓ Stress, Psychological Factors and Health

- ✓ Health Enhancing and health compromising behaviours
- ✓ Health promotion and education
- ✓ Introduction to Medical Anthropology
- ✓ Theoretical Perspectives in Medical Anthropology
- ✓ Biomedicine as a Cultural Category
- ✓ Quantifying Health and Illness
- ✓ The Social and Political Determinants of Health
- ✓ Healers and their Patients in Ethnographic Context
- ✓ Magic, Religion, and Healing
- ✓ Cross-cultural Psychiatry

- ✓

7. Nutrition and dietetics

Course name: Nutrition and Dietetics

Course description: This course covers the science of food and nutrition and teaches about nutrition and diet for good health, to prevent and treat illness and disease or assist with special needs. Students will learn and develop the key knowledge, attributes and skills used in normal nutrition and the relationship between nutrition, food and health.

Expected learning outcomes: By the end of this course, students should demonstrate relevant knowledge, skills, attitudes and experiences in human nutrition and dietetics that will enable them to contribute to the improvement of health care using nutrition and dietetics.

Detailed course content

- ✓ Introduction to Nutrition and Dietetics
  Introduction to the Nutrition Care Process
- ✓ Principles of Human Nutrition
  - **Nutrition:** Introduction: importance of nutrition and its role in health; assessment of nutritional status: dietary history, anthropometric measurements, biochemical tests.

- Recommended dietary allowance (Energy needs, Dietary protein, Nitrogen balance, Dietary fat, Vitamins, Fat-soluble vitamins and minerals, and associated diseases)

- ✓ **Nutrition disorders:** under nutrition (PEM): classification, aetiology, clinical features vs biochemical bases, metabolic disorders & laboratory findings in the different forms of PEM; Over nutrition (obesity): Grading of obesity and associated health risks, , aetiology, causes, leptin and obesity, childhood obesity, health problems associated with increased body fat, metabolic syndrome criteria.
- ✓ Food Science
- ✓ Food Safety and Hygiene
- ✓ Meal Planning, Management and Service
- ✓ Legal Aspects in Nutrition and Dietetics
- ✓ Diet Therapy
- ✓ Maternal and Child Nutrition
- ✓ Nutrition in the Lifecycle
- ✓ Nutrition and public health
- ✓ Nutrition for Vulnerable Groups
- ✓ Nutrition in HIV and Aids
- ✓ Management of Malnutrition
- ✓ Introduction to Nutrition Surveillance
  Nutrition in Emergencies

8. Communication skills for health workers

Course name: Communication skills for health workers

Course description:
The course should prepare students to communicate with patients/clients, their families, colleagues and other healthcare service providers in the health care setting and in the community. This course should be designed for 1st year medical students and in other health programmes.

Expected learning outcomes: By the end of the course students should be able to:

a) Demonstrate effective and appropriate listening, verbal, non-verbal and written communication skills with and about patients to family, colleagues and the public
b) Demonstrate a commitment to working in collaborative groups in all aspects of health care

c) Act in a consultative role with other health and non-health professionals
d) Demonstrate the ability to adapt communications to a variety of professional settings and roles
e) Demonstrate ability to maintain comprehensive, timely and legible medical records

Detailed course content: The course should cover the following minimum content

- ✓ The process of Communication
- ✓ Requirements for Effective Communication
- ✓ Requirements for Effective Communication
- ✓ Communicating with children and their families
- ✓ Confidentiality
- ✓ Sensitive listening
- ✓ Exploring prejudices
- ✓ Understanding stress
- ✓ Stress Management
- ✓ Introduction to breaking bad news
- ✓ Difficult Situations and questions
- ✓ Ethics and communication
- ✓ Introduction to basic Counselling skills
- ✓ Communication and Team work

Practicals

Students should have practical communication sessions. The focus of these sessions is to practice using the communication skills of sensitive listening, checking understanding-which includes paraphrasing, reflecting, clarifying and summarizing. Students should also observe attitude and qualities that promote good communication

9. Immunology, microbiology and parasitology

Course name: Immunology, microbiology and parasitology

Course description: This biomedical course introduces the student to the study of the immune system and its function, and consequences of defects in the immune system. The student also learns about disease causing organisms and their biology, and how they interact with the body to cause disease.

Expected learning outcomes:

By the end of this course, students should

a) Understand the structure of various disease causing agents
b) Know the body's response to these agents
c) Knowledge of communicable diseases
d) Understanding of emerging and re-emerging diseases
e) Interpret diagnostic tests as relates to the common clinical and laboratory findings in disease states
f) Describe the epidemiology of various disease causative agents and approaches that are useful in reducing the incidence and prevalence of the various organisms
g) Ability to perform and to interpret technical procedures like, gram, ZN staining, blood films, etc
h) Be able to utilise appropriate technologies like PCR, ELIZA, in order to enhance diagnosis of diseases and to enhance the practice of medicine and delivery of health care services
i) Understand the scientific language i.e. nomenclature of various organisms
j) able to appreciate the importance of microbiology in clinical practice and disease control.
k) Understand the role of normal flora
l) Appreciate the consequences of a disordered immune response
m) Appreciate the role of pathogenic bacteria in the pathogenesis of different diseases
n) appreciate the importance of virology, parasitology and entomology in clinical practice and disease control

Detailed course content

- ✓ General Microbiology
- ✓ Immunology
    - Innate and acquired immunity;
    - Antigens and antibodies;
    - The immune response;
    - The complement system;
    - Dynamics of the immune response; The major histocompatibility complex;

- Immunity to infections: bacteria, viruses, parasites, fungi; Autoimmunity;
- Hypersensitivity states;
- Serological tests.

✓ Bacteriology
✓ Mycology
✓ Parasitology
✓ Protozoa
✓ Virology
✓ Entomology

10. Pathology

Course name: Pathology

Course description:

This course introduces the student to the study of the general processes of diseases by scientific methods.

Expected learning outcomes:

By the end of this course, students should have acquired knowledge and skills in investigation of diseases and interpretation of findings so obtained in the evaluation by histopathology, cytopathology and clinical genetic studies.

Detailed course content

✓ Introduction to Pathology
✓ Cell Injury, Necrosis, Apoptosis
✓ Cellular adaptation, growth and differentiation
✓ Inflammation
✓ Tissue repair, regeneration and wound healing
✓ Hemostasis, blood flow, and homeostasis
✓ Disorders of the immune system
✓ Infectious diseases
✓ Disorders of metabolism
✓ Amyloidosis
✓ Neoplasia

- ✓ Genetic disorders
- ✓ Systemic pathology
    - o Diseases of the respiratory system
    - o Diseases of the gastrointestinal tract
    - o Diseases of the endocrine system
    - o Diseases of the cardiovascular system

Study/Information resources needed/practicals

- ✓ Necropsy and interpretation of results
- ✓ Laboratory methods of processing the tissue, stains
- ✓ Methods of diagnosis in pathology
    - – Exfoliative cytology: (vaginal, lungs), fluids
    - – Excisional, and incisional biopsy
    - – Importance of FNAB methods
- ✓ Cell injury and Cell adaptation
- ✓ Inflammation (Acute, Chronic)
- ✓ Tissue repair
- ✓ Local and systemic disorders of circulation
- ✓ Metabolic disorders: Diabetes
- ✓ Amyloidosis
- ✓ Neoplasm(benign ,and malignant tumor)
- ✓ Genetic disorders
- ✓ Immunological diseases

11. <u>Biostatistics</u>

Course name: Biostatistics

Course description: This course introduces the student to the basic statistical methods of data collection, analysis, interpretation and utilization. The aim of the Biostatistics course is to develop skills in summarization, interpretation and presentation of data.

Expected learning outcomes: By the end of the course, students should be able to:

a) Define the different types of data

b) Identify and critically appraise data sources as well as data collection methods
c) Calculate basic statistical measures
d) Identify and calculate appropriate statistics to assess relationships between data
e) Collect simple data and demonstrate different ways of summarizing and presenting data.
f) Identify and interpret basic statistics presented in reports and journal articles

Detailed course content

- ✓ Introduction to Biostatistics: Definitions – data, population, sample and variable, Descriptive and inferential analyses and their relevance
- ✓ Data Sources and Data Collection Methods: Sources, quality and uses of data, Data collection methods and tools, Tools development and data collection, Sampling methods, sample size estimation
- ✓ Summarizing, Presenting/Communicating Data: Types of data, Introduction to computer data entry and analysis, Frequency distributions, Ratios, proportions, rates, Measures of central tendency, variation, position
- ✓ Introduction to Statistical Inference, Introduction to probability theory, The normal distribution and standard score, Confidence intervals for means and proportions
- ✓ Hypothesis testing: The chi-square test, the Paired t-test and the Independent two-sample t-test
- ✓ Introduction to regression analysis- Scatter diagram, Correlation, Simple linear regression

12. Epidemiology and demography

Course name: Epidemiology and demography

Course description: This course introduces the students to the basic concepts of epidemiology and how they are used to control diseases. Students will also be introduced to the key concepts in demography; basic measures of fertility morbidity and mortality, factors that influence population dynamics and their relevance to population health will be discussed.

Expected learning outcomes: By the end of this course, students should understand basic concepts in epidemiology and demography and how they can be used in the control of diseases

Detailed course content

- ✓ Definitions, concepts, methods, and uses of epidemiology
- ✓ Descriptive epidemiology
- ✓ Dynamics of disease transmission
- ✓ Investigation and control of epidemics
- ✓ Population hierarchy in epidemiological studies
- ✓ Experimental studies
- ✓ Counting disease rates; incidence and prevalence
- ✓ Surveys and epidemiological investigation
- ✓ Introduction to Demography: Sources and quality of demographic data, Basic demographic measures, Demographic processes and population composition, Relationship between population and development

13. <u>Research methods</u>

Course name: Research methods

Course description: This course introduces the student to purpose, types and designs of research methods and provides the student with a practical research project. It aims at imparting the required skills, knowledge and attitudes in research project development.

Expected learning outcomes: At the end of this course, the student should be able to:

a) Explain the purpose, main features and use of research
b) Discuss the advantages and limitations of different kinds of techniques used in health research
c) Explain how to conduct a critically review literature
d) Formulate research questions and objectives;
e) Design a research protocol
f) Write a research report

Detailed course content

- ✓ Introduction to Research methods (Quantitative and qualitative research methods, Operational research, Participatory action research, and Rapid appraisal)
- ✓ Research approaches (Rapid appraisal techniques, Surveys and questionnaires, Focus groups and key informant interviews, and participative observation, narrative

inquiry techniques)

- ✓ Proposal development (Problem statement, objectives, justification of the study, review of available information/literature, variable and sample definition, data sources, resource allocation and designing of research tools)
- ✓ Data management (Data entry formats and templates, coding, quality control, data entry, analysis and interpretation)
- ✓ Report writing and communication of results (Report formats and writing styles, preparation of power point presentations)

Study/Information resources needed/practicals

Data collection techniques (questionnaires, focus group discussions, interviews), proposal development, data entry, and report writing and presentation

14. <u>ICT in Health Care</u>

Course name: Information and Communications Technology (ICT) in health Care

Course description

Computers, information and communications technology now have a central place in the practice of medicine and delivery of health services. This ranges from electronic medical records, investigations and imaging, communicating with patients, health workers and the public, managing and monitoring patients, to medical research and training/teaching. This course is designed to be an introductory information and communications technology course. It aims to transfer fundamental concepts, theories, and applications of computers, the basics of hardware, software, computer ethics, systems software, application software and the role of information and communications technology in society and the practice of medicine today. The use and role of the internet in the field of medicine is explored. The concepts of electronic medical records and telemedicine are also introduced.

Expected learning outcomes: By the end of this course, students should be able to

a. Know and understand how to use a computer to perform basic functions and use basic programmes.

b. Use basic computer software programmes (e.g. word, excel, power-point) and applications in learning/teaching, reporting and in the practice of medicine, and management of health care systems.
c. Apply software programmes to research, management and analysis of data
d. Understand and use computerized medical records for patient care
e. Use the internet for learning, communication with patients, colleagues and the public, and for telemedicine
f. Apply computer knowledge and skills to interpret medical information, investigations, imaging and patient treatment options.
g. To make use of patient data base systems for planning and improving patient care.
h. To make use of mHealth platforms for the promotion of public health

Detailed course content

- ✓ Course overview and Introduction
- ✓ Computer concepts
- ✓ Operating Systems
- ✓ Internet & E-mail
- ✓ Word Processing
- ✓ Spreadsheets
- ✓ Database Management Systems
- ✓ Presentations
- ✓ Computer and Web security
- ✓ Mobile devices
- ✓ Integration
- ✓ Telemedicine
- ✓ Electronic medical records

15. PHARMACOGNOSY – PLANT IDENTIFICATION AND PROCESSING

COURSE DESCRIPTION

This course unit provides details on taxonomic features of plants that contain medicines, animal parts and minerals having medicinal values. It provides the student will practical skills and techniques of medicinal plant identification, characterisation, propagation and herbarium preparation.

LEARNING OUTCOMES

By the end of the course unit, the student should be able to do the following;

1. Define pharmacognosy, and the common terms and concepts used in pharmacognosy.
2. State the sources and general methods of obtaining drugs.
3. Identify taxonomic and other distinguishing features of plants from which drugs may be derived
4. Collection and identification of local medicinal plants, their diagnostic anatomical characteristics and the relevant species.
5. Describe plant taxonomy, anatomy and morphology.
6. Describe drugs as products of secondary metabolic processes in plants.
7. Preparation of herbarium specimens
8. Preparation of extraction material for polar and nonpolar solvents
9. Comparison of concoction procedures in herbal medicine
10. Preparation of a herbarium

COURSE CONTENT

Introduction to pharmacognosy

a) Definitions:
   i. Pharmacognosy
   ii. Drug
   iii. Medicinal plant
   iv. Secondary and primary metabolites
   v. active principles of biomedical products

History of drugs

Origin of drugs

Sources of Biomedical products

Cultivation of medicinal plants

a) Plant selection and breeding
b) Cell and tissue culturing
c) Plant nutrients and plant hormones

Processing of plant drugs

a) Collection
b) Drying
c) Packing
d) Presentation and protection
e) Storage: Physico-chemical parameters
f) Adulteration detection

Medicinal and aromatic plants of East Africa

Drugs as products of secondary metabolic processes, including brief description of;

a) Glycosides
b) Alkaloids
c) Volatile oils
d) Resins and oleo-resins
e) Gum resins
f) Tannins
g) Steroids and others

Anatomical characteristics and chemical substances associated with the following taxa

a) Myophyta
b) Bryophyta
c) Pteridophyta
d) Spermatophyta

Morphological, anatomical and chemical differences between plant families

a) Magnoliatae (Dicotyledons)
b) Liliatae (Monocotyledons)

16. INTRODUCTION TO PHARMACEUTICS

COURSE DESCRIPTION

This first course unit of pharmaceutics sets the stage for subsequent courses in this course by defining the key terms and concepts to be encountered later on, and defines

the scope of pharmaceutics, the typical stages and processes involved in drug development, and good dispensing practices.

EXPECTED LEARNING OUTCOMES

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

1. Define pharmaceutics and the common terms and concepts used in pharmaceutics
2. Outline the scope of pharmaceutics
3. Outline the major processes of drug development
4. Explain the relevance and significance of drug design and formulation of medicine.
5. Discuss good dispensing procedure.

COURSE CONTENT

Definitions of key terms

1. Pharmaceutics
2. Drug, dosage form
3. Medicine
4. Excipient
5. Pharmacological efficacy
6. Blood drug levels
7. Pharmacological effect
8. Pharmacological toxicity
9. Drug design
10. Sterilization
11. Current good manufacturing practice (cGMP)
12. Quality assurance (QA)
13. Pharmacopoeia
14. Formulary
15. Compendia
16. Bioavailability
17. Bioequivalence
18. Formulation

19. Good dispensing procedure

Scope of pharmaceutics

1. Design and formulation of medicines
2. Classification of dosage forms
3. Definitions and descriptions of dosage forms
4. Manufacture of medicine (small and large scale)
5. Quality assurance
6. Distribution

Process of drug development

1. Discovery
2. Synthesis
3. Isolations
4. Purification
5. Testing of Pharmacological effects
6. Toxicological evaluation
7. Design and formulation
8. Compounding
9. Quality assurance
10. Large scale manufacture
11. Good dispensing procedure

Preformulation

1. Concept
2. Processes
3. Significance.

17. FIRST AID AND NURSING PROCESS

COURSE DESCRIPTION

This course introduces the student to the core principles in the nursing process, such as patient admission, taking of vital signs, general examination, nursing care includingassistance during feeding and elimination.

LEARNING OUTCOMES

By the end of this course the student should be able to do the following;

1. Describe the general principles for nursing procedures
2. Describe the management of equipment before, during and after procedures
3. Discuss the nurses role in caring for patients environment, during admission of a patient and taking of vital observations
4. Describe the care during patient feeding, elimination.

COURSE CONTENT

Managing patient's environment

1. Types of hospitals
2. Principles and methods of cleaning hospital wards and equipment
3. Disposal of refuse and management of contaminated articles

Admission of patients

1. Types of admission
2. Observations during admission
3. History taking during admission
4. Orientation of patient/care take to ward routine and facilities
5. Transfer of patients
6. Introduction of hospital staffs

Bed making

1. Principles of bed making
2. Types of hospital beds and their functions
3. Accessories of the hospital beds
4. Aims of bed making

Positions used in nursing

1. Cardiac
2. Recumbent or supine
3. Sitting up
4. Left lateral position and sim's position
5. Prone, semi-prone

6. Lithotomy and Trendelenburg

Principles of moving, lifting and turning a patient

1. Moving a helpless patient up in bed
2. Moving a patient from the stretcher or trolley to the bed
3. Lifting a patient from a bed to a chair
4. Equipment used in positioning and lifting

Physical examination of a patient

1. Equipment used in physical assessment
2. History taking
3. Recording of findings of physical assessment
4. Complete physical examination of the body and interpretation of keys findings

Bathing a patient

1. Care of the skin
2. Requirements for bathing a patient
3. Types of baths
4. Cause, prone areas and groups of people at risk of developing pressure sores.

Feeding a patient by tube

1. Indications for tube feeding
2. Types of nasogastric tubes
3. Complications of tube feeding
4. Techniques of passing NG tubes and care

Medicine administration and maneuvers

1. Parenteral (IV, IA, IM, SC, IT, ID, Intracardiac, ocular, etc)
2. Per rectal
3. Cannulation
4. Phlebotomy

Patient's fluid and electrolyte balance

1. Normal distribution of water in different body compartments
2. Major ways of fluid and electrolyte intake and output
3. Clinical features of common fluid and electrolyte imbalance
4. Intravenous infusions

5. Care of a patient on intravenous infusion and blood transfusion

Meeting a patient's need for elimination

1. Bowel elimination
2. Use and care of bed pans and obtaining stool specimen
3. Caring for a patient with constipation, fecal impaction
4. Giving of enema, passing flatus tube
5. Caring for a patient with diarrhea
6. Caring for a patient with fecal incontinence
7. Giving and removing urinals
8. Catheterization, bladder washout and irrigation
9. Care for a patient with double incontinence

Nursing Process: Stages

1. Assessment
2. Collecting nursing health history
3. Performing physical examination
4. Collecting laboratory data
5. Validating data
6. Clustering data
7. Documenting data

Nursing diagnosis

1. Identifying clients problems
2. Formulating Nursing diagnosis
3. Documenting Nursing diagnosis

Planning

1. Identifying clients goals
2. Establishing expected outcomes
3. Selecting Nursing actions
4. Consulting
5. Delegating actions

Implementation

1. Performing Nursing actions
2. Reassessing client

3. Reviewing and modifying existing care plan

Evaluation

1. Comparing client response to expected outcome
2. Analyzing reasons for results and conclusions
3. Modifying care plan

18. PHARMACY PRACTICE – EVOLUTION OF PHARMACY AND THE HEALTHCARE SYSTEMS IN UGANDA

COURSE DESCRIPTION

This course is intended to acquaint students with the different areas of the practice of pharmacy, which the student may encounter. The students will also have field visits to these practice areas, the basis starts in health centers, hospitals and stems out to communities, industries, and natural ethno botany gardens.

COURSE LEARNING OUTCOMES

At the end of this course, the student is expected to be able to:

1. Define pharmacy, pharmacist and describe the evolution and scope of pharmacy.
2. Outline the various opportunities in pharmacy practice and roles played by the pharmacist.
3. Describe the available sources and proper use of information sources in pharmacy practice.
4. Describe the local (Ugandan) healthcare system
5. Describe the components of a prescription and interpret abbreviations used in prescription writing.
6. Discuss good dispensing practice
7. Carry out field work in the various designated pharmacy practice areas and compile a comprehensive report on the various activities performed in the various pharmacy practice areas.

DETAILED COURSE CONTENT

Introduction to pharmacy practice

1. General Overview of pharmacy and pharmacy practice

2. Definition of pharmacy practice, pharmacy, pharmacist and pharmacy technician
3. Differences between a pharmacist and pharmacy technician

Evolution of pharmacy

1. Prehistoric outlook
2. Traditional outlook
3. Modern outlook
4. Future outlook.
5. Traditional era , scientific era, clinical era, pharmaceutical-care era
6. Important persons in the history of pharmacy (Hippocrates, Galen, Theophrastus, Paracelcus, etc.)

Opportunities in the practice of pharmacy

1. Community pharmacy
2. Industrial pharmacy
3. Hospital pharmacy
4. Forensic Pharmacy
5. Academics and research
6. Public health service
7. Other practice settings e.g. Cardiovascular pharmacy, Nuclear/radiopharmacy, disaster management

Sources of information in pharmacy practice

1. Primary sources of drug information e.g. Journals,
2. Secondary sources of information. e.g. Abstracts and indexes
3. Tertiary sources of information e.g. Textbooks, handbooks, drug compendia
4. Internet as a source of information
5. Advantages and disadvantages of each source of drug information
6. Formularies and pharmacopoeia including the British National Formulary (BNF)
7. British Pharmacopoeia (BP)
8. British Pharmaceutical Codex (BPC)

Orientation of health care systems

1. Local (Uganda) healthcare system and set up.

2. Health centre I,II,III,IV
3. District hospitals, Regional Referral hospitals, National Referral hospitals
4. Private Not For Profit Organizations
5. Complementary Health care system (e.g. Traditional Health care system)
6. Practitioners in the Uganda health Care System (Including herbalists)

Prescription

1. Parts of prescription (superscription, Subscription, Inscription, Signatura)
2. Interpretation of prescriptions
3. How to write a prescription: Sample prescription
4. Use of prescriptions
5. Abbreviations and Latin words used in prescription writing
6. Processing of prescriptions

Dispensing practice

1. Good Dispensing Practices
2. Processing and response to prescriptions
3. Concordance and compliance
4. Extemporaneous preparations
5. Labeling dispensed preparations and products

Key considerations in dispensing to special populations

1. Paedeatrics
2. Infants
3. Pregnant mothers
4. Nursing mothers
5. Geriatrics

Rational Drug Use

1. Definition of rational use of medicines
2. The medicine use process
3. Aspects of irrational use
4. Factor underlying irrational use of medicines
5. Consequences of irrational use
6. Strategies to improve use of medicines

Field tours to the various practice areas (Practicals)

1. To the community pharmacy
2. To the hospital pharmacy
3. To the industry
4. To the drug shops
5. To the natural ethnobotany gardens
6. To National Medical Stores/ Joint Medical Stores
7. To National Drug Authority

19. PHARMACOGNOSY AND ALTERNATIVE SYSTEMS OF MEDICINE PLACEMENT

COURSE DESCRIPTION

This course unit provides hands-on experience in identification, taxonomic, processing and application of plants that contain medicines, and alternative systems of medicine.

LEARNING OUTCOMES

By the end of the course unit, the student should be able to do the following;

4.1 Identify taxonomic and other distinguishing features of plants from which drugs may be derived
4.2 Process herbs and natural products into medicines.
4.3 Preparation of a herbarium.
4.4 Appreciate and apply alternative system of medicine in practice.

COURSE CONTENT

Placements with herbalists and people practicing traditional medicine.

20. BASIC INORGANIC AND PHYSICAL CHEMISTRY

COURSE DESCRIPTION

This course encompasses aspects of physical and inorganic chemistry. It consists of both theory and practical components and will be delivered in form of lectures, practicals, tutorial sessions and self-directed learning.

EXPECTED LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Describe the various concepts in physical chemistry i.e. thermodynamics, reaction kinetics and electrochemistry.
2. Describe periodicity, periodic properties of elements in the periodic table, atomic and molecular structures.

COURSE CONTENT

Electrochemistry

a) Electrolytes
b) Equilibrium in electrochemical cells
c) Application of conductance measurement (conductimetric titrations and determination of solubility of a sparingly soluble salt)
d) Chemical equilibrium
e) Equilibrium constants
f) Le-Chatelier's principle

Ionic equilibria in solution

a) Acids and bases
b) Self-ionization of water
c) Hydrolysis of salts
d) Solubility of sparingly soluble salts, acid base indicators, buffer solutions

Chemical kinetics

a) Effect of concentration
b) The activated complex
c) Effect of temperatures
d) Catalysis
e) Studying mechanism of a reaction
f) Order and molecularity of reaction.

g) Phase equilibria
h) One component phase diagram
i) Gibbs' phase rule
j) Clapeyrons equation
k) Binary Solutions
l) Partial immiscibility
m) Colligative properties of solutions
n) Formation of a solid solution
o) Properties of gases

Inorganic chemistry

a) Atomic structure and the periodic table
b) Periodic properties of elements of the periodic table
c) Valence bond theory
d) Molecular orbital theory
e) Valence bond theory and complexes
f) The application of these theories in the determination of structures.

Practicals

a) Potentiometric titration of a weak acid with a strong base
b) Potentiometric titration of a weak base with a strong acid
c) Determination of solubility of a sparingly soluble salt
d) Determination of rate and order of reaction
e) Acid-base titration experiment involving a strong acid and a strong base
f) Determination of boiling and melting points of a chemical substance

21. PHARMACY PRACTICE – UNITS OF MEASUREMENTS AND CALCULATIONS IN PHARMACY

1. COURSE DESCRIPTION

This course covers fundamental concepts in pharmaceutical calculations, using specific gravity to weigh and measure volumes of solvents and solutions, weights and measures, various ways of expressing concentration of active drug substances in drug formulations, calculation doses for adult and pediatric patients, preparation of isotonic solutions, active drug moiety as well as reducing and enlarging drug formulas.

EXPECTED LEARNING OUTCOMES

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

1. Convert common fractions, decimal fractions, and percentages to their corresponding equivalent expressions and apply each in calculations.
2. Demonstrate an understanding and application of the International System of Units.
3. Define *density*, *specific gravity*, and *specific volume* and determine each through appropriate calculations
4. Apply percent strength and ratio strength to calculate the quantity of an ingredient to use in compounding a pharmaceutical preparation.
5. Calculate doses based on factors of age, body weight, and body surface area.
6. Perform the calculations required to prepare isotonic compounded prescriptions.
7. Calculate problems involving milliequivalents, millimoles and milliosmoles, active drug moiety in compounding procedures, reduction or enlargement of formulas for pharmaceutical preparations stated in metric quantities and in proportional parts, differentiation and integration

COURSE CONTENT

Fundamentals of pharmaceutical calculations

1. Common and decimal fractions
2. Exponential notations
3. Ratios
4. Proportions
5. Significant figures
6. Rules for rounding

Weights and measures

1. The metric system (metric weights, metric volume)
2. Other systems of weights and measures (household, avoirdupois, apothecary)

Calculations involving Density, specific gravity and specific volume

1. Density versus specific gravity
2. Calculating specific gravity of liquids
3. Use of specific gravity in calculation of weight and volume

4. Calculation of specific volume

Expressions of concentration

1. Percentage strength (percentage weight-in-weight, percentage weight-in-volume, percentage volume-in-volume)
2. Calculation of percentage strength by allegation (allegation alternate, allegation medial)
3. Ratio strength
4. Parts per million (PPM) and parts per billion (PPB)

Altering product strength, and use of stock solutions

1. Dilution and concentration of liquids
2. Stock solutions
3. Dilution of acids

Calculation of doses

1. General dose calculations
2. Dosage based on age
3. Dosage based on weight
4. Dosage based on body surface area

Calculations involving isotonicity adjustment

1. Physical/chemical considerations in preparations of isotonic solutions
2. Calculation of I factor
3. Calculation of sodium chloride equivalent (E)
4. Using sodium chloride equivalent method to adjust tonicity of hypotonic solutions
5. Use of freezing point data in isotonicity calculations

Calculations involving solutions containing charged species (Electrolytes)

1. Milliequivalents,
2. Millimoles
3. Milliosmoles

Calculation of active drug moiety

1. Calculations of Atomic and Molecular Weights
2. Calculations of Chemically Equivalent Quantities
3. Calculations of Active Drug Moiety Equivalence

Enlarging and reducing formulas

1. Calculations of Reducing and Enlarging Formulas
2. Calculation of a Formula Expressed in Parts

Linear transformations and matrices, permutations and combinations

Calculus

1. Integration
2. Fourier and Laplace transformations in calculus.

Refractional and Multiple Prefixes

Relationships between weights and measures

21. ORGANIC CHEMISTRY

COURSE DESCRIPTION

This course consists of both theory and practical components. It introduces the student to key concepts of organic chemistry such as homologous series, functional groups and their reactivities, aliphatic & aromatic compounds, heterocyclics, stereochemistry, polymers, and synthetic organic chemistry.

EXPECTED LEARNING OUTCOMES OF THE COURSE

At the end of this course, the student is expected to:

1. Identify the various types of functional groups present in organic compounds and their nomenclature
2. Describe the chemical reactions undergone by different functional groups present in organic compounds
3. Describe mechanisms of reactions undergone by various functional groups in chemical compounds
4. Define a heterocyclic compound and state what heteroatoms are commonly present in heterocyclic compounds
5. Describe the nomenclature of heterocyclic compounds
6. Define the terms used in stereochemistry including: isomerism, isomers, geometrical isomerism, epimers, chiral carbon, chirality, stereoisomerism, optical activity, optical rotation, enantiomers, diastereomers, racemates, resolution, and enantiomeric purity, etc.

DETAILED COURSE CONTENT

Aliphatics

1. Alkanes, alkenes, alkynes
2. Alcohols and ethers
3. Aldehydes, ketones, and carboxylic acids
4. Esters and amides
5. Amines and alkylhalides
6. Nitriles and thiols

Aromatics

1. Benzenoids and their reactions
2. Aromatic amino acids
3. Anilines
4. Aromatic sulphonic acids
5. Phenols
6. Non-benzenoid aromatic compounds
7. Heterocyclic compounds
8. The 5 membered ring compounds (furan, thiophene, pyrrole), 6-membered (pyridine)

Stereo Chemistry

1. In natural products
2. Polarisation of light
3. The use of Nicol prism in measurement of optical rotation and the calculations involved
4. Tartaric acid
5. Lactic acid
6. The synthesis
7. Resolution of racemic mixtures
8. Synthesis of a new asymmetric centre
9. Correlation and conventions

Racemisation

1. Epimers
2. Quasi racemetes
3. Compound with dissimilar asymmetric carbon atoms (chiral centre)
4. Walden inversion
5. Geometric isomerism
6. Stereoisomerism of cyclic compounds

7. Asymmetric molecules
8. Allene isomerism

Poly functional aliphatic compounds

1. Dienes
2. Diols
3. Oxiranes (epoxides)
4. Dicarbonyl compounds
5. Dicarboxylic acids
6. The applications of diels-alder reaction
7. Michael addition
8. Diekmann condensation
9. Taumerism
10. Oximes
11. Polymerization

Heterocyclics

1. 3-membered
2. 4-membered
3. 5-membered
4. 6-membered
5. Fused systems

Practicals

1. Organic analysis: identification of simple unknown organic compounds
2. Organic preparations:
    a) Benzoic acid
    b) Aspirin
    c) Acetanilide
    d) Iodoform
    e) 3 – Nitrophthalic acid
    f) Benzhydrol
    g) 2, 4 – Dinitrochlorobenzene

22. APPLIED MICROBIOLOGY

COURSE DESCRIPTION

This course builds on earlier microbiology courses by integrating students' knowledge of structure and behavior of microorganisms with clinical symptoms, management, prevention and control of microbial infections due to bacteria, viruses and fungi.

EXPECTED LEARNING OUTCOMES

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

1. Classify, characterize and describe the pathophysiology of infections caused by medically important bacteria, fungi and viruses.
2. Describe the principles of laboratory methods and diagnosis of pathogenic organisms.

COURSE CONTENT

Clinical Bacteriology

a) Bacterial infections of GIT: Infections of the Teeth, Jaw, Mouth, Esophagus and stomach; Osteomyelitis, Gastroenteritis, Diarrhoea, Dysentery
b) Bacterial Infection of the Blood & Lymphatic System: Bacteraemia, and Septicaemia
c) Bacterial/fungal Disease of the Central Nervous System (CNS): Meningitis
d) Cardiovascular System Infections, Pericarditis, Myocarditis, Infective Endocarditis
e) Bacterial/fungal Soft Tissue Infection: Staphylococus infections, Streptococcus infections
f) Mycobacterial infections: Otitis, Pharyngitis, Epiglottitis, Laryngitis and Laryngotracheitis, Bronchitis and Bronchiolitis Whooping Cough (Pertussis), Pneumonia, Pulmonary Tuberculosis
g) Bacterial Infections of the Genital Tract:
    i. Diseases characterized by genital ulcers, urethritis and cervicitis
    ii. Diseases characterized by vaginal discharge
h) Pelvic inflammatory Disease (PID), Epididymitis, Proctitis, Proctocolitis,Prostatitis, Vaginitis and Enteritis, Syphilis, Chancroid or soft chancre soft chancre Disease, *Granuloma inguinale*, *Lymphogranuloma Venereum*, Gonorrhea, Nongonococcal urethritis (NGU), Chlamydial infections
i) The Urinary Tract: Urethritis: Gonococcal and Nongonococcal urethritis (NGU); Chlamydial infections, Cystitis and Pyelonephritis

Clinical Mycology

a) Fungal infections of GIT: Infections of the teeth, jaw, mouth, esophagus and stomach
    i. Oro-pharyngeal-candidiasis, dental caries, osteomyelitis, infection of the supporting structures of the teeth, fungal infections of GIT: Intestinal infections
b) Fungal infection of the blood & lymphatic system: Fungemia and Septicaemia
c) Fungal disease of the central nervous system (CNS)

i. Meningitis, cardiovascular system infections

d) Bacterial/fungal soft tissue infection
   i. Phaeohyphomycosis: Dermatophytes, Onychomycosis, Dermatomycosis, Piedra, Mycetoma, Chromoblastomycosis, Lobomycosis,
e) Other Respiratory System Infections
   i. Otitis, Pharyngitis, Epiglottitis, Laryngitis and Laryngotracheitis, Histoplasmosis, *Coccidioides immitis*,*Blastomyces dermatitidis*, Paracoccidioides, Cryptococcus infections.
f) Diseases Characterized by:
   i. Genital Ulcers, Urethritis and Cervicitis
   ii. Diseases Characterized by Vaginal Discharge
   iii. Pelvic inflammatory Disease (PID), Epididymitis, Proctitis, Proctocolitis, Prostatitis, Vaginitis and EnteritisDisease, *Granuloma inguinale*, *Lymphogranuloma venereum*.

Clinical Virology

a) Parvovirus & adenovirus
b) Poxvirus
c) Herpes viruses: HSV-1, HSV-2, VZV, CMV, EBV etc.
d) Orthomyxoviruses & Rhabdoviridae
e) Paramyxovirus & Rubella viruses
f) Coronaviruses
g) Viral hepatitis
h) Picornaviruses
i) Viral gastroenteritis
j) Arboviruses & HFV
k) Oncogenic viruses
l) Retroviruses & HIV infection
m) Prions & Other slow viruses

Each of the topics above is to be discussed under the following sub-heading; etiology, Epidemiology, pathogenesis, clinical presentation, lab diagnosis, treatment and prevention.

23. PHARMACOGNOSY – SECONDARY METABOLITES

COURSE DESCRIPTION

The course offers details on basic metabolic pathways in plants and animals. These pathways are the origins of secondary metabolites. It also contains crude drug active principles (secondary metabolites),examples of natural products with these active principles, botanical sources, geographical sources, methods of extraction of these active principles and their

medicinal values. It also entails extraction and isolation techniques in phytochemical screening of herbal medicines.

Learning Outcomes
By the end of this course the students should be able to:

1. Identify the main and various chemical groups of active principles of official crude drugs
2. Describe vernacular names, botanical and geographical source, historical development and standards of official crude drugs
3. Describe conditions for cultivation and collection of crude drugs
4. Describe organoleptic, macroscopic, microscopic, chemical methods of identification and chemical constituents
5. Discuss the pharmacological and commercial significance of crude drugs
6. Distinguishes official drugs from adulterants
7. Describe the biosynthetic pathways involved in the production of secondary metabolites
8. Identify the powder ingredients of crude drugs

COURSE CONTENT

Basic metabolic pathways and the origin of secondary metabolites

1. General description,
2. Enzymes
3. Glycosides
4. Fats and fatty acids
5. Aromatic biosynthesis (shikimic acid pathway, acetate pathway)
6. Peptides and proteins
7. Isoprenoid compounds
8. Stress compounds.

Groups of active principles

1. Hydrocarbons
2. Acids (tamarind pulp, benzoin)
3. Alcohols
4. Esters
5. Balsam (balsam of Peru, balsam of Tolu)
6. Fats and fixed oils (almond oil, arachis oil, olive oil, cottonseed oil, linseed oil, castor oil, wool fat)
7. Waxes (yellow beeswax, white beeswax, carnauba wax)

8. Carbohydrates
    a) General description.
    b) Sugars (mono, di, tri, tetra and polysaccharides)
    c) Commercial plant-derived fibres and products (cotton, absorbent cotton wool)
    d) Starches
    e) Algal gelling agent (alginic acid, agar)
    f) Gums and mucilages (tragacanth, sterculia gum, acacia gum, psyllium
    g) Miscellaneous (honey)
9. Phenols and phenolic glycosides
    a) General description
    b) Simple phenolic compounds (coal tar, vanilla and vanillin, capsicum)
    c) Tannins (oak bark, galls and tannic acid, hamamelis leaf, catechu)
    d) Coumarins and glycosides
    e) Anthraquinones (senna leaf; senna leaf and pods; rhubarb; aloe)
    f) Flavone and related flavonoid glycosides (birch leaf)
    g) Anthocyaninides and glycosides (bilerry fruit)
    h) Stilbenes
    i) Liganans and lignin
10. Saponins, cardioactive drugs and other steroids
    a) General description, biogenesis of steroid saponins, natural steroids for the production of pharmaceuticals.
    b) Pentacyclic triterpenoid saponins.
    c) Cardioactive drugs; Cardenolides (digitalis leaf, digitalis lanata leaf), Bufadienolides, other steroids.
11. Cyanogenetic glycosides, glucosinolate compounds, cysteine derivatives and miscellaneous glycosides
    a) Cyanogenetic glycosides (general description, biogenesis, wild cherry bark)
    b) Glucosinolate compounds (mustard seed)
    c) Cysteine derivatives (garlic)
    d) Miscellaneous glycosides.
12. Volatile oils and resins
    a) General description
    b) Biogenesis
    c) Production
13. Terpenes and Terpenoids (oil of rose, peppermint leaf and peppermint oil, rosemary leaf and rosemary oil, lavender flower and lavender oil, dill and dill oil, bitter orange peel, orange oils, coriander and coriander oil, colophony resin and turpentine, lemon

oil, cinnamon and cinnamon oil, natural camphor, clove and clove oil, eucalyptus leaf and eucalyptus oil, ginger wormwood.

a) Resins, gum-resins and similar substances (myrrh, asafetida, colophony, jalap)
b) Volatile oils in aromatherapy
c) Alcohol volatile oils

14. Isoprenoids
    a) General description,
    b) Monoterpenes Iridoids (gentian, centaury, valerian root, Devil's claw)
    c) Sesquiterpens (arnica flowers, feverfew, artemisinin, gossypol)
    d) Diterpenoids (ginkgo)
    e) Sesterterpenes
    f) Triterpenoids (quassia wood, black horehound)
    g) Tetraterpenes – Carotenoids
    h) Polyterpenoids (rubber, gutta-percha)
15. Alkaloids
    a) General description, classification, tests, extraction, functions
    b) Ornithine-derived alkaloids (tropane alkaloids, biogenesis, stramonium leaf, hyoscyamus leaf)
    c) Belladonna leaf, coca leaf and cocaine
    d) Lysine-derived alkaloids (lobelia, pomegranate, pepper, lycopodium)
    e) Protoalkaloids (ephedra, khat)
    f) Benzylisoquinoline derivatives (opium, curare)
    g) Tetrahydroisoquinoline monoterpenoid alkaloids and glycosides (ipecacuanha, cocillana)
    h) Phenethylisoquinoline alkaloids (colchicum seed and corm)
    i) Tryptophan-derived alkaloids (biogenesis, ergot, calabar bean, *nux vomica*, rauwolfia, African rauwolfia, cinchona
    j) Imidazole alkaloids (jaborandi leaf)
    k) Purine alkaloids (cocoa seed)
    l) Reduced pyridine alkaloids (hemlock fruit, areca nut)
    m) Terpenoid alkaloids (aconite root)
    n) Steroid alkaloids (veratrum, kurchi bark)

General methods of phytochemical investigation of herbal products

1. General description
2. Extraction of plant material
3. Separation and isolation of constituents
4. Characterization of isolated compounds

Practicals

1. General consideration about morphology, microscopy and powder analysis of crude drugs.
2. *Morphology and microscopic study of Roots and rhizomes (Ginger, Rauwolfia)*
3. *Morphology and microscopic study of Stem (Ephedra)*
4. *Morphology and microscopic study of Flower bud (Clove)*
5. *Morphology and microscopic study of Fruit (Fennel)*
6. *Morphology and microscopic study of Seed (Nux vomica)*
7. *Morphology and microscopic study of Bark (Cinnamon bark, Cinchona bark)*
8. *Morphology and microscopy of Wood (Quassia)*
9. *Morphology and microscopic study of Leaf (Datura, Vinca, Eucalyptus, Senna)*
10. *Morphology of Unorganized (acellular) crude drugs (Agar, Tragacanth, Colophony, Talc, Kaolin, Bentonite, Aloes, Asfoetida, Benzoin, Black catechu, Myrrh, Myrobalan)*
11. *Morphology of fibres (Cotton, Wool, Silk, Glass wool)*
12. Qualitative chemical tests for primary and secondary constituents of crude drugs
    a) Carbohydrates (General test, reducing sugars, starch, gums, mucilages)
    b) Proteins
    c) Fats and oils
    d) Steroids
    e) Tannins
    f) Volatile oils
    g) Glycosides (cardiac, anthraquinone, C-glyco, saponins, cyanogenetic, coumarins, flavonoids)
    h) Alkaloids
13. Extraction of active principles from crude drugs
    a) Extraction of starch from potatoes
    b) Extraction of solanin from potatoes
    c) Extraction of calcium citrate from Lemon
    d) Extraction of pection from orange peels
    e) Extraction of curcumin from turmeric powder
    f) Extraction of caffeine from tea leaves
    g) Isolation of volatile oil from *E. leaves*
    h) Extraction of oleo-resin from ginger
    i) Extraction of volatile oil from Fennel
    j) Extraction of hesperidin from dried orange peels
    k) Extraction of quinine from cinchona bark
14. Identification of crude drugs (name, source and uses of various crude drugs)

15. Testing some of these extracts containing secondary metabolites on animal models such as mice, rats, rabbits and/or guinea pigs. Some of the tests include:
    a) Analgesic tests e.g tail flick pain tests, acetic acid induced pain tests in mice and formalin induced pain tests.
    b) Anti-inflammatory tests using cotton thread and plethysmometer with fresh egg albumin, carrageenan, histamineand serotoninas inflammatory agents.
    c) Anti-pyretic tests using industrial yeast as inducer of pyresia.
    d) Anti-diarrhoea tests using dropping, enteropooling and charcoal intestinal transit models.
    e) Anti-ulcer tests.
    f) Acute, subacute/subchronic and chronic toxicity tests.

24. PHARMACEUTICS – TECHNOLOGY OF UNIT PROCESSES

COURSE DESCRIPTION

This course covered the basic theories and unit processes encountered in pharmaceutical production. The course discusses thesignificance and application of these unit processes in pharmaceutical formulation.

EXPECTED LEARNING OUTCOMES

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

1. Describe unit processes, their significance and application in pharmaceutical formulation.
2. Describe solubility and solutions
3. Explain fluid mechanics
4. Explain interfacial phenomena and activity
5. Describe surface-active agents and their use in pharmaceutical formulation.
6. Describe pharmaceutical pre-formulation and its significance.

COURSE CONTENT

Unit processes used in pharmacy

a) Dissolutions
b) Solubilisation
c) Distillation
d) Evaporation
e) Drying
f) Crystallization

g) Particle size reduction
h) Mixing
i) Sterilization (including steriliser design and operation)
j) Surface and interfacial phenomena
k) Surface-active agents
l) Granulation
m) Packaging (primary and secondary packaging)

Solubility

a) Intrinsic solubility
b) Dissolution rate constant
c) Factors affecting solubility
d) Mechanisms of dissolution and solubility constants

Solubilisation

a) Definition
b) Mechanisms
c) Processes
d) Commonly used solubilizing agents
e) Dissolution, solubility and solubilization
f) Solutions
   i. Classification of solutions
   ii. Solution phase equilibria
   iii. Solid–liquid solutions
   iv. Liquid solutions
   v. Gas-liquid solutions
   vi. Solid-solid solutions

Distillation

a) Processes and techniques
b) Apparatus used and applications

Evaporation

a) Processes and techniques
b) Equipment used
c) Factors affecting evaporation and applications

Drying

a) Principles
b) Processes and techniques of drying

c) Equipments used
d) Factors affecting drying and application

Mixing

a) Theory of mixing
b) Mixing of powdered materials
c) Mixing of miscible liquids and suspensions
d) Mixing of semi-solids

Particle size reduction and sieving

a) The need of particle size reduction
b) Methods
c) Techniques and equipment uses
d) Sieving
e) Processes
f) Techniques and equipment used in sieving
g) Sieves and powder classification
h) Methods and equipment used for dust control

5.9. Sterilization

a) Processes of sterilization and techniques in used in sterilization
b) Physical methods
c) Chemical methods
d) Air purification methods
e) Techniques and their applications

Adsorption

a) Types
b) Processes and their importance and application in pharmacy

Crystallization

a) Types
b) Processes
c) Techniques and their importance and application in pharmacy

Surface and interfacial phenomena

a) Surface tension and surface free energy

Biphasic/Multiphasic Systems

a) Liquid-vapour systems

b) Liquid-liquid systems
c) Solid-vapour systems
d) Solid-liquid systems
e) Solid-liquid-vapour systems

Surface activity and surface-active agents

a) Properties of surface-active agents
b) Surface-active agents and their use in pharmacy

Rheology (fluid mechanics)

a) Definition of Rheology
b) Characteristics of fluids
c) Viscosity and its determination
d) Newtonian fluids
e) Non-Newtonian fluids
f) Application of rheology in pharmacy

25. BASIC PHARMACOLOGY

COURSE DESCRIPTION

This course is both theoretical and practical. Introducing students to basic pharmacology, some common terms used in pharmacology to make it easy for a student to understand pharmacology

LEARNING OUTCOMES

Upon completion of this course the student should be able to:

1. Describe and explain the basic principles governing the pharmacokinetic and pharmacodynamic action of drugs.
2. Classify adverse drug reactions and describe pharmacogenetic factors that affect the patient's response to drug effects.
3. Understand the principles and processes of drug development and extrapolate it to development of a local product.
4. Classify drugs used to modify and treat conditions affecting the functioning of the autonomic nervous system.
5. Perform basic experimental techniques involving effects of drugs on the autonomic nervous system.

COURSE CONTENT

Introduction to pharmacology

1. Definitions and basic concepts in pharmacology

Routes of drug administration

1. Enteral routes of drug administration: Their merits and demerits
2. Parenteral routes of drug administration: Their merits and demerits
3. Topical routes of drug administration: Their merits and demerits
4. Special routes

Pharmacodynamics

1. Definitions and basic concepts
2. Signal transduction in cells as basis of drug action
3. Receptors and drug-receptor interactions
4. Dose-response relationships
5. The concepts of potency, efficacy, full and partial agonists
6. Drug antagonism
7. Relation between drug dose and clinical response
8. Concepts of tolerance and drug dependence

Basic & clinical principles of pharmacokinetics

1. Definition of terms in pharmacokinetics
2. Drug absorption and factors affecting drug absorption
3. Drug distribution and factors affecting drug distribution
4. Drug metabolism and factors affecting drug metabolism
5. Drug excretion and factors affecting drug excretion

Adverse drug reactions and Pharmacogenetics

1. Terminology involved
2. Classification of adverse drug reactions
3. Influence of genetic variability to response to drugs
4. Examples of genetic disorders influencing response to drugs

Autonomic nervous system pharmacology

1. Review of anatomy and physiology of autonomic nervous system
2. Principles of neurotransmission with emphasis on relation to action of drugs
3. Drugs affecting the cholinergic system
    a) Cholinergic neurotransmission
    b) Cholinergic receptors
    c) Cholinergic agonists and antagonists
4. Drugs affecting the adrenergic system
    a) Noradrenergic neurotransmission
    b) Adrenergic receptors
    c) Adrenergic agonists and antagonists

Autacoid pharmacology

1. Histamine: agonists and antagonists
2. 5-Hydroxytryptamine (serotonin)
3. The eicosanoids
4. Kinins and cytokines
5. The renin angiotensin aldosterone system
6. Nitric oxide
7. Substance P
8. Neuropeptides

Fundamental principles of drug development

1. Preclinical development:
   a) Acute toxicity evaluation: Oral, intraperitoneal, dermal, inhalation
   b) Sub-acute toxicity evaluation
   c) Sub-chronic toxicity evaluation
   d) Chronic toxicity evaluation
2. Clinical development: The four phases of clinical trials

Practicals in pharmacology

1. Introduction to experimental pharmacology and laboratory setup
2. Video aided pharmacology practicals on drug action on autonomic nervous system

26. COMPARATIVE VETERINARY ANATOMY AND PHYSIOLOGY

COURSE DESCRIPTION

It describes and explains different animals and their groupings and naming. Their parts, systems and how they function in comparison to human beings.

EXPECTED LEARNING OUTCOMES

1.1 Should be able to group animals based on their anatomy or physiology.
1.2 Compare and contrast the different parts, organs and their functions of different animals among themselves and to those of human beings.
1.3 Compare and contrast systems and their functioning among different animals and to those of human beings.

COURSE CONTENT

1. Classification of vertebrates
2. Terminologies in groupings and naming animals
3. Different Animal anatomy and body parts.

4. Differences in animal organs, systems and their functions
    a. Digestive system,
    b. Genitourinary system,
    c. Respiratory system,
    d. Blood and cardiovascular system
    e. Neuromuscular system
    f. Skeletal system and locomotion,
    g. Skin.
    h. Liver.

27. INDUSTRIAL PHARMACY AND PHARMACEUTICAL PRODUCTION PLACEMENT

COURSE DESCRIPTION

This course is about hands-on experience in processing and manufacture of medicines, pharmaceuticals and cosmetics products. This includes Quality assurance of products, production and manufacturing plants for medicines, pharmaceuticals and cosmetics products.

EXPECTED LEARNING OUTCOMES

Makes one able to carry out procedures in manufacturing, production and quality assurance of pharmaceuticals and cosmetics.

COURSE CONTENT

Placements in pharmaceutical or cosmetics manufacturing facilities, which make at least three different poducts.

28. PHARMACEUTICAL BIOTECHNOLOGY

COURSE DESCRIPTION

This course basically deals with the use of microorganisms in the production of useful products for use as vaccines, pharmaceuticals, hormones, beverages or foods, etc.

EXPECTED LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Explain the use of microorganisms in production of valuables substances.
2. Explain the role of microorganisms in keeping the environment clean.
3. Explain the processes of cell and tissue culture.

COURSE CONTENT

1- **Microbial metabolism**
2- **Microbial cultivation**
    a) Culture media and its short history.
    b) Cultivation methods.
3- **Introduction: Scope of biotechnology and industrial microbiology**
    a) Nature of biotechnology and industrial microbiology.
    b) Characteristics of industrial microbiology:
        i. Industrial vs medical microbiology.
        ii. Multi-disciplinary or team-work nature of industrial microbiology.
        iii. Obsolescence in industrial microbiology.
        iv. Free communication of procedures in industrial microbiology.
    c) Patents and intellectual property rights in industrial microbiology and biotechnology.
    d) The use of the word 'fermentation' in industrial microbiology.
    e) Organizational set-up in an industrial microbiology establishment.
4- **Some microorganisms commonly used in industrial microbiology and biotechnology**
    a) Basic nature of cells of living things.
    b) Classification of living things: three domains of living things.
    c) Taxonomic grouping of micro-organisms important in industrial microbiology and biotechnology.
        i. Bacteria.
        ii. Eucarya: fungi.
    d) Characteristics important in microbes used in industrial microbiology and biotechnolgy.
5- **Aspects of molecular biology and bioinformatics of relevance in industrial microbiology and biotechnology**
    a) Protein synthesis.
    b) The polymerase chain reaction.
        i. Some applications of PCR in industrial microbiology and biotechnology.
    c) Microarrays.
        i. Applications of microarray technology.
    d) Sequencing of DNA.
        i. Sequencing of short DNA fragments.
        ii. Sequencing of genomes or large DNA fragments.
    e) The open reading frame and the identification of genes.
    f) Metagenomics.
    g) Nature of bioinformatics.
        i. Some contributions of bioinformatics to biotechnology.
6- **Industrial media and the nutrition of industrial organisms**
    a) The basic nutrient requirements of industrial media.
    b) Criteria for the choice of raw materials used in industrial media.
    c) Some raw materials used in compounding industrial media.
    d) Growth factors.
    e) Water.

f) Some potential sources of components of industrial media.
    i. Carbohydrate sources.
    ii. Protein sources.
g) The use of plant waste materials in industrial microbiology media:
    i. Saccharification of polysaccharides.
    ii. Starch.
    iii. Cellulose, hemi-celluloses and lignin in plant materials.

7- Metabolic pathways for the biosynthesis of industrial microbiology products

a) The nature of metabolic pathways.
b) Industrial microbiological products as primary and secondary metabolites.
    i. Products of primary metabolism.
    ii. Products of secondary metabolism.
c) Trophophase-idiophase relationships in the production of secondary products.
d) Role of secondary metabolites in the physiology of organisms producing them.
e) Pathways for the synthesis of primary and secondary metabolites of industrial importance.
    i. Catabolism of carbohydrates.
    ii. The catabolism of hydrocarbons.
f) Carbon pathways for the formation of some industrial products derived from primary metabolism.
    i. Catabolic products.
    ii. Anabolic products.
g) Carbon pathways for the formation of some products of microbial secondary metabolism of industrial importance.

8- Overproduction of metabolites of industrial microorganisms

a) Mechanisms enabling microorganisms to avoid overproduction of primary metabolic products through enzyme regulation:
    i. Substrate induction.
    ii. Catabolite regulation.
    iii. Feedback regulation.
    iv. Amino acid regulation of RNA synthesis.
    v. Energy charge regulation.
    vi. Permeability control.
b) Derangement or bypassing of regulatory mechanisms for the over-production of primary metabolites:
    i. Metabolic control.
    ii. Permeability.
c) Regulation of overproduction in secondary metabolites:
    i. Induction.
    ii. Catabolite regulation.
    iii. Feedback regulation.
    iv. ATP or energy charge regulation of secondary metabolites.

d) Empirical methods employed to disorganize regulatory mechanisms in secondary metabolite production.

9- Screening for productive strains and strain improvement in biotechnological organisms

a) Sources of microorganisms used in biotechnology:
   i. Literature search and culture collection supply.
   ii. Isolation *de novo* of organisms producing metabolites of economic importance.

b) Strain improvement:
   i. Selection from naturally occurring variants.
   ii. Manipulation of the genome of industrial organisms in strain improvement.

10- The preservation of the gene pool in industrial organisms: culture collections

a) The place of culture collections in industrial microbiology and biotechnology.
b) Types of culture collections.
c) Handling culture collections.
d) Methods of preserving microorganisms.
   i. Microbial preservation methods based on the reduction of the temperature of growth.
   ii. Microbial preservation methods based on dehydration.
   iii. Microbial preservation methods based on the reduction of nutrients.
   iv. The need for experimentation to determine the most appropriate method of preserving an organism.

11- Fermentors and fermentor operation

a) Definition of a fermentor.
b) The aerated stirred tank batch fermentor:
   i. Construction materials for fermenters.
   ii. Aeration and agitation in a fermentor.
   iii. Temperature control in a fermentor.
   iv. Foam production and control.
   v. Process control in a fermentor.
c) Anerobic batch fermentors.
d) Fermentor configurations:
   i. Continuous fermentations.
e) Fed-batch cultivation.
f) Design of new fermentors on the basis of physiology of the organisms: air lift fermentors.
g) Microbial experimentation in the fermentation industry: the place of the pilot plant.
h) Inoculum preparation.
i) Surface or solid state fermentors.

12. Use of microorganisms in production of important products

1. Alcoholic beverages
2. Yeast products
3. Fermented foods
4. Antibiotics

5. Enzymes
6. Organic acids
7. Acetone-butanol
8. Treatment of organic wastes

13. Production of human insulin by genetic manipulation

14. Production of hepatitis B vaccine by genetic manipulation

15. Steroid transformation by microorganisms

16. Production of monoclonal antibodies using cell-line

17. Maintenance and stimulation of microorganisms and cell line used in biotechnology (2 hrs)

18. Tissue culturing

1. Culture using protoplast fusion

19. Transgenic animals and plants in production

20. Enzymatic transformation of lipids

29. PHARMACEUTICAL MICROBIOLOGY – MICROBICIDES, ANTIBIOTICS AND APPLICATIONS

COURSE DESCRIPTION

This course is about biocides, antibiotics and antimicrobial surfaces. It describes the actions of biocides and these antimicrobials, factors influencing their actions and resistance towards them. It goes further to describe and explain their applications.

COURSE LEARNING OUTCOMES

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

1. Discuss the antimicrobials: Biocides, Antibiotics and Antimicrobial surfaces.
2. Discuss the factors that influence their actions.
3. Discuss resistance towards them and how to reduce.
4. Discuss their use in patient management and
5. Discuss their industrial use and other applications.

6. Perform validation of processes for microbial safety.

COURSE CONTENT

1- Introduction to pharmaceutical microbiology and the applications of pharmaceutical microbiology.

2- Planktonic and sessile (biofilm) growth and control strategies

a) Biofilm recalcitrance: theories and mechanisms
b) Microbial biofilms: consequences for health.

3- Enumeration of microorganisms

4- Biocides (microbicides)

a) Types of microbicidal and microbistatic agents.
b) Modes of action.
c) Microbes sensitivity and mechanisms of resistance to microbicides.
d) Chemical disinfectants, antiseptics and preservatives.
e) Factors affecting the activities of microbicides. Including dilution and concentration exponents. Temperature coefficients.
f) Calculations involving concentration and temperature coefficients.

NB: Fungicidal, protozoal, virucidal and viriodal microbicides are included here.

5- Antimicrobial surfaces and devices

a) Antimicrobial surfaces.
b) Antimicrobial devices.
c) Antimicrobial dressings.
d) Antimicrobial textiles and testing techniques.

6- Use of microbicides in other health sectors

a) Use of microbicides in disinfection of contact lenses.
b) Special issues in dentistry.

7- Disinfection for infection control

a) A pragmatic approach to judicious selection and proper use of disinfectant and antiseptic agents in healthcare settings.
b) Extended activity of healthcare antiseptic products.
c) Disinfectant rotation in a cleaning and disinfection program for clean rooms and controlled environment.
d) New technologies in disinfection and infection control.

8- Disinfectant and antiseptic use in critical clinical issues

a) Biofilms – costs and prevention.
b) Reprocessing flexible endoscopes: origin of standards.
c) Biofilms: consequences of biofilms on indwelling medical devices.
d) Infection-resistant implantable devices: biofilm problems and design strategies.
e) Infections of intracardiac devices.
f) Intrauterine devices: infections and biofilms.
g) Antimicrobial urinary catheters.
h) Risk factors for postoperative infectious complications after abdominal surgery.
i) Issues associated with the decontamination of laundry and clinical waste.

9- Industrial and other Applications of microbicides

10- Antiobiotics: Actions, Resiatnce, Clinical use and stewradship

11- Regulatory constraints on disinfectants and decontamination

a) Introduction, overview and issues.
b) Importance of inspections in the lifecycle of medicines

12- Current trends and new directions

a) Introduction.
b) Natural products.
c) Applications of bacteriophage technology.
d) The wider contribution of microbiology to the pharmaceutical sciences.

30. SYSTEMIC PHARMACOLOGY

COURSE DESCRIPTION

This course is mainly theoretical, focusing on the effects of drugs system by system and importantly on how drugs do modify the functioning of those systems.

EXPECTED LEARNING OUTCOMES

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

1. Describe and explain the functioning of chemical mediators in the CNS clearly bringing out the roles of the excitatory, inhibitory and modulatory pathways in the brain.

2. Describe the pathological conditions affecting the central nervous system
3. Be able to diagnose the conditions
4. Carefully choose drugs that can ably manage those conditions
5. Describe and explain the actions of analgesics; their clinical indications and contraindications
6. Describe and explain the actions of anaesthetics, both local and general
7. Describe and explain the actions of the hormonal system
8. Identify hormonal agents used as drugs for various conditions and describe their pharmacology.
9. Describe the effects of drugs on the cardiovascular system and safely prescribe drugs with effects on the cardiovascular system.
10. Effectively identify, describe and prescribe drugs that are effective on the gastrointestinal and respiratory system.
11. Describe important drugs for treatment and prevention of haematological disorders
12. Classify and describe drugs used in treatment of rheumatoid arthritis and gout

COURSE CONTENT

1. Drugs acting on central nervous system

a) Neurotransmission in the CNS
b) CNS stimulants
c) Neurodegenerative disorders: Drugs used in Parkinson's and Alzheimer's diseases
d) Sedative hypnotics
e) Drugs in the treatment of sleep disorders
f) Anti-epileptics (Anticonvulsants)
g) Major tranquilisers
h) Antidepressants
i) Analgesics: Opioid and non-opioid analgesics; Opioid antagonists
j) Anaesthetics: Local anaesthetic agents; General anaesthetic agents

2. Hormones and related drugs

a) Anterior pituitary hormones
b) Thyroid hormones and thyroid inhibitors
c) Insulin, oral hypoglycaemic drugs and glucagon

d) Corticosteroids
e) Gonadal hormones (sex hormones) and their antagonists
f) Oxytocin and drugs acting on the uterus
g) Drugs affecting calcium balance

3. Cardiovascular/ renal drugs

a) Diuretics and related renal drugs
b) Antihypertensive drugs
c) Drugs used in the treatment of congestive heart failure.
d) Antiarrhythmic drugs
e) Antianginal drugs

4. Gastrointestinal drugs

a) Drugs used in Peptic ulcer disease and gastrinomas
b) Drugs used to treat constipation: Prokinetic agents and laxatives
c) Antidiarrhoeal agents
d) Emetics and antiemetics
e) Drugs used in management inflammatory bowel disease

5. Respiratory drugs

a) Drugs used in asthma and chronic obstructive pulmonary disease
b) Anti-cough agents

6. Vitamins

7. Drugs affecting blood and blood formation

a) Anticoangulant, antiplatelet and fibrinolytic agents
b) Hypolipidaemic drugs and plasma expanders
c) Haemopoietic agents
d) Anti-anaemic agents

8. Anti-rheumatoid and anti-gout agents

9. Hands-on practicals

a) Evaluation of analgesic and anti-inflammatory effects
b) Phenobarbitone sleep-time demonstration
c) Evaluation of antidiabetic/ hypoglycaemic effect of drugs (including herbal products)
d) Action of drugs on ulcers in animal model
e) Anti-diarrhoeal activity of drugs in animal model

31. PHARMACY PRACTICE – PATIENT CARE, SETTINGS AND DEVICES MANAGEMENT

COURSE DESCRIPTION

This course is both theoretical, community and hospital pharmacy practice based, patient's focused and practical, and molds students for future licensure, certification, re-certification, research and internship programmes.

COURSE LEARNING OUTCOMES

At the end of this course, the student is expected to be able to:

1. Explain the various processes in community pharmacy practice
2. Explain the various processes in institutional pharmacy practice
3. Discuss the significance of patient compliance in improving therapeutic outcomes
4. Describe the essential drug concept
5. Distinguish the structural and administrative setups of a large pharmaceutical industry from those of the small scale compounding units in either a hospital or a community pharmacy on site.
6. Compare and contrast products from complementary and nutraceutical sources from the conventional dosage forms.
7. Illustrate the differences among selected specialized areas in pharmacy practice.
8. Explain the objectives, roles, organization, services and requirements for setting up a drug information centre in a particular needy community.
9. Describe the requirements and roles of a pharmacist in the dispensation of disaster management in pharmacy practice.

DETAILED COURSE CONTENT

Institutional pharmaceutical care and hospital pharmacy practice

1. Hospital structures (administrative)
2. Set ups
3. Hierarchies
4. Pharmacy department structure
5. In-hospital drug supplies and stocking
6. Pharmaceutical storage in wards
7. Clinical pharmacy

8. Hospital controlled drugs
9. Emergency medicine procedures
10. In-patient services
11. Out-patient services
12. Drug dosing and devices

Community Pharmacy Practice

1. Services provided by a community pharmacist
2. Organization of a community pharmacy
3. Administration of a community pharmacy
4. Supply and control of medicines
5. Financial control
6. Introduction to computer application in a community pharmacy
7. Ambulatory pharmaceutical care
8. Over the counter products (OTCs)
9. Pharmacy initiated therapy
10. Patient profiling and drug use review
11. Handling narcotic drugs
12. Diagnostic tests done by a pharmacist

Patient Adherence

1. Types and effects of non-compliance
2. Improving patient adherence
3. Communication in the practice of pharmacy and counseling during drug use.

The Essential drugs concept

1. Description and significance.

Complimentary and Nutritional therapy

1. Introduction/Definition
2. Reasons for CAM
3. Categories of CAM
4. Therapies using medicinal substances
5. Therapies not using medicinal substances
6. Therapies using both medicinal substances and other treatment
7. Regulation of CAM

Nutraceuticals

Specialized Areas of Pharmacy Practice

1. Oncology pharmacy practice
2. Cardiothoracic pharmacy practice
3. Paediatric pharmacy practice
4. Geriatric pharmacy practice
5. Drug use in pregnancy
6. Psychiatric pharmacy practice
7. Military pharmacy practice

Physiotherapy

1. Description of diseases best treated by physiotherapy
2. Effects of physiotherapy to the body (structural and physiological)
3. When to refer patients for physiotherapy

Radiotherapy

1. Description of diseases best treated by radiotherapy
2. Effects of radiotherapy to the body (structural and physiological)
3. When to refer patients for radiotherapy

Devices:Calibration, maintenance and handling

1. BP machines
2. Stethoscopes
3. Thermometers
4. Contraceptive devices e.g. IUDs

Drug Information

1. Definition and Objectives
2. Sources of drug information
3. Role of drug information in pharmacy practice
4. Organization and provision
5. Requirement for setting of drug information centre

Disaster Management Pharmacy Practice

1. Meaning of disaster
2. Disaster management

3. Factors affecting disaster management
4. Disaster management in pharmacy practice

32. THERAPEUTICS – ANTINEOPLASTICS AND ANTIINFECTIVES

COURSE DESCRIPTION

This course will be theoretical mainly. Practical where applicable will include visits to the hospital pharmacy to familiarize with the drugs themselves and encouraging the students to be in close contact with those in the laboratories to learn about culture and sensitivity testing while for their laboratory placement.

COURSE LEARNING OUTCOMES

The student who completes this course properly will be able to:

1. Explain the different chemotherapeutic agent used against pathologic infections.
2. Explain the different chemotherapeutic agents used in the treatment of neoplasms.
3. Prescribe/use drugs rationally and effectively and to educate the community members on rational drug use.

COURSE CONTENT

Introduction to chemotherapy

1. Mechanisms of action of chemotherapeutic agents
2. Resistance to chemotherapeutic agents

Antibacterial and antimycobacterial agents

1. Cell wall synthesis inhibitors
2. Protein synthesis inhibitors
3. Antifolate agents
4. DNA gyrase inhibitors
5. Miscellaneous agents
6. Anti-mycobacterial agents

Antifungal agents

1. Polyene antifungals
2. Azoles antifungals

3. Antimetabolytes
4. Echinocandins
5. Allylamines
6. Griseofulvin

Antiviral agents

1. Antiherpes, anti-Human Papilloma Virus and anti-Cytomegalovirus agents
2. Antiinfluenza agents
3. Antihepatitis agents

Antiretroviral agents

1. HIV replication/Pathogenesis
2. Fusion inhibitors
3. Nucleoside/nucleotide reverse transcriptase inhibitors
4. Non-nucleoside reverse transcriptase inhibitors
5. Integrase inhibitors
6. Protease inhibitors
7. Maturation inhibitors

Antiprotozoals

1. Antimalarial agents
2. Anti-trypanosomal agents
3. Anti-amoebic agents

Antihelmintics

1. Drugs for thread worms
2. Drugs for ascaricides
3. Drugs for tape worm infections
4. Drugs for hookworm infections
5. Schistosomicides
6. Filaricides
7. Drugs for cutaneous larva migrans
8. Drugs for strongiloidiasis

Antineoplastics

1. Cell cycle and cancer
2. Cytotoxic agents
3. Hormonal agents and biological response modifiers

General principles of therapeutics

1. Prescription order writing, its legal and professional importance
2. Essential drugs concept
3. Rational use of drugs I: principle of rational use of drugs
4. Rational use of drugs II: problems associated with irrational use of drug
5. Rational use of drugs III: quantitative and qualitative studies to identify irrational use of drugs.
6. Observational studies on indicators of irrational drug use
7. Rational use of drugs IV: interventional studies to improve rational use of drugs
8. Therapeutic drug monitoring
9. Guide to good prescribing practice I: concept of P drugs and the process of their selection
10. Guide to good prescribing practice II: using the P-drugs to treat patients
11. Guide to good prescribing practice III: patient instructions and follow-up process
12. Therapeutic monitoring
13. Legal and professional aspects of a prescription order
14. Other therapeutic practices; fluid therapy, nutritional therapy, immunotherapy, radio therapy, herbal therapy, yoga, faith healing etc.

Hands-on practicals

1. *In vitro* activity of antibacterial agent (including use of herbal extracts)
2. *In vitro* activity of antifungal agent (including use of herbal extracts)
3. Experiment on cytotoxic effects of drugs (including herbal extracts)

33. CLINICAL PHARMACY – INTRODUCTION TO PHARMACEUTICAL CARE, BIOPHARMACEUTICSAND CLINICAL LAB DATA

COURSE DESCRIPTION

This core course introduces the concepts and theories in pharmaceutical care. It prepares students for clinical work by providing information on roles of a clinical pharmacist in patient care, effect of disease conditions on pharmacokinetics and pharmacodynamics of drugs, and drug use in special groups.

COURSE LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Explain the concepts of clinical pharmacy and develop a pharmaceutical care plan
2. Integrate and apply knowledge obtained in the basic and pharmaceutical sciences to solve clinical problems.
3. Co-operate with other health workers in patient care.
4. Interpret clinical laboratory data
5. Describe the effect of disease conditions on the pharmacokinetics and pharmacodynamics of drugs

DETAILED COURSE CONTENT

Clinical pharmacy process

1. Definition of key terms:Clinical pharmacy, pharmaceutical care and medicines management
2. Roles of the Clinical Pharmacist or Clinical roles of the pharmacist Concepts and practice of pharmacy
3. Practical steps in the delivery of pharmaceutical care are (development of a pharmaceutical care plan)
4. Benefits of pharmaceutical care, Scope of pharmaceutical care
5. Components of pharmaceutical care
    a) Pharmacist-patient interactions (patient handling and counseling)
    b) Pharmacist work up of drug therapy
    c) Documentation of pharmaceutical care plan (FARM & SOAP notes)

Clinical applications of therapeutic drug monitoring

1. Definition of therapeutic drug monitoring
2. The purpose of therapeutic drug monitoring
3. Steps for monitoring drug therapy
4. Reasons for using clinical labs as monitoring tools
5. Case examples: Initial assessment of the patient
6. Therapeutic goal for the patient
7. How do I monitor the patient
8. Blood drug levels
9. Causes of adverse effects

10. Drug Interactions
11. Possible outcomes for therapeutic drug monitoring
12. Clinical relevance of therapeutic drug monitoring.

Pharmacist and primary health care

1. Definition of primary health care
2. Functions of a responsible primary health care system
3. Roles of the pharmacist in primary health care
4. Expanded roles of the pharmacist in primary health care
5. Challenges of the pharmacist in primary health care

Interpretation of clinical laboratory data

General Principles

1. Reference Ranges
2. Evaluating Laboratory Results (factors that affect lab results)
3. Test Reliability
4. Units of measure

Fluids and electrolytes

1. Sodium, Potassium, calcium, magnesium, phosphate, uric acid
2. Carbon Dioxide Content, chloride, Anion Gap, Blood Urea Nitrogen (BUN), creatinine, creatinine clearance, glomerular filtration rate (GFR), Glucose, Glycosylated Hemoglobin, Osmolality

Proteins

1. Prealbumin
2. Albumin
3. Globulin

Cardiac markers

1. Creatine kinase, Troponin, Myoglobin, Homocysteine, Lactate Dehydrogenase, Brain Natriuretic Peptide, C-Reactive Protein

Liver function tests

1. Aspartate Aminotransferase, Alkaline Phosphatase, Alanine Aminotransferase, Gamma-Glutamyl Transferase, Bilirubin

Hematology

2. Complete blood count
3. Red Blood Cells (Erythrocytes): Hematocrit, hemoglobin, red blood cell indices (Mean cell volume, mean cell hemoglobin), Reticulocytes, Erythrocyte Sedimentation Rate
4. White Blood Cells: neutrophils, lymphocytes, eosinophils, monocytes, basophils
5. Thrombocytes

Coagulation studies

1. Activated Partial Thromboplastin Time
2. Prothrombin Time
3. International Normalized Ratio

Urinalysis

1. Gross Appearance of the Specimen: Specimen pH, Specific gravity, Proteins
2. Microscopic examination

Miscellaneous tests

1. Prostate-Specific Antigen
2. Thyroid-Stimulating Hormone
3. Procalcitonin
4. Cholesterol and Triglycerides

Diagnostic procedures

Nutritional status

Key Concepts of Pharmacokinetics

1. ADME of drugs
2. Plasma concentration of drugs
3. Volume of distribution
4. Clearance of drugs (first order, zero order and second order elimination of drugs)
5. Bioavailability
6. Single and double compartment models
7. Evaluation of renal function and mathematical treatment of these parameters

Sociology of patients (4 hrs)

1. Definition of sociology
2. Behaviours that may contribute to the development of disease
3. Management of these sociological problems

Psychology of patients

1. Definition of psychology
2. Histories of psychiatric and psychosocial disorders suffered by the patient or the family of the patient
3. Any link between sociology and psychology of patients?
4. How could they be managed?

Influence of disease on pharmacokinetics and pharmacodynamics

Drug use in special groups

1. Neonates
2. Children
3. Elderly
4. Pregnancy
5. Breastfeeding
6. Renal failure
7. Liver failure

Biopharmaceutics

a) Pharmacokinetics
   i. Drug absorption
   ii. Drug distribution
   iii. Drug metabolism
   iv. Elimination of drug
b) Toxicokinetics
c) Bioavailability of dosage forms
d) Pharmacokinetic concepts and parameters with examples of calculations and their relevance

Practicals/Tutorials

Ward rotations: review casebooks from Paediatrics, Medicine, Obstetrics/Gynaecology, Surgery and Psychiatry wards and write a report.

34. PHARMACEUTICS – DOSAGE FORM FORMULATIONS

COURSE DESCRIPTION

This course deals formulation of pharmaceutical liquids (injectables and infusions), ophthalmic products, creams, tablets and capsule dosage forms. Emphasis is placed on the unit processes involved and the quality assurance aspects of the entire manufacturing process. Also considered in this course are aspects of drug stability, preformulation and formulationrequirements.

EXPECTED LEARNING OUTCOMES

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

1. Describe drug stability and the factors affecting drug stability.
2. Discuss the formulation of pharmaceutical liquid preparations, injectable preparation, infusions, ophthalmic products, tablet and capsule dosage forms.
3. Discuss the formulation of creams and ointments.

COURSE CONTENT

Drug stability

1. Principles of chemical kinetics
2. Factors affecting stability
3. Stability of pharmaceutical dosage forms and drug stabilization methods
4. Stability tests
5. Changes influenced by microbial contamination

Formulation of pharmaceutical liquid preparations

1. Constituents
2. Classification
3. Characteristics and requirements
4. True solutions
5. Disperse systems
6. Examples of dosage forms

Aseptic production

1. Introduction.
2. Cleanroom contamination.

3. Cleanroom classification.
4. Isolators.
5. Cleanroom certification.
6. Cleanroom testing.
7. Other cleanroom disciplines.

Injectable preparations

1. Quality requirements
2. Classification
3. Routes of administration and drug absorption
4. Solvents/vehicles
5. Additives
6. Technology

Infusions or large volume parenterals

1. Constitution
2. Characteristics and examples
3. Preparation/manufacture and equipment
4. Plasma substitutes
5. Changes in compatibility

Ophthalmic products

1. Brief review of anatomy & physiology of the eye and drug absorption
2. Categories of ophthalmic preparations
3. Auxiliary preparations used with contact lenses
4. Techniques and equipment used
5. Quality assurance of ophthalmic preparations

Tablets

1. Characteristics
2. Classification
3. Tablet excipients
4. Tablet production process
5. Design
6. Tablet coating
7. Techniques and equipment used

8. Quality Control requirements

Capsules

1. Definition and classification
2. Excipients used in capsulation
3. Preparation of capsules
4. Techniques and equipment used
5. Quality control of capsule dosage forms

Creams

1. Brief review of anatomy and physiology of the skin
2. Properties influencing percutaneous absorption
3. Types of bases
4. Formulation of creams
5. Techniques and equipment used
6. Quality assurance of creams

Ointments

1. Definition
2. Preparation
3. Examples of ointments
4. Techniques and equipment used
5. Quality assurance of ointments

35. QUALITY ASSESSMENT AND STANDARDISATION OF BIOLOGICAL PRODUCTS (HUMANS)

COURSE DESCRIPTION

This course is about quality assessment and standardisation of biologicals for administration into human beings. It will consist of theory, practical and tutorial sessions about quality parameters desired in a typical biological preparation and the methods by which such parameters can be precisely, accurately and reproducibly assessed. Quality assurance aspects of these products will also be covered, in particular the pharmacopoeial quality parameters, namely: identification, potency, safety, labeling, transportation and storage.

EXPECTED LEARNING OUTCOMES

At the end of the course, in regards to biologicals administered into human beings, the students should be able to:

1. Describe the quality parameters required of biological preparations.
2. Describe the techniques used in the assessment of quality parameters in biological products.
3. Describe the methods of assessing the quality of biological products.
4. Explain the factors and ways in which these factors affect the quality of biological products
5. Explain the labeling, transportation and storage of biological products

COURSE CONTENT

- **General about vaccines for administration into humans.**
- **Genral about antisera for administration into humans.**
- **Specific vaccine products**
  - General Human Vaccines
  - Live: Un-attenuated bacterial/viral (human vaccines
  - Attenuated bacterial/viral (human) vaccines.
  - Killed/inactivated (human) vaccines.
  - Combined human vaccines.
- **Toxoids**

- Human toxoids
- Mixed human toxoids
  - **Toxins/allergens**
- Human toxins/allergens.
  - **Antibodies**
- Human Immunoisera,
- Antibodies for human use
- Antisera for human use
- Antisera for snake venoms
  - **Hormones**
- Hormones for human use

- **Blood products**
- Fibrinogen
- Prothrombin
- Plasma
  - **Enzymes**
- Streptokinase
- Pancrease
- Urokinase
  - **Diagnostic and laboratory biologicals**
- Nucleic acids
- Crude drugs
- Biostatistics in the assay of biologicals
  - **Sutures for Human Use**
- Absorbent cotton
- Catgut

36. PHARMACEUTICAL MICROBIOLOGY – STERILISATION PROCESSES AND PRESERVATION

COURSE DESCRIPTION

This is the second pharmaceutical microbiology course which focuses on microbial contamination, spoilage, sterilization and preservation processes applicable in pharmaceutical production of sterile pharmaceuticals and parenteral medicines, and non-sterile pharmaceuticals and medicines.

COURSE LEARNING OUTCOMES

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

1. Discuss conatamination and microbial spoilage.
2. Describe the processes involved in heat, cold, radiation, gaseous, filtration, gas plasma, desiccation and osmotic pressured-based sterilization of pharmaceuticals and health supplies;
3. Discuss the procedures involved in sterilization achievementl, sterility assurance and preservation.

4. Discuss preservatives.
5. Perform validation and in-process monitoring of sterilization procedures and preservation;
6. Describe the factors affecting sterilization effectiveness and preservation effectiveness;
7. Effectively engage in public health microbiology initiatives such as infection prevention and control within the community.

COURSE CONTENT

1) Recap of Planktonic and sessile (biofilm) growth and control strategies

2) Product contamination, spoilage and infection control

a) Introduction.
b) Microbial risks to pharmaceuticals.
c) Microbiological concerns in non-sterile manufacturing.
d) Microbial challenges to process environments.
e) Sources of microbial contamination.
f) Fate of microbial contamination in pharmaceutical products.
g) Consequences for microbial growth
h) Infection risk.
i) Contamination control.
j) Cleaning and disinfection.
k) The need for safer and better microbicides for infection control.

3) Pharmaceutical water systems and treatments

a) Introduction.
b) Pharmaceutical facility water.
c) The microbial ecology of water.
d) Design and control of water systems.
e) Qualifying water systems.
f) Microbial contamination.

4) Recap of sterilizer design and operation

4.1 Heat sterilization

- Kinetics of heat inactivation
- Microbial susceptibility to heat

- Mechanisms of microbial inactivation
- Mechanisms of spore resistance to heat

a) Moist heat sterilization: sterilization:

   i) Tyndallisation
   ii) Pasteurization
   iii) Boiling
   iv) Autoclaving

b) Dry heat sterilisation:

   i) Direct flaming. Direct flaming,
   ii) Hot-air sterilization.

4.2 Cold sterilization

a) Slow freezing,
b) Rapid freezing,
c) Lyophilisation.

4.3 Radiation sterilization

a) Ionising radiations:
   i) X-rays sterilizers
   ii) Gamma ray sterilizers
   iii) Electron accelerators (sterilisers)
b) Nonionizing radiations:
   i) Infrared radiation
   ii) Microwave radiation
   iii) Ultraviolet irradiation sterilisers
c) Quantifying radiation sterilization and calculations

4.4 Gaseous sterilization

a) Ethylene oxide,
b) Formaldehyde,
c) Peroxygen compounds.

4.5 Gas plasma sterilization

4.6 Filtration sterilization

a) Membrane filters
b) Depth filters.
   - Filtration sterilization of liquids.

- Filtration sterilization of gases.

5) **Desiccation**
6) **Osmotic pressure**
7) **Miscellaneous**
   a) Aseptic filling
   b) Blow-fill-seal technology.
8) **Sterilization control and sterility assurance**
   a) D-value concept,
   b) Z-value concept,
   c) Lethality of a sterilization process,
   d) Sterility assurance level***(microbial safety index)***.
   e) Quantifying heat sterilization and calculations with these concepts.
9) **Validation and in - process monitoring of sterilization procedures**
   a) Introduction, origins, types of, characteristics of, testing issues, areas of concern and testing errors of the following below:
      i. Physical indicators,
      ii. Chemical indicators,
      iii. Biological indicators.
10) **Factors affecting sterilisation effectiveness**
11) **Preservation and preservatives - Microbial challenges and solutions**
   a) Introduction to Preservation,
   b) Different Preservatives,
   c) Factors affecting preservatives and preservation,
   d) Microbial spoilage,
   e) Preservation of medicines, cosmetics, foods and beverages.
12) **Public health microbiology: infection prevention and control**
   f) Sisyphus in the microbial world revisited: global governance, antimicrobial strategies, and humanity's health.
   g) Overview of structure function, and review of recent outbreaks.
   h) Control of infectious bioagents.
   i) Human microbiome project.

37. COMPARATIVE VETERINARY PHARMACOLOGY AND BIOPHARMACEUTICS

COURSE DESCRIPTION

It compares and contrasts drugs in different animals, amog themselves and with humans. What the drug does to the body of an animal and what the body of the animal does to the drug. What and how absorption of drugs are affected in animals.

EXPECTED LEARNING OUTCOMES

The student is able to discuss the actions and side effects of drugs in diferent animals.

Discuss what and how absorption of drugs are affected in animals.

COURSE CONTENT

1. Drugs acting on central nervous system

k) Neurotransmission in the CNS
l) CNS stimulants
m) Neurodegenerative disorders: Drugs used in Parkinson's and Alzheimer's diseases
n) Sedative hypnotics
o) Drugs in the treatment of sleep disorders
p) Anti-epileptics (Anticonvulsants)
q) Major tranquilisers
r) Antidepressants
s) Analgesics: Opioid and non-opioid analgesics; Opioid antagonists
t) Anaesthetics: Local anaesthetic agents; General anaesthetic agents

2. Hormones and related drugs

h) Anterior pituitary hormones
i) Thyroid hormones and thyroid inhibitors
j) Insulin, oral hypoglycaemic drugs and glucagon
k) Corticosteroids
l) Gonadal hormones (sex hormones) and their antagonists
m) Oxytocin and drugs acting on the uterus
n) Drugs affecting calcium balance

3. Cardiovascular/ renal drugs

f) Diuretics and related renal drugs
g) Antihypertensive drugs
h) Drugs used in the treatment of congestive heart failure.
i) Antiarrhythmic drugs
j) Antianginal drugs

4. Gastrointestinal drugs

f) Drugs used in Peptic ulcer disease and gastrinomas
g) Drugs used to treat constipation: Prokinetic agents and laxatives
h) Antidiarrhoeal agents
i) Emetics and antiemetics
j) Drugs used in management inflammatory bowel disease

5. Respiratory drugs

c) Drugs used in asthma and chronic obstructive pulmonary disease
d) Anti-cough agents

6. Vitamins

7. Drugs affecting blood and blood formation

e) Anticoangulant, antiplatelet and fibrinolytic agents
f) Hypolipidaemic drugs and plasma expanders
g) Haemopoietic agents
h) Anti-anaemic agents

8. Antibiotics

9. Anticancers

10. Biopharmaceutics

38. CLINICAL PHARMACY – HOSPITAL PLACEMENT

COURSE DESCRIPTION

This course is about hands-on experience in management of health conditions in patient of institution care settings and administration of institutions. It also gives the opportunity to students to administer medicines in patients – parenterally and through other routes.

EXPECTED LEARNING OUTCOMES

To give effective efficient care of patients when in institutions and

To correctly administer medicines parenterally and through various ways to patients.

COURSE CONTENT

Placements in direct patient care and administration of the hospitals or large patient care centres.

CLINICAL PHARMACY – MANAGEMENTOF INFECTIOUS DISEASES

COURSE DESCRIPTION

This course covers the pathophysiology, treatment and prevention of diseases that are caused by bacteria, fungi, viruses and helminthes.

LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Explain the pathophysiology of infectious disease states
2. Draw a pharmaceutical care plan essential for the management of infectious diseases
3. Identify drug-related needs of patients and explain possible drug interactions and adverse effects of drugs used in the management of infectious disease states
4. Identify drug-related needs of patients with communicable diseases
5. Communicate effectively with patients and other health care professionals

DETAILED COURSE CONTENT

Protozoal infections

1. Malaria
2. Human African Trypanosomiasis (Sleeping Sickness)
3. Amoebiasis
4. Leishmaniasis

Bacterial diseases

1. Brucellosis

2. Typhoid fever
3. Tuberculosis
4. Meningitis
5. Pneumonia
6. Septicaemia
7. Sexually transmitted diseases
    a) Urinary tract infections (UTIs)
    b) Syphilis
    c) Gonorrhea
    d) Abnormal Vaginal Discharge Syndrome
    e) Urethral Discharge Syndrome (Male)

Fungal infections

1. Candidiasis (invasive & noninvasive)
2. Aspergirosisis
3. Cryptococosis
4. Histoplasmosis

Viral infections

1. HIV/AIDS
2. Hepatitis A, B & C
3. Typhus fever
4. Viral Haemorrhagic Fevers (Yellow fever, Ebola and Marburg)

Helminthiasis

1. Intestinal Worm infections (Ascariasis, Enterobiasis, Hook worm, Strongyloidiasis, Trichuriasis)
2. Taeniasis (Tape worm)
3. Dracunculiasis (Guinea Worm)
4. Schistosomiasis (Bilharziasis)
5. Lymphatic Filariasis
6. Onchocerciasis (River Blindness)
7. Echinococcosis (Hydatid Disease)

Antimicrobial prophylaxis for surgical procedures

Skin disorders

1. Boils (Furuncle)/Carbuncle
2. Acne
3. Psoriasis
4. Urticaria
5. Eczema (Dermatitis)
6. Tineasis
7. Tungiasis (Jiggers)

Gastrointestinal diseases

1. Gastrointestinal infections
    a) Diarrhea and constipation
    b) Amoebiasis
    c) Bacillary dysentery (Shigellosis)
    d) Cholera
    e) Giardiasis
2. Gastrointestinal disorders
    a) Peptic ulcer disease (PUD)
    b) Zollinger-Ellison syndrome
    c) Gastroesophageal Reflux Disease (GERD)
    d) Ulcerative colitis
    e) Crohn's disease
    f) Irritable bowel syndrome

Respiratory diseases

1. Infectious respiratory diseases including:
2. Pneumonia
3. *Pneumocystis jirovecii*pneumonia
4. Bronchiolitis
5. Coryza (common cold)
6. Influenza ("Flu")
7. Acute epiglottitis

39. PHARMACEUTICAL CHEMISTRY – ORGANIC PHARMACEUTICALS, DRUG DISCOVERY AND DESIGN

COURSE DESCRIPTION

The course is both theoretical and practical, consisting of lectures, practicals, tutorial and self-directed learning sessions. The topics covered include synthesis, analysis, and structure-activity relationships (SARs) of various organic pharmaceuticals.

EXPECTED LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Explain the concept of isosteric replacement as applied to drug design and discovery.
2. Describe the structure, synthesis and structure activity relationships (SARs) of selected organic pharmaceutical drugs
3. Describe identification, assay and storage requirements of the above organic pharmaceutical drugs.

COURSE CONTENT

Isosteric replacement

1. Examples of isosteric replacement
2. Non-classical isosteric replacement.
3. Applications of isosteric replacement in drug design

The structures, synthesis, structure-activity relationships (SARs), assay, identification and storage requirements and pharmaceutical applications of the following classes of drugs

1. Non-Steroidal Anti-inflammatory Drugs (NSAIDS)
2. Cyclic ureids (barituric acid derivatives)
3. Phenothiazines
4. Benzodiazepines
5. Local Anaesthetics (esters and amides)
6. Antihistamines

7. Diuretics
8. Adrenergic agents
9. Anticoagulants
10. Steroids
11. Antihelminthics
12. Anti-ulcers

40. PHARMACEUTICAL COSMETOLOGY

COURSE DESCRIPTION

This course deals with production, quality aspects, and use of all cosmetics formulations intended for application to the hair, body and skin, nails.

EXPECTED LEARNING OUTCOMES

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

1. Define cosmetics and terminologies used in cosmetology
2. Explain human conditions that require use of cosmetics.
3. Procure and dispense different types of cosmetics.
4. Explain the dangers associated with use of cosmetics.
5. Describe quality control of cosmetics.
6. Explain the mechanisms of action of cosmetics.

COURSE CONTENT

Introduction

1. Define the term cosmetics and other terminologies in cosmetology.
2. Review anatomy and physiology of the skin and its appendages, including the breast.
3. Common solvents and harmful agents used in cosmetics.

Hair

1. Conditions that require both medical attention and cosmetic use
2. Conditions that require only medical attention and intervention.
3. Forms of cosmetics used in hair cosmetology. Hair washes, tonics, bleach, shiners and dyes and colourants.

4. Hair growth agents.
5. Hair straighteners and perms.
6. Hair neutralizers and removers of cosmetics.
7. Quality of cosmetics used in hair.

Body and Skin

1. Conditions that require both medical attention and cosmetics use
2. Conditions that exclusively require only medical attention and intervention.
3. Forms of cosmetics used on the body.
4. Skin cleansers, antiperspirants (deodorants), perfumes and fragrants.
5. Skin bleachers, browners, shades and colourants.
6. Spot removers, wart removers and anti-acne agents.
7. Skin emollients, softeners and moisturizers.
8. Skin anti-aging agents, anti-oxidants and Ultraviolet (UV) protectants.
9. Lip moisturizers, colourants, and shiners.
10. Protectants of cosmetics.
11. Tattooing. Hair removers.
12. Removers of cosmetics from the body
13. Quality of cosmetics used on the body

Nails

1. Conditions that require only medical attention and intervention
2. Conditions that require both medical attention and cosmetic use.
3. Forms of cosmetics used in nails.
4. Washes, polishes and varnishes and colourants.
5. Nail protectants.
6. Quality of cosmetics used in nails.

41. HARMACEUTICAL ANALYSIS – INSTRUMENTATION AND METHODS

COURSE DESCRIPTION

The course is highly practical oriented but also contains a substantial amount of lectures meant to introduce the student to the theory of various techniques used in the analysis of organic and inorganic compounds such as chromatography, mass spectrometry, UV/Vis spectroscopy, and atomic spectrophotometry.

COURSE LEARNING OUTCOMES

At the end of this course, the students is expected to:

1. Identify the different chromophores present in organic compounds
2. Classify different spectrophotometric techniques used in the analysis of medicines
3. Describe the principles upon which the different spectrophotometric techniques work
4. Quantify a given drug using spectroscopic methods
5. Define chromatography and the various technical terms used in chromatographic techniques, such as mobile phase, stationary phase, retention time, resolution, peak symmetry, efficiency, selectivity, peak area normalization, internal/external standardization, etc.
6. State the main parts of an HPLC chromatograph and their key functions
7. Interprete the parts of a chromatogram and how it can be used to identify chemical substances
8. State the mobile phases used in the different modes of chromatography
9. Differentiate normal phase, reversed phase and hydrophilic interaction liquid chromatography
10. State the mobile phases and stationary phases employed in gas chromatography
11. Describe the basis of nuclear magnetic resonance (NMR) spectroscopy

DETAILED COURSE CONTENT

Introduction to Analytical Chemistry

1. Classification of techniques
2. Instrumentation used in each technique
3. Qualitative and quantitative methods of analysis
4. Non-instrumental techniques of analysis

Atomic Spectroscopy

1. Definition of terminologies
2. Theories of radiant energy
3. Fundamental laws and related terms of spectrophotometry
4. Instruments in spectrophotometry

5. Atomic emission spectrophotometry (flame photometry)
6. Atomic absorption spectrophotometry

Molecular Spectroscopy

1. Ultraviolet (UV) spectroscopy
2. Infrared spectroscopy
3. Spectrofluorimetry
4. Applications of molecular spectroscopy

Spectropolarimetry

1. Plane polarized light
2. Instrumentation
3. Dextro- and Laevo-rotatory compounds
4. Measurement of optical rotation
5. Calculation of specific optical rotation
6. Calculation of enantiomeric purity
7. Examples of BP specifications for enantiomeric purity

Chromatography

1. Definition
2. Basic principles
3. Thin layer chromatography
4. Column chromatography
5. Adsorption chromatography
6. Partition chromatography
7. Ion-exchange chromatography
8. Reverse phase chromatography
9. Normal phase chromatography
10. Molecular size exclusion chromatography
11. High performance liquid chromatography
12. Gas chromatography

Nuclear magnetic resonance (NMR)

1. Theory
2. Instrumentation
3. Chemical shift

4. Spin-spin coupling
5. Splitting patterns
6. Area under the peak
7. Sampling
8. Use of NMR in quantification of pharmaceuticals

42. QUALITY ASSESSMENT AND STANDARDISATION OF BIOLOGICAL PRODUCTS (VETERINARY)

COURSE DESCRIPTION

This course is about quality assessment and standardisation of biologicals for administration into other animals. It will consist of theory, practical and tutorial sessions about quality parameters desired in a typical biological preparation and the methods by which such parameters can be precisely, accurately and reproducibly assessed. Quality assurance aspects of these products will also be covered, in particular the pharmacopoeial quality parameters, namely: identification, potency, safety, labeling, transportation and storage.

EXPECTED LEARNING OUTCOMES

At the end of the course, in regards to biologicals for veterinary use, the students should be able to:

6. Describe the quality parameters required of biological preparations.
7. Describe the techniques used in the assessment of quality parameters in biological products.
8. Describe the methods of assessing the quality of biological products.
9. Explain the factors and ways in which these factors affect the quality of biological products
10. Explain the labeling, transportation and storage of biological products

COURSE CONTENT

General about vaccines for veterinary use.

Genral about antisera for veterinary use.

Specific vaccine products

General Veterinary

Live: Un-attenuated bacterial/viral (veterinary) vaccines

Attenuated bacterial/viral (veterinary) vaccines.

Killed/inactivated (veterinary) vaccines.

Combined human vaccines. Combined veterinary vaccines.

Toxoids

1. Veterinary toxoids
2. Mixed veterinary toxoids.

Toxins/allergens

1. veterinary toxins/allergens.

Antibodies

1. Veterinary Immunoisera,
2. Antibodies for veterinary use
3. Antisera for veterinary use

Hormones

1. Hormones for veterinary use

Diagnostic and laboratory biologicals

1. Nucleic acids
2. Crude drugs
3. Handling of laboratory animals
4. Biostatistics in the assay of biologicals

Sutures for veterinary use

1. Absorbent cotton
2. Catgut

43. CLINICAL PHARMACY – SYSTEMIC NON-INFECTIOUS DISEASES

COURSE DESCRIPTION

This course covers the pathophysiology, treatment and prevention of non-communicable diseases.

LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Explain the pathophysiology of non-infectious disease states
2. Draw a pharmaceutical care plan essential for the management of non-infectious diseases
3. Identify drug-related needs of patients and explain possible drug interactions and adverse effects of drugs used in the management of non-infectious disease states
4. Identify drug-related needs of patients with non-infectious diseases
5. Communicate effectively with patients and other health care professionals

DETAILED COURSE CONTENT

Endocrine disorders

1. Thyroid disorders
2. Diabetes mellitus

Cardio-vascular disorders

1. Hypertension
2. Cardiac failure
3. Angina
4. Cardiac arrhythmias

Disorders of renal function

1. Acid-base disorders
2. Acute renal failure
3. Chronic renal failure
4. Dialysis (Dialysis equipment, Drug use during dialysis)

CNS disorders

1. Headache
2. Pain management
3. Nodding disease
4. Parkinson's disease
5. Dementia
6. Alzheimer's disease
7. Autism

8. Epilepsy
9. Psychotic disorders: schizophrenia
10. Bipolar disorders: mania and depression

Haematological disorders

a) Thrombosis
b) Peripheral vascular diseases
c) Anaemias
d) Haemophilia
e) Sickle cell anaemia
f) Leukaemias

44. CLINICAL PHARMACY – JUNIOR PHARMACY CLINICAL CLERKSHIPS

COURSE DESCRIPTION

This course consists of lectures, tutorials and on-practice sessions designed to inculcate knowledge, attitudes and skills to the student on how to become a competent pharmacist. The student is expected to spend at least two (2) weeks in a hospital pharmacy environment, at least two weeks in the ward (each discipline of medicine) and one (1) week at either central, regional or district office of the drug regulatory agency or community pharmacy.

EXPECTED LEARNING OUTCOMES

By the end of this course, the student should be able to:

1. Describe the organization of a hospital and community pharmacy
2. Participate in drug supply management
3. Participate in pharmacy healthcare management activities
4. Participate in regulation and control of drugs
5. Carry out elementary identification of medicines

COURSE CONTENT

Pharmacy management

1. Organization of a hospital and community pharmacy
2. Drug supply management
3. In-hospital drug distribution

Ward pharmacy and disease management

1. Clinical laboratory data
2. Patient interviews
3. Medication history taking
4. Abbreviations
5. physical assessment skills
6. Patient case presentation/presentation format
7. Therapeutic planning

Monitoring drug therapies

Control of narcotics

Pharmacy and therapeutics committee (PTC)

Health management information systems (HMIS)

Human resource management

Financial management and pharmacoeconomics

Clinical pharmacokinetics

Therapeutic drug monitoring

Drug regulation

1. Regulation and control of human and veterinary drugs including agro-chemicals
2. Elementary identification of medicines

45. GENERAL MANAGEMENT, AND PHARMACEUTICAL AND HEALTH SUPPLIES CHAIN MANAGEMENT

COURSE DESCRIPTION

This course consists of lectures and extensive tutorials sessions focusing on the practical aspects of pharmaceutical supply chain management including forecasting, budgeting, etc. Basic techniques for identification of medicines, supply management of pharmaceutical products in Uganda, and computer applications in pharmacy will also be covered.

EXPECTED LEARNING OUTCOMES

At the end of this course, the student is expected to be able to:

1. Describe the elementary identification of medicines.
2. Discuss the supply and management of pharmaceutical products.
3. Carryout computer applications in pharmacy practice.

COURSE CONTENT

1. Introduction to medicines/drug management

a) Identification of medicines/drugs
b) Organoleptic and elementary identification
c) Inventory management
d) Drug management
e) Objectives of drug management
f) Definitions/explanations of terms: medicine, drug, chemical name, generic name, brand/trade name, spurious, substandard, misbranded, adulterated drugs, etc.

2. Controlled drug classification

a) Classification according to schedules

3. Rational and irrational drug use

a) Definition
b) Process of prescribing
c) Common pattern of irrational prescribing
d) Problem of irrational use of drugs
e) The impact of irrational use of drugs
f) Steps to improve rational drug prescribing

4. Medication errors

a) Reasons for medication errors
b) Preventing medication errors

5. Drug Store Management (The pharmaceutical management)

a) Selection of products
    i. Drug selection process
    ii. Criteria for selection of drugs
b) Quantification (demand planning)

i. Consumption method
ii. Morbidity method
iii. Adjusted consumption method

c) Procurement
   i. Guiding principles of good drug procurement
   ii. Drug procurement cycle
   iii. Factors determining drug procurement

d) Storage
   i. Preparation of drug store at a health facility
   ii. Designing a medical store
   iii. Identification of poor quality and damaged supplies
   iv. Some common systems for arranging medicines include
   v. Cold storage of drugs & Vaccines
   vi. Checklist for drug warehouse management

e) Inventory management
   i. Accounting
   ii. Handling of narcotics
   iii. Handling of hazardous drugs
   iv. Disposal methods

f) Distribution

6. Introduction to logistics and Supplies Chain Management (SCM)

a) Define logistics, supply chain and SCM
b) Describe the purpose of anessential medicines and health supplies management system
c) Outline the benefits of good SCM

7. Dispensing

a) Describe the role of dispensers in promoting rational drug use
b) Identify who can be a dispenser
c) Describe good dispensing practices
d) List the steps in dispensing
e) Fill the HMIS 016
f) List the indicators used for measuring dispensing in the data collection tool
g) Carry out an assessment using the dispensing indicators

8. Communication Skills

a) Understand the basic principles of communication
b) Understand the importance of effective communication
c) Demonstrate practical skills for effective communication
d) Teach communication skills to other health providers

9. Safety and Misuse of Medicines

a) Identify cases of abuse and misuse of medicines
b) Understand how to handle cases of theft of medicines

10. Monitoring and Evaluation (M&E)

a) Explain what is involved in M & E
b) Explain the Rationale of M & E
c) Explain the Log frames used in M & E
d) Explain Performance Indicators M & E
e) Explain how to perform of M & E in Pharmaceuticals and health supplies M & E

11. Financial management

a) Understand the policies, legal and regulatory framework of health financing
b) Understand the financial and health commodity tracking systems
c) Identify sources of financial data for health commodities
d) Identify sources of funding for health commodities

12. Pharmaceutical information portal (PIP) and electronic medicines management systems

a) Explain importance of data ware house technology
b) Understand eMMIS and PIP and their role in medicines management
c) Use eMMIS software of medicines management

13. Data analysis and utilization

a) Understand the different software for data analysis
b) Understand different ways of presenting data
c) Explain use of data in medicines management

14. Pharmacovigilance

a) Define pharmacovigilance and related terms
b) Understand the importance and purpose of pharmacovigilance
c) Describe the steps in setting up a pharmacovigilance center
d) Fill adverse drug reaction form and report cases of adverse drug reactions

46. AGRO-VETERINARY PHARMACY – POULTRY AND PET ANIMAL DISEASES MANAGEMENT

COURSE DESCRIPTION

This course will is about treatment and management of diseases and health conditions of Pet animals and of poultry.

COURSE LEARNING OUTCOMES

By the end of the course, in regards to pet animals and poultry, the student should be able to do the following:

1. Carry out rational dispensing of veterinary medicines.
2. Diagnose, and manage, simple and uncomplicated veterinary conditions
3. Appropriately procure, store and dispense chemical products used in agriculture.
4. Carry out clinical pharmacy practice

COURSE CONTENT

Introduction

1. Definition of terminologies
2. Nomenclature and grouping of various pet animals and poultry in veterinary practice
3. Recap of and unique anatomy, physiology and pharmacology of these animals
    a) Dogs
    b) Cats
    c) Poultry: chicken, turkey, ducks and pigeons

Animal psychology and communication

1. Definition of terminologies

2. Nomenclature used in agriculture.

Parasitology

1. Reservoir
2. Transmission
3. Proliferation
4. Signs and symptoms
5. Pathophysiology
6. Treatment and prevention and control of skin and blood parasites and worm infestation in animals.

Infections

1. Skin and systemic bacterial
2. Protozoal
3. Viral diseases in animals

Zoonotic diseases

1. Reservoir
2. Transmission
3. Treatment, Prevention and control

Common conditions

1. Metabolic and nutritional conditions
2. Age related conditions
3. Antisepsis in animals

Other conditions

New areas

1. Management of common diseases in new areas like fish farming and apiary (apiculture)

Veterinary equipment

1. Unique veterinary equipment and surgicals used in administration of medicines in animals
2. Unique Agricultural equipments used in application of chemicals in agricultural practices

Common chemical agents

1. Pesticides in various crops and seed storage/preservation
2. Herbicides in agriculture
3. Fertilizers of various crops
4. Fungicides used in crops
5. Fungicides used in seed storage

Equipment in agriculture

1. Unique agricultural equipment used in application of pesticides and other chemicals in agricultural practices.

47. AGRO-VETERINARY – FARM & VETERINARY CLINIC PLACEMENT

COURSE DESCRIPTION

This course is about hands-on experience in management of health conditions in animals in Farms and administration of these clinics and farms. It also gives the opportunity to students to administer medicines in Animals – parenterally and through other routes.

EXPECTED LEARNING OUTCOMES

To give effective efficient care of these animals when in farms or clinics and

To correctly administer medicines parenterally and through various ways to these animals.

48. TOXICOLOGY AND FORENSIC PHARMACY – PLACEMENT

COURSE DESCRIPTION

This course is about hands-on experience in Forensic, investigations, litigations, expert witnessing and being part of the jury in cases involving, pharmaceuticals, drugs, chemicals and other poisons. It will cover identification of antidotes and education for prevention or treatment.

EXPECTED LEARNING OUTCOMES

Ability to:

Carry out forensic investigations, preservation and storage of forensic samples and sites,

Identification of antidotes.

Carry out presecution, expert witnessing and performing as part of the jury in such cases.

Carry out education for prevention or treatment.

COURSE CONTENT

Placements in Police investigatiojns, judiciary and courts.

49. CLINICAL PHARMACY – NON-SYSTEMIC & NON-INFECTIOUS DISEASES

COURSE DESCRIPTION

This course covers the pathophysiology, treatment and prevention of non-communicable diseases.

LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. Explain the pathophysiology of non-infectious disease states
2. Draw a pharmaceutical care plan essential for the management of non-infectious diseases
3. Identify drug-related needs of patients and explain possible drug interactions and adverse effects of drugs used in the management of non-infectious disease states
4. Identify drug-related needs of patients with non-infectious diseases
5. Communicate effectively with patients and other health care professionals

DETAILED COURSE CONTENT

1. Cancers

1. Introduction
2. Lymphomas e.g. Hodgkins and Burkitt's non-Hodgkins lymphomas
3. Prostrate Disease
4. Breast cancer
5. Cervical cancer
6. Lung cancer

2. Contraceptives

a) Combined hormonal contraceptives
b) Progestogen-only contraceptives
c) Emergency contraception
d) Contraceptive devices
e) Other methods of contraception

3. Infertility and sexual dysfunction

4. Eye disorders

a) Glaucoma
b) Conjunctivitis

5. Respiratory diseases

a) Non-infectious Respiratory Diseases
   i. Asthma
   ii. Chronic Obstructive PulmonaryDisease (COPD)

6. Ear, Nose and Throat conditions

a) Epistaxis (nose bleeding)
b) Otitis externa
c) Otitis media
d) Pharyngitis (sore throat)
e) Tonsillitis
f) Rhinitis
g) Sinusitis

7. Immunization

a) Routine childhood vaccination
b) General principles of routine childhood immunization

c) Administration and storage and transport of vaccines
d) Reconstitution and administration
e) Other vaccinations
   i. Hepatitis B Vaccination
   ii. Yellow Fever Vaccination
   iii. Tetanus Prevention (Prophylaxis Against Neonatal Tetanus, Vaccination Against Adult Tetanus

50. NUCLEAR PHARMACY

COURSE DESCRIPTION

This course covers the various radio pharmacy concepts and principles

EXPECTED LEARNING OUTCOMES

Learners should be able to;

1. Demonstrate conceptual knowledge of radioactivity, radionuclide principles and radio-pharmacy
2. Demonstrate practical skills in compounding and assessing radio-pharmaceuticals
3. Demonstrate professionalism and ethical practice
4. Apply knowledge obtained in matters of Population health
5. Demonstrate clinical skills
6. Demonstrate scientific critical enquiry

COURSE CONTENT

- Introduction to radioactivity
  The structure of the atom ,Electronic structure of the atom ionic bonds, covalent bonds, coordinate covalent bonds ,complex formation, Structure of the nucleus Unstable Atom and modes of decay Alpa (α)decay, Beta(β^-) decay Positron (β^+) decay Gamma (γ) decay , radioactivity definition and the decay equation
- Production of Radionuclides

Atomic Reactor produced (fusion and fission reactions), cyclotron produced , types of generators and principal, quality control of generators

- Production of Radiopharmaceuticals
  Procedure for Kits formulations from ligands, types, chemistry of 99m Technetium ,

  Radiolabeling procedures of various radiopharmaceuticals, mechanisms of localization

- Quality Assurance of Radionuclides and Radiopharmaceuticals
- Physical and Chemical tests
  - Physical Characteristics
  - PH and ionic strength
  - Radionuclidic Purity
  - Radiochemical Purity
  - Chemical purity
  - Radio-assay
- Biological Tests
  - Sterility
  - Apyrogenicity
  - Toxicity
  - Animal Distribution Tests
- Record Keeping
  Traceability of records

- Instrumentation in Nuclear Medicine
  - Instruments working on the Principal of gas ionisation
    - ✓ Dose Calibrator
    - ✓ Survey meter
    - ✓ Hand Monitors
  - Instruments working on the Principal of Scintillation
    - ✓ Planar Gamma Camera
    - ✓ Single Photon Emission Computed Tomography Camera (SPECT)
    - ✓ Scintigraphic Counters
    - ✓ Positron Emission Tomography Cameras (PET)
- Uses of Radiopharmaceuticals
  - Diagnostic Radiopharmaceuticals
  - ^{99m}Technetium Labelled radiopharmaceuticals
  - Non ^{99m}Technetium Labelled radiopharmaceuticals
  - Therapeutic radiopharmaceuticals

- 131 Iodine
- 89Sr- Strontium chloride(Metastron)
- 90Y- Ibritumomab Tiuxetan (Zevalin)

- Radiation protection aspect
  - ALARA concept
  - Shielding
  - Distance
  - Time
- Regulatory Aspect in Radiopharmacy
- Medical use
- Transport
- Practicals
  - Production of radiopharmaceutical kits
  - Quality control procedures of kits (ITLC, PC, sterility))
  - Sterilisation methods,
  - Microbial evaluation of working tables and surfaces
  - Elution of a generator and compounding of radiopharmaceuticals(observatory)
  - RIA procedures in the RIA lab

Record keeping

51. PHARMACEUTICS – MODIFIED RELEASE DOSAGE FORM TECHNOLOGY & CLINICAL PHARMACY

COURSE DESCRIPTION

This is one of the core courses in pharmacy and will be delivered in form of lectures, practicals and tutorial sessions to impart knowledge and develop skills in the design of various pharmaceutical and radiopharmaceutical formulations.

EXPECTED LEARNING OUTCOMES

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

1. Discuss the formulation of creams, ointments, suppositories and aerosols.
2. Describe the concept of modified release formulations and their use.
3. Describe powders and particulate preparations, tinctures, pills, patches, sponges, micro-encapsulation, liposomes and depot dosage forms.

4. Discuss the principles in radiopharmaceutics and their application.
5. Discuss biopharmaceutics and relevantly apply the pharmacokinetic concept to calculations.

COURSE CONTENT

1. Creams

a) Brief review of anatomy and physiology of the skin
b) Properties influencing percutaneous absorption
c) Types of bases
d) Formulation of creams
e) QA of creams.

2. Ointments

a) Definition
b) Preparation
c) Examples of ointments
d) Quality assurance of ointments.

3. Suppositories

a) Brief review of the anatomy and physiology of cavity
b) Uses of suppositories
c) Bases used
d) Preparation of suppositories and equipment used
e) Quality control and packaging

4. Aerosols

a) Definition and principles
b) classification and routes of administration
c) Composition, preparation and examples.
d) Quality control of aerosols.

5. Modified release preparations

a) Concept
b) Excipients
c) Examples of modified release

d) Preparations, application

6. Pharmaceutical Powders

a) Classification
b) Advantages/Disadvantages
c) Preparations
d) Principles Involved
e) Dispensing of powders
f) Theory of powders:Equations of Heckel, Kawakita, etc
g) Various Calculations

7. Microencapsulation

a) Advantages/Disadvantages
b) Techniques of microencapsulation
   i. Spray drying
   ii. Spray congealing
   iii. Pan coating
   iv. Co-Extrusion
   v. Spinning desk

8. Liposomes

a) Definition/Concept
   i. Vesicles
   ii. Phospholipids
   iii. Phosphatidylcholines
   iv. Ligand
   v. Lamellar phase
   vi. Liposome
b) Preparation/Application

9. Nanotechnology and Nano-Medicine

a) Definitions
b) Mechanism
c) Double and triple emulsion
d) Nano-medicine
e) Nano-Pharmarceutical

f) Preparation/Application
g) Advantages/Disadvantages
h) Use/application

10. Computer Aided Drug Design

a) Definitions
   i. Biomolecule
   ii. Ligand
   iii. Biological target
   iv. Centroids
   v. Pharmacophore
b) Crystallography
c) NMR Spectroscopy
d) Drug Design
e) Types/Applications of Computer-aided drug design

11. Nuclear Medicine/Nuclear Pharmacy (Radiopharmaceuticals)

a) Review of atomic structure
b) Modes of nuclear decay production of radionuclides
c) Radiopharmaceuticals.
d) Types and formulation of kits
e) Utilization and application.

12. Dosage forms of interest

a) Patches
b) Sponges
c) Pills
d) Depot dosage forms

13. Clinical Pharmaceutics

52. PHARMACEUTICAL MICROBIOLOGY – PHARMACEUTICAL AND FOOD MICROBIOLOGICAL QUALITY CONTROL, ASSURANCE AND AUDITING

COURSE DESCRIPTION

This is thefinal pharmaceutical microbiology course which focuses on pharmaceutical and food microbiological quality control, assurance and auditing within the setting of a microbiological laboratory.

COURSE LEARNING OUTCOMES

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

1. Describe the various microbiological tests including laboratory testing of antimicrobial agents;
2. Describe the process of manufacture of selected culture media;
3. Perform microbiological testing of disinfectants and decontaminants for critical surfaces and environmental monitoring;
4. Conduct measurement of cell concentration in suspension by optical density;
5. Perform i*nvitro* and *in vivo* testing for pyrogens and endotoxins;
6. Perform bioburden determination;
7. Conduct analysisof foods and pharmaceutical grade water;
8. Properly manage and analyse microbiological data generated during laboratory experiments.

COURSE CONTENT

1. **Microbiological test methods**
   a) Including rapid microbiological methods:
      i. Introduction.
      ii. Changing world of microbiology.
      iii. Advantages of rapid methods.
      iv. Regulatory acceptance.
      v. Types of rapid microbiological methods.
      vi. Selection of rapid microbiological methods.
2. **Manufacture of culture media**
   a) Introduction and manufacture.
   b) Media release and quarantine.

c) Quality control of culture media.

3. **Laboratory evaluation of antimicrobial agents**
   a) Microbial susceptibility testing.
   b) Antimicrobial efficacy testing (preservative efficacy testing).
   c) Disinfectant evaluation.
4. **Microbiological testing of disinfectants and decontaminants for critical surfaces and environmental monitoring**
   a) Measuring disinfection effectiveness.
   b) Disinfectant efficacy.
   c) Environmental monitoring.
5. **Pharmacopeia and microbiological tests including sterility testing**
6. **Measurement of cell concentration in suspension by optical density**
7. **In-vitro and in-vivo testing for pyrogens and endotoxins**
   a) Introduction.
   b) Pyrogenicity.
   c) Bacterial endotoxin.
   d) Quantifying endotoxin
   e) The limulus amebocyte lysate test.
   f) *Limulus amebocyte* lysate test methods.
   g) *Limulus amebocyte* lysate test applications.
   h) *Limulus amebocyte* lysate test interference.
   i) Alternative test methods.
   j) Calculations about endotoxin quantifications, quantities and amebocyte lysates.
8. **Bioburden determination**
   a) Introduction.
   b) Total microbial count.
   c) Units of measurement.
   d) Nonsterile products and microbial limits testing.
   e) In-process material bioburden assessment.
   f) Presterilization bioburden assessment.
   g) Alternative methods of bioburden assessment.
9. **Specified and objectionable microorganisms**
   a) Introduction.
   b) Indicator microorganisms.

c) Determining which microorganisms are objectionable and assessing risk.

10. Pharmaceutical food and water analysis

d) Microbiological sampling and testing.

e) Action and alert limits.

f) Undesirable (objectionable) microorganisms.

g) Microbiological assessment and rapid microbiological methods.

11. Risk assessment and microbiology

a) Introduction.

b) The nature of risk.

c) The need for microbiological risk assessment.

d) Microbial contamination transfer.

e) Identification of sources and routes of contamination.

f) Routes of transfer.

g) Risk assessments for general cleanroom areas.

h) Risk scoring systems.

12. Manufacturing and validation

a) Introduction.

b) Manufacturing procedures.

c) Validation and auditing.

13. Microbiological data

a) Introduction.

b) Counting microorganisms.

c) Sampling.

d) Microbial distribution.

e) Data trending.

f) The use of alert and action levels and the setting monitoring limits.

g) Data reporting.

14. Pharmaceutical microbiology laboratories

a) Introduction.

b) Setup.

c) Equipment.

d) Auditing the microbiology laboratory:

i. Quality audits.

ii. Auditors and the audit process.

iii. Auditing the microbiology laboratory.

53. AGRO-VETERINARY PHARMACY – FARM AND BIG ANIMAL DISEASES MANAGEMENT

COURSE DESCRIPTION

This course will is about treatment and management of diseases and health conditions of Pet animals and of poultry.

EXPECTED LEARNING OUTCOMES

By the end of the course, in regards to Farm animals and Big animals, the student should be able to do the following:

1. Carry out rational dispensing of veterinary medicines.
2. Diagnose, and manage, simple and uncomplicated veterinary conditions
3. Appropriately procure, store and dispense chemical products used in agriculture.
4. Carry out clinical pharmacy practice

COURSE CONTENT

Introduction

1. Definition of terminologies
2. Nomenclature and grouping of various Farm animals and Big animals in veterinary practice
3. Recap of and unique anatomy, physiology and pharmacology of these animals
   a) Guinea pigs
   b) Rabbits
   c) Goats
   d) Sheep
   e) Donkeys
   f) Cattle.

Animal psychology and communication

1. Definition of terminologies

2. Nomenclature used in agriculture.

Parasitology

1. Reservoir
2. Transmission
3. Proliferation
4. Signs and symptoms
5. Pathophysiology
6. Treatment and prevention and control of skin and blood parasites and worm infestation in animals.

Infections

1. Skin and systemic bacterial
2. Protozoal
3. Viral diseases in animals

Zoonotic diseases

1. Reservoir
2. Transmission
3. Treatment, Prevention and control

Common conditions

1. Metabolic and nutritional conditions
2. Age related conditions
3. Antisepsis in animals

Other conditions

New areas

1. Management of common diseases in new areas like fish farming and apiary (apiculture)

Veterinary equipment

1. Unique veterinary equipment and surgicals used in administration of medicines in animals
2. Unique Agricultural equipments used in application of chemicals in agricultural practices

Common chemical agents

1. Pesticides in various crops and seed storage/preservation
2. Herbicides in agriculture
3. Fertilizers of various crops
4. Fungicides used in crops
5. Fungicides used in seed storage

Equipment in agriculture

1. Unique agricultural equipment used in application of pesticides and other chemicals in agricultural practices.

53. PHARMACOGNOSY – NATURAL PRODUCTS, TRADITIONAL MEDICINES AND COMPLEMENTARY SYSTEMS OF MEDICINES

COURSE DESCRIPTION

The course entails standards applicable to crude drug evaluation and quality control using herbal pharmacopoeia monographs. It also offers insights on plant nutraceuticals, toxic plants, and phytochemical interactions.

LEARNING OUTCOMES

By the end of this course the students should be able to:

1. Describe the general aspects of British Herbal Pharmacopoeia (BHP) and African Pharmacopoeia (AP).
2. Carry out quality control tests on crude drugs according to monograph specifications.
3. Outline discovery of drugs from natural sources.
4. Learns poisonous plants and carcinogens.
5. Describe aspects of complimentary and traditional medicine.
6. Compare the parallel, alternative and complimentary medicine.

COURSE CONTENT

1. Introduction to Pharmacopoeias

a) British Herbal Pharmacopoeia (BHP)
b) African pharmacopoeia (AP)

2. Traditional and complimentary systems of medicine

a) African
b) Chinese
c) Indian
d) Traditional medicine in Uganda.
e) National drug policy on Traditional medicine and regulation of Herbal medicine.

3. Traditional plant medicines as a source of new drugs

a) General description
b) Process of modern drug discovery using ethnopharmacology
c) Value of ethnopharmacological approach

4. Problems with ethnopharmacological approach

5. Pharmacological activities of natural products

a) Drugs acting on the nervous system
b) The heart, circulation and blood
c) Action on the gastrointestinal tract
d) Action on nasal and respiratory systems
e) Action on liver
f) Action urinary and reproductive systems
g) Action skin and mucous membranes
h) Action on sugar metabolism
i) Steroids and anti-inflammatory drugs
j) Non-steroidal anti-inflammatory drugs
k) Treatment of infections
l) Treatment of malignant diseases
m) Treatment of allergies
n) The immune system.

6. Pharmacological screening methods

a) General description
b) Assessment of Hepatoprotective activity of plant extract
c) Anti-Bacterial Assay
d) Anti-HIV Assay
e) Hypoglycemic / Antidiabetic Activity Assays

f) Antimalarial Assay
g) Analgesic Assays
h) Anti-inflammatory Assays
i) Anti-pyretic Assays.
j) Anti-diarrhoea Assays.
k) Anti-ulcer Assays.
l) Anti-convulsant Assays.
m) Acute, subacute/subchronic and chronic toxicity AssayS
n) Other simple Assays

7. Interactions in phytochemicals

a) Synergy, prediction of effects
b) Demonstration of synergy and polyvalent action in phytomedicines
c) Enhancement or reduction of absorption or bioavailability
d) Examples of synergy, polyvalent action or antagonism in herbal medicines
e) New technologies

8. Discovering new lead compounds in pharmaceutical research and development

a) General description
b) Biological assays and high throughput screening
c) Availability and selecting samples for screening
d) Process for identification of plants for targeted sets
e) Sample preparation
f) De-replication and isolation of active components

9. Quality control of crude drugs

a) Standards applicable to crude drugs (preliminary examination, foreign matter, moisture content, extractive values, ash values, crude fibre, volatile oil content, tannin content, bitterness value, swelling index, volatile and fixed oils)
b) Assays (gravimetric, titrimetric, chromatographic, spectroscopic analysis, fluorescence analysis, Immunoassays, quantitative microscopy).

10. Plant nutraceuticals

a) General description
b) Carotenoids
c) Linolenic acid

d) Policosanol
e) Resveratrol
f) Sterols
g) Theanine
h) GSPE
i) Pycnogenol
j) Soy isoflavones
k) Tea catechins
l) Cocoa
m) Cranberry
n) Flaxseed
o) Olives
p) Coenzyme Q10
q) Melatonin
r) Synergistic and adverse effects
s) Quality of products

11. Colouring and flavouring agents

a) General description
b) Red poppy petals
c) Cochineal
d) Saffran
e) Annatto
f) Marigold flowers
g) Red beetroot
h) Monascus
i) Red rose petals
j) Dyestuffs
k) Flavouring and sweetening agents

12. Hallucinogenic allergenic, teratogenic and other toxic plants

a) Fungi
b) Lysergic acid derivatives
c) Peyote
d) Indian hemp

e) Pollens
f) Spores
g) Rhus
h) Teratogenic and toxic plants

13. Pesticides of natural origin

a) Acaricides
b) Insecticides (pyrethrum flower, Derris and lanchocarpus, nicotinoids
c) Rodenticides
d) Molluscicides

14. Miscellaneous products

a) Kieselguhr or diatomite
b) Prepared chalk
c) Gelatin
d) Fish body oils
e) Silk
f) Wool, animal wool, sheep's wool
g) Shellac

15. NB: Veterinary components to be included.

54. PHARMACY PROFESSIONAL ETHICS AND LAW

COURSE DESCRIPTION

This course covers concepts of forensic pharmacy, ethics and law that are involved in the practice of the pharmacy profession. The course is theoretical and will consist of lectures and case studies.

EXPECTED LEARNING OUTCOMES

At the end of this course, the student is expected to be able to:

1. Discuss professional ethics in pharmacy practice.
2. Discuss the laws and regulations pertaining to the control of pharmaceuticals, medical, and surgical supplies in Uganda.
3. Discuss the legal aspects of pharmacy practice.

4. Describe the laws governing international regulation of classified drugs.

COURSE CONTENT

Recap of General Ethics

Professional ethics

1. Characteristics of a profession
2. Professional status of pharmacy
3. Constraints to pharmacy's professional status
4. Deprofessionalisation
5. Professional project
6. Pharmacy as a discipline
7. Responsibilities and roles
8. Attitudes and professional behavior
9. Function and performance of the pharmacist
10. Relationship with the patient, society and other healthcare professionals
11. Pharmacy oath
12. Code of ethics
13. Code of professional conduct

Pharmacy laws and regulation

1. Drug policy
2. Pharmacy and Drugs Act, 1970
3. National Drug Policy and Authority Act, 1993
4. Handling of investigational new drugs
5. Drugs that have been donated
6. Promotional drug samples
7. International regulations on narcotics and other classified drugs
8. Property rights and patenting of pharmaceuticals

Ethics and professionalism

1. Definition and scope of ethics
2. Comparison of ethics and law
3. The need for professional ethics
4. A profession and its characteristics

5. The pharmacy profession in Uganda
6. The code of ethics for pharmacist
7. Patient consent principles
8. Patient confidentiality principles
9. Ethics in the sale and supply of medicines
10. Ethics in the advertising medicines and professional services
11. Ethics for pharmacists in positions of authority
12. Beneficence/Nonmaleficence principle
13. Fidelity and veracity principles

The Pharmacy and Drugs Act, 1970

1. The pharmacy board, its committees, composition and functions
2. The Pharmaceutical Society of Uganda, its membership requirements, committees and its functions
3. The Pharmacy Council of Uganda, its composition and functions
4. Regulation of the pharmacy profession in Uganda
5. Classified drugs (A, B, C) and their regulation
6. Restricted drugs
7. Control of importation of drugs in Uganda
8. Control of manufacture of drugs in Uganda

The National Drug Policy and Authority Statute, 1993

1. The National Drug Authority (NDA) roles, mandate & regulatory activities.
2. The National Drug Policy (NDP) objectives & components
3. The National drug authority, its committees and their functions
4. Regulation of sale of medicines in Uganda
5. Regulation of importation of medicines into Uganda
6. Regulation of manufacture of medicines in Uganda
7. Classified and restricted drugs

Standards for pharmacy practice in Uganda, 2001

1. Standards for premises
2. Standards for personnel
3. Standards for dispensing
4. Standards for manufacture

55. PHARMACOECONOMICS

COURSE DESCRIPTION

This is about using economics that to examine cost-benefit, cost-effectiveness, cost-minimization, cost-of-illness and cost-utility analyses to compare pharmaceutical products and treatment strategies.

EXPECTED LEARNING OUTCOMES

1.1 To define pharmacoeconomics
1.2 To explain the phases in pharmacoeconomic evaluation
1.3 To discuss the methods used in pharmacoeconomic evaluation
1.4 To explain the choice of pharmacoeconomic methods
1.5 To discuss the appraisal of pharmacoeconomic studies
1.6 To discuss the financing of pharmaceuticals.

COURSE CONTENT

Definition of pharmacoeconomics, Phases in pharmacoeconomic evaluation, Analytical perspectives, Types of pharmacoeconomic evaluation, Pharmacoeconomic methods: cost of illness, cost minimization analysis, cost utility analysis, cost benefit analysis, cost effectiveness analysis; measuring and valuing costs, measuring and valuing consequences, discounting, sensitivity analysis, choosing a pharmacoeconomic method, appraisal of pharmacoeconomic literature, financing and cost-containment for pharmaceuticals. Critical appraisal of economic evaluations, Health-related quality of life, In at the deep end, Interpreting data from individual trials and Introduction to decision-making

56. PHARMACEUTICAL CHEMISTRY – LIMIT TESTS AND STANDARDIZATION OF ORGANIC AND INORGANIC PHARMACEUTICAL COMPOUNDS

COURSE DESCRIPTION

This is the first of the two pharmaceutical chemistry course units and it discusses drug standardization and drug quality, drug quality assurance, inorganic pharmaceutical chemistry, and the chemistry of organic pharmaceuticals. Emphasis is placed on synthesis, structure-activity relationships, analysis, and storage of these types of drugs.

EXPECTED LEARNING OUTCOMES

At the end of this course, the student is expected to:

1. List the various compendia used for controlling the quality of pharmaceutical products
2. State the possible sources of impurities in pharmaceuticals
3. Describe the processes that lead to chemical and physical instability in pharmaceuticals
4. Describe the process of standardization of active pharmaceutical ingredients and formulated products
5. Describe the various limit tests in pharmaceutical chemistry
6. Describe the physico-chemical properties of inorganic pharmaceutical preparations.
7. Describe the production/synthesis, assay, identification and quality control of inorganic pharmaceutical preparations.
8. Outline the medical uses of inorganic pharmaceutical preparations.
9. Describe the source, structure determination, classifications, synthesis, and structure-activity relationship of antibiotic, anti-neoplastic agents, anti-helminthic agents and antimalarials.

COURSE CONTENT

Chemical purity and its control

1. Pharmacopoeia and other documents controlling drug quality
2. Source ofimpurities in pharmaceuticals
3. Chemical and physical instability

Standardization of pharmaceutical substances

1. Active pharmaceutical ingredients
2. Formulated pharmaceutical products
3. Manufacturing product license standards
4. Pharmacopoeial standards

Limit tests

1. Specificity of tests
2. Sensitivity and control of personal errors
3. General limit tests for non-specific impurity

4. Limit tests for metallic impurities
5. Limit tests for acid-radical impurities

Inorganic pharmaceutical chemistry

The physicochemical properties, production, assay, identification, quality control requirements, and pharmaceutical applications of the following:

1. Halogen compounds
2. Group VI A elements (oxygen and sulphur compounds)
3. Group V A elements (nitrogen and arsenic compounds, arsenic anti-dote)
4. Group III A elements (boron compounds)
5. Group II elements (magnesium, calcium, barium, zinc, and mercury, and mercury antidotes)
6. Group I elements

Organic pharmaceutical chemistry

Definitions, classification, mechanisms of action, structures and their elucidation, quality control, and pharmaceutical applications of:

1. Antibiotics
2. Antineoplastic agents
3. Antimalarials
4. Antihelminthics

57. PHARMACEUTICS – QUALITY ANALYSIS OF DOSAGE FORMS

COURSE DESCRIPTION

This is the course that teaches fitness for purpose of pharmaceutiucal and cosmetics dosage forms of products for quality of the performance of the dosage forms per se. ie, Tablets, capsules, powders for injection, suspensions, emulsions, ointments, and creams and others.

EXPECTED LEARNING OUTCOMES

Ability to assess the dosge forms for their fitness per se. Eg. Friability test and disintegration test for tablets, and spreading tests for creams and ointments.

COURSE CONTENT

Pharmacopoeial Quality performance analysis of the dosage forms per se. ie, Tablets, capsules, powders for injection, suspensions, emulsions, ointments, and creams and others.

58. TOXICOLOGY AND FORENSIC PHARMACY

COURSE DESCRIPTION

This course will be both theoretical and practical. Theory will focus on facts about the toxic effects of drugs and their evaluation, and how drugs can be used rationally considering that despite their therapeutic role, drugs can be harmful to humans. The practical sessions in this course unit will focus mainly on demonstration and evaluation of toxic effects of drugs covered in the various course units as well as effects of poisonous substances used in day-to-day life.

EXPECTED LEARNING OUTCOMES

On completion of this course, a student should be able to:

1. Define the general terms used in toxicology and forensic pharmacy.
2. Describe the various fields of toxicology.
3. Describe the major factors considered in safety evaluation of drugs
4. Explain the principles used in management of poisoned patients.
5. Describe the prevention and control of poisoning.
6. Discuss the management of patients poisoned by pharmaceutical and non-pharmaceutical substances.
7. Describe toxic effects of drugs and other chemicals on the human body systems
8. Be able to manage/treat toxic effects of drugs and other chemicals in patients.
9. Be able to conduct basic experiments on toxicity, and effects on enzymes
10. Discuss forensic aspects in pharmacy practice.

DETAILED COURSE CONTENT

Principles of toxicology

1. Definitions and General principles
2. Toxicity evaluation

3. Teratogens
4. Carcinogens
5. Pesticides
6. Heavy metal toxicity
7. Poison management
8. Some common toxicities (drug groups, solvents, Gases, venoms etc)

Analysis of a poison situation

1. Principles
2. General measures: airway, breathing and air circulation (ABC)
3. Decontamination of the skin
4. Gut decontamination: emesis, gastric lavage, activated charcoal, laxatives

Enhancing elimination of toxicants

1. Multiple dose activated charcoal
2. Urine alkalinisation
3. Dialysis

Poison control

1. Factors associated with poisoning
2. Household industry and workplace, pharmacist's role
3. Toxic exposure surveillance

Toxicology of non-pharmaceutical substances

1. Heavy metals and their antidotes
2. Cyanide
3. Corrosive poisons
4. Ethanol
5. Methanol
6. Carbon monoxide and smoke
7. Pesticides
8. Snake and scorpion venoms and others

Toxicology of pharmaceutical products

1. Antipsychotic, narcotics, analgesics, and anticonvulsants
2. Barbiturates, benzodiazepines, antidepressants, paracetamol, salicylates and other NSAIDS

3. Selected antimicrobials including antimalarials
4. Adverse drug reactions (systemic approach)
5. Unfavourable drug interactions

Introduction to forensic pharmacy

1. Definition of terms
2. Scope of forensic pharmacy (drug abuse, sports medicine and doping, blood drug levels, drugs alcohol and driving, criminal cases, forensic pharmacovigilance and ecotoxicology, off-label drug use, fraud and white-collar crime)
3. Analytical toxicology versus forensic pharmacy
4. Pharmacist as an expert witness in courts of law

Crime analytical lab

1. Setup of crime lab
2. Types of specimens collected for analytical work
3. Sample analysing methodology
4. Forensic tests (screening tests, confirmatory)

5Drugs of abuse and other substances commonly abused

1. Commonly used drugs and other substance
2. Analysis of seized drugs and other substances

Post-mortem drug levels

1. Physiologic changes in the body after death
2. Drug characteristics
3. Specimens and other exhibits collected
4. Analysis of drug level information
5. Interpretation of post mortem drug levels

Drug abuse in sports

1. Substances and methods prohibited by human sports bodies
2. Specimens collected
3. Interpretation of drug levels

Drug facilitated sexual assault

1. Definition of OTCs and PoM

2. Criteria used to classify drugs as OTCs and PoM
3. Specimens and analytical methods

Alcohol, drugs and driving

1. Forensic aspects of alcohol drugs and driving
2. Effects of alcohol on driving
3. Effects of drugs on driving
4. Tests for impairment
5. Blood alcohol concentration (BAC) measurement
6. Interpretation and presentation of BAC results

Practicals in pharmacology

1. Acute toxicity evaluation
2. Evaluation of analgesic and anti-inflammatory effects
3. Phenobarbitone sleep time demonstration

9.6 Instructional Methods

Benchmark Standard

The Methods of instruction shall be stated for every course unit. Pharmacy School/Departments are encouraged to adopt instruction methods that support innovation, student-centered learning, mentorship and use of evidence-based training methodologies.

9.7 Assessment of Student Performance

Benchmark Standard

a. *The Pharmacy School/Department shall put in place appropriate assessment procedures that will ensure proper assessment of the students.*
b. *The Pharmacy School/Department shall ensure that evaluation and assessment of students meet the objectives and learning outcomes of the programme.*
c. *The Pharmacy School/Department shall have well-documented examination policy and regulations.*

Guidelines

a. *Examinations, projects and other assessment instruments should be designed to evaluate*

the extent to which students can demonstrate achievement of the programme outcomes both throughout the programme and at its conclusion.

b. *The Pharmacy School/Department shall undertake intermediate evaluation to establish the progress of students and identify students' difficulties for corrective measures;*
c. *Examinations should be basis analysis and problem solving and not on the recitation of facts or standard solutions.*
d. The assessment should be a combination of any of the following:
    - *Written examinations*
    - *Objective Structured Practical Examination (OSPE),*
    - *Objective Structured Clinical Examination (OSCE),*
    - *Viva voce*
    - *Assignments*
    - *Logbook examination*
    - *Seminar presentation*
    - *Project assessment*
    - *Practicals*
    - *Case presentation*
    - *Clinicals*

9.8 Programme Monitoring And Evaluation

Benchmark Standard

b. *The Pharmacy School/Department shall have a policy on quality assurance and quality control, which should address monitoring and evaluation systems including student feedback mechanism.*
c. *The programme shall be reviewed every five years and submitted to National Council for re-accreditation*
d. *There shall be a review(self-assessment) of the programmes every four years prior to accreditations.*

Guidelines

a. *The Pharmacy School/Department shall prepare an annual M&E for the programme. There shall be formal reviews at the end of every programmes cycle.*
b. *The procedures for evaluation of the courses of a given programme shall be clearly documented.*

c. All aspects of a given course shall be evaluated. These include the:

a. *course content;*

b. *instructional process;*

c. *infrastructure and equipment for the delivery of the course;*

d. *instructional and reference materials; and*

e. *assessments.*

d. Feedback on course evaluation shall be utilized in decision-making with regard to the course in focus.

9.9 Annual Reporting

Benchmark Standards

Every Pharmacy School/Department shall prepare and submit to Pharmaceutical Society of Uganda and the National Council for Higher Education an annual report on the operations and progress of the Pharmacy School/Department giving a detailed evaluation of its academic activities and the extent to which the prescribed institutional standards are met.

Guidelines

a) *The annual report shall show evidence of being up to date with annual submission of students' names to the Pharmacutical Society of Uganda(PSU) for indexing.*

b) *The annual report shall indicate admitted students as well as progression trends.*

9.10 Laboratories and Workshops

Pharmaceutical Programmes involve a lot of practical work and therefore require the utilization different types of equipment for teaching and research

A laboratory is a key component of clinical care. Flexner report re-emphasized role of laboratories in training of health

The training of Pharmacists will require both Biomedical Sciences Lab and Clinical Laboratories.

Biomedical Sciences/Basic Sciences

- Anatomy & Histology
- Physiology
- Biochemistry
- Microbiology
- Pathology

Pharmacy Laboratories

i. Physical chemistry
ii. Pharmacology including animal house
iii. Pharmaceutics including Dispensing Laboratory
iv. Pharmaceutical Chemistry
v. Pharmacognosy including Medicinal Plant Garden
vi. Drug Information Unit
vii. Pharmaceutical Technology including Pilot Drug Production
viii. Herbarium
ix. Clinical Pharmacy

9.10.1 General Requirements

All labs should be spacious with adequate illumination, ventilation, and wired for Internet connections, audio-visual presentations and telemedicine. In addition there should be

- Adequate working Space. *The following requirements shall apply for laboratory space.*
  - *Acceptable: 1.0 sqm per student*
  - *Good: 2.0 sqm per student*
  - *Ideal Practice: 2.5 sqm per student.*
- Proper working Tables
- Flowing water and enough water sinks
- Store
- Preparation Room(s)
- Proper & Sufficient airflow
- Waste Disposal Facilities

9.10.2 Human Anatomy & Histology Laboratory

Anatomy and Embryology

This should contain body store, preparation room, prosecution room,' embalming room, museum, dissection room for 8-10 students per cadaver, tutorial room, general store, staff offices, etc. There should also be:

1. Embalmed bodies - I cadaver per set of 8 students
2. Equipment Trolleys
3. Electric Embalming Machine
4. Bone cutting equipment - Electric saw/drill
5. Articulated and unarticulated skeletons
6. X-ray viewing boxes
7. Air-conditions for the dissecting rooms and air extractors.
8. Models
9. Slide of sections
10. Slide projectors
11. Toilet facilities
12. Changing room
13. Shower Room etc.

Histology Laboratory

There should be an air-conditioned store where consumable material should be kept, preparatory room, teaching laboratory for student, microscope store or underbench cupboards. wash up room work benches with zinc or Formica shelves for

glass ware. burners etc.

1. Microtome (2) Rotary/Sledge

2. Microtome Knives (3)

3. Light Microscopes I per 2 students

4. Vacuum Pump

5. Dissecting Microtome

6. Cryostat with Microtome (I)

Animal House

There should be for all the laboratories. a common and properly maintained animal house with an adequate number of animals.

9.10.3 Biochemistry Laboratory

a. Centrifuge
b. Ultracentrifuge
c. Electronic Balances
d. Heating Blocks
e. Vacuum Pumps
f. Spectrophotometers 1 per 20 students
g. pH Meters 1 per 20 students
h. Thermostatic Water Baths
i. Ovens
j. Gas Chromatograph
k. HPLC
l. Electrophoresis Equipment
m. Flame Photometer
n. Water Distiller
o. There should be an air-conditioned store where consumable materials should be kept.

9.10.4 Physiology Laboratory

The physiology department should have a small laboratory for animal experiments and a large laboratory for human experiments.

The Physiology Lab should have an air-conditioned store, a preparatory room, wash room, material store and should be equipped with a polygraph.

The following items of laboratory equipment and materials are required.

a) Spirometers- 1 for 20 students
b) Vitalograph-1 for 20 students
c) Peak Flowmeters1 for 20 students
d) Gas Meters (2)
e) ECG Machines(2)
f) Spectrophotometers-1 for 20 students
g) Physiography Recorders Transducers
h) Oscilloscopes(4)
i) Centrifuges(5)
j) Blood Gas Calipers(2)
k) Audiometer(2)
l) Geiger Counters
m) Water Baths
n) Electronic Weighing balance.
o) Flame Photometer
p) Microcentrifuge
q) Water Distiller
r) Bicycle ergometer
s) Snelle's chart

9.10.5 PHARMACOLOGY LABORATORY

1. Thermocirculators
2. Student Stimulators
3. Research Stimulators
4. Analytical Balances
5. Avery Balances
6. Student Kymographs
7. Drums (Smoking)
8. Small Animal Respirators
9. Jacketed Baths assorted of 5ml, 10ml, 25ml, and 50ml capacity.
10. Assorted Organ Baths

11. Langendoffs
12. Hamstead Operating Tables
13. Refrigerator
14. Brown-Schaster Myograph stand
15. Aerator (Organ Bath)
16. Infusion Pump
17. Peristaltic Pump
18. Centrifuge (Bench)
19. Hot Plates
20. Water Bath
21. Deioniser
22. Syringes of different sizes 1ml, 2ml, etc.
23. Smoking burners
24. Assorted sizes of white glazed paper
25. Levers assorted
26. Stop watch
27. Stop Clock
28. Light Pulleys
29. Boss Head Support rods
30. Clamping upright Rods
31. Standard Boss Head
32. Oxford Clamp
33. Angle poise lamp
34. pH Meters
35. Chromatography Oven Separating Chamber
36. Assorted sizes of white glazed paper
37. Rotary Vacuum Evaporators with vertical inclined condenser
38. Autoclave
39. Each Surgical Instrument Assorted
40. Micro Slides Cabinet
41. Radiating Safety Equipments
42. All glass still
43. Manesty still
44. Steam Sterilizer Pressure Type
45. Freezers
46. Physiograph with attachments
47. Grass polygraphs with attachments accessories
48. Recording Microdynamometer with accessories
49. Refrigerated Centrifuge
50. Digital Fitter Photometer MK 40

51. Automatic Flake Ice Machine
52. Cell Homogenizers
53. Egg Incubator
54. Perfusion Pump
55. Gross Cardiotachnometer
56. Elecromagnetic Flow Meter
57. Potter Elvehyn Homogeniser
58. Voltage Stabilizer
59. High Performance Liquid Chromatograph
60. UV Spectrophotomete
61. Spectrofluorimeter

9.10.6 PHARMACEUTICS LABORATORY

1 Dispensing balances with weights
2. Analytic balances, single pans for weighing ointment
3. 5kg Top loading Balances
4 Beam Balances with flat pans for weighing ointment
5 Refrigerator
6 Hot Air Ovens
7 Glassware set
8 Suppository Moulds
9 pH meters and accessories
10 Potentiometers
11 Conductivity bridge
12 Planimeter
13 Refractometer
14 Colorimeter
15 Water Baths Thermostatically controlled
16 Cone and Plate Viscometer
17 Brookfield Viscometer
18 Torision Viscometer
19 Mettler balances
20 Chemical balances
21 Water Baths
22 Magnetic stirrer
23 Pyrex all glass still
24 Cenro film balance
25 Hot air ovens
26 Bench centrifuges
27 Vacuum pump

28 Shaking reaction incubators
29 Counting machine
30 Fluid energy mill (Jet mill)

31 Sets of BS 410 test sieves set of 15 with replacement
32 Sieve shaker
33 Watson splitting cylinder eyepieces BS graticule 3265 and stage micron
34 Koeffler melting point Microscope apparatus
35 Photosedimentometer
36 EEL visible Spectrophotometer
37 Fluidised belt drier 5kg capacity
38 QVF Climbing film evaporator
39 Rotary evaporator (Zeiss, Jena)
40 Table Press single station
41 Punches
42 Multi purpose motor units e.g. Erweka AR 400
43 Tablet Hardness Tester
44 Roche Friabilator
45 Dissolution apparatus
46 Disintegration tester with spares
47 Electronic calculator with four memories stores
48 Helium densitometers
49 Bowl mixer
50 Platinum resistance thermometers and direct readout meter
51 Cooling unit for water baths
52 PH meters and accessories
53 Spectrophotometer with thermostated cell and sampling system
54 Compressor, piston type with reservoir capacity 10 cub fit/min
55 Vacuum pumps Edwards RB5
56 Voltstals

9.10.7 PHARMACOGNOSY

1. Assorted Heating mantles
2. Drying oven (200/240v)
3. Spectrophotometer
4. Polarimeter
5. Sodium lamps (for P5-450)
5. Polarimeter tube (100)
6. Polarimeter tube (200)

7. Polarimeter tube (400)
8. Refractometer
9. Flame Analyser (200/240v)
10. Colorimeter
11. Filter Calcium
12. Lamps, Anglepoise
13. Boxes cover glasses 22mm
14. Sodium lamps (for P5-450)
15. Stage graticules 10mm
16. Stage graticules 1mm
17. Stage graticules
18. Laboratory pH meters
19. Glass Electrode combined with silver chloride reference electrode
20. Manesty water still
21. Replacement heating element for DT-616-150w with safety devices
22. Ultra-microtome
23. Mortars and pestles, glass with foot and sport
24. Test Tube stands
25. Test tube holders
26. Laboratory trolleys
27. Waste sack
28. Waste sack polythene light duty 60 x 20 cm
29. Junior centrifuge 220/240v
30. Angle head
31. Melting point apparatus 220/240v
32. Spectrophotometer I.R400-40.0cm
33. Water pump
34. Freezer drying apparatus
35. Hot plates
36. Ice flake making machine
37. Fridge
38. Hot plates
39. Combined hot plate magnetic stirrer 220/240
40. Mechanical stirrer 220/240
41. Uroplan leveler model P
42. Tile adjustable spreader including gauge
43. T.L.C. Spotting jig
44. Chromajar complete
45. Microliter pipettes IV
46. Microliter pipettes 2

47. Microliter pipettes 5U
48. Microliter pipettes IOU
49. T.L.C.Chromatank (20 x 20)
50. T.L.C. potting jig
51. Preparative tank
52. Chromatography oven
53. Microscopes 242-948
54. Step transformer 243-376
55. Photoautomat
56. Driving tube
57. U.V. Spectrophotometer
58. I.R. Spectrophotometer
59. H.P.L.C.
60. Assorted Soxhlet apparatus
61. Fractional Distillation Assembly
62. Socket lamp spare (6v-5w) Bulbs 106-321
63. Pairs polariser/analiser d. 33mm 127-582
64. Voltage stabilizer
65. Museum equipment and furniture
66. Miscellaneous glassware
67. Large scale extractors with spare parts.

9.10.8 PHARMACEUTICAL CHEMISTRY

1. H.P.L.C.
2. I.R. Spectrophotometer
3. UV-VIS Spectrophotometer
4. Precision Polarimeter
5. Gas chromatograph
6. Polarograph 6(b) Frame photometer
7. Refractometer
8. Flourimeter
9. Colorimeter
10. pH. Meter (with titration unit)
11. Potentiometer
12. Densitometer
13. Mettler Balance
14. Chemical balance
15. Top lading balance
16. Over-head Projector

17. Epivisor projector
18. Manesty Distilled water still
19. All-glass water still
20. Fridge – (ice-machine)
21. Fridge – Thermostat arrangement (cooled incubator)
22. Thermostats
23. Thermostrirrers
24. Stirrer heads and stirrer
25. Magnetic stirrer
26. Centrifuge (electrically operated)
27. Centrifuge
28. Assorted heating mantles
29. Control for heating mantles
30. TLC-UNIT
31. Column Chromatography fraction collector
32. Chamber-paper Chromatography
33. Rotary evaporator with thermostatic arrangement
34. Vacuum pumps.
35. Air pump
36. Hydrogenator (pressure)
37. Vacuostat-vacuum gauge
38. Ovens
39. Vacuum Oven
40. Muffle furnace
41. Water pumps
42. UV lamp (360nm, 240nm)
43. I.R. Heating lamp
44. Micro-Kjedahl apparatus
45. Vacuum pistol
46. Shaker Orbital shaker
47. Hot-air blower
48. Hot plates
49. Assorted soxhlet apparatus
50. Heating assembly for soxhlet extractor
51. Smelting point apparatus
52. Sodium wire press
53. Thermometer 3600
54. Thermometer 1100
55. Microburnners
56. Water Baths (Multiple)

57. Water baths different sizes
58. Stop watch
59. Molecular model (student)
60. Cork bore set and Unit
61. Glass cutter
62. Fractional Distillation Assembly
63. Periodic Table Charts (wall chart)
64. Spray gun
65. Laboratory coat, glove, mask
66. Pressure regulator
67. Assorted quick iron stand, clamps
68. Lablox-scaffolding unit
69. Assorted quick-fit apparatus
70. Utra-centrifuge
71. Voltage stabilizers
72. Miscellaneous glassware and general equipment

9.10.9 PHARMACEUTICAL TECHNOLOGY LABORATORIES

A. Unit Operations Laboratory

Laboratory models of the following must be provided

1. Hammer Mill
2. Ball Mill
3. Triple-Roller Mill
4. Cube Mixer
5. Bowl Mixer
6. Sigma-blade mixer
7. Homogenizer/blender
8. Top Loading balance electronic
9. Filter Press
10. Centrifuge
11. Tray dryer
12. Fluidized bed Dryer 5kg
13. Rotary Evaporator
14. Erweko AR400 serial Power Units

B. Liquid Processing Laboratory

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

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

Dry Processing Laboratory
1. Rotary Table Press
2. Granulators, wet and dry
3. Fitzpatrick mill model D
4. Fluid Bed Dryer min 30kg capacity
5. Sieving machine & set of sieves
6. Table Deduster
7. Autodryertex Extractor
8. Capsule filling machine

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

Sterile Production Laboratory
1. Water still
2. Autoclaves
3. Ampoule Dryer
4. Ampoule Washer
5. Ampoules filling and sealing
6. Laminar flow cabinet
7. Pressure vessels/filtration systems
8. Hot air sterilizing oven

9. Hot air oven (Glass-ware dryer)

9.10.10 CLINICAL PHARMACY

1. High performance liquid chromatographs
2. UV-VIS Spectrophotometer
3. Dissolution Rate apparatus
4. Analytical balances
5. Magnetic stirrer
6. pH meters and accessories
7. Refrigerators
8. A deep freezer
9. An ultracentrifuge
10. Shakers
11. Water baths
12. Junior centrifuge (electrically operated)
13. T.L.C. Spotting jigs
14. TL.C. Chromatank (20 x 20)
15. Flame photometer
16. Rotary evaporator with thermostatic arrangement
17. Voltage stabilisers
18. Stop Watches
19. Ovens
20. Assorted soxhlet extractors
21. Spectrofluorimeter

9.10.11 DARKROOM EQUIPMENT

1. Darkroom safelight
2. Processing filters
3. Developing tanks
4. Film reel
5. Film loader
6. Film agitator
7. Film washing device
8. Dryer
9. Developing trays (different sizes)
10. Print tong
11. Film drying cabinet
12. Print drying cabinet

13. Enlarger
14. Exposure timers
15. Camera with lenses and accessories
16. Storage cabinets
17. Photomicrography Equipment

9.10.12 AUDIO VISUAL EQUIPMENT

1. Slide Projector
2. Video Camera
3. Overhead Projector
4. Projector screens
5. Audiotape Recorders
6. Computer facilities with internet access
9. Scanner
10. Video Recorders/Player
11. Coloured Multi-System CCTV Set in a network @one set to five students

9.10.13 Research Laboratories

These laboratories should have integrated research facilities and should be multidisciplinary.

References

National University Commission, Nigeria: Benchmark Minimum Academic Standards for Undergraduate programmes in Nigerian Universities, Basic Pharmaceutical Sciences, November 2014.