جمهورية السودان

جامعة كرري

كلية الصيدلة

Karary University

Faculty of Pharmacy

برنامج درجة البكالوريوس في الصيدلة

المقررات الدراسية

Karary University

Faculty of pharmacy

1. Mission:

Our mission at Karary University's Faculty of Pharmacy is to contribute to the development and promotion of the community by preparing pharmacists with professional ethics who are knowledgeable about the most recent pharmacy concepts and therapeutic care. This lets them contribute to the growth of the pharmaceutical industry and improve the efficiency of the pharmaceutical care system at the local and regional level in hospital pharmacies, private pharmacies, pharmaceutical factories and companies, quality control labs, and research and development centers.

2. Values:

2.1. Integrity / Transparency:

The faculty of pharmacy at Karary University will operate as a community trust, supported and established by the community. We will be honest in everything we do and be good stewards of the resources we have.

2.2. Respect:

We will respect our colleagues, our students, and our community. We treat others and their ideas in a manner that conveys respect as we discuss our differences. We will teach our students to respect their patients and co-patients, other members of the healthcare team, and their colleagues.

2.3. Compassion:

Compassion defines a good pharmacist; it is at the very heart of all we do. We will look for students and faculty who have this trait and work to improve it through education, research, and service.

2.4. Collaboration/ Generosity/Partnership:

Karary University's faculty of pharmacy will value what everyone in the region has to offer and believe our collaboration strengthens all. We will work to create partnerships with educational and health-related organizations that support our mission: to provide our students with an inter-professional education and to improve the health of the citizens of Khartoum State, Sudan at large, and neighboring African countries and other countries. We will share what we have learned with others and assist whenever possible to serve the people of our state, nation, and beyond.

2.5. Discovery and Scholarship:

Discovery and scholarship are what differentiate academic pharmacy programs. Karary University will encourage its faculty and students to keep looking for and making new knowledge that will help people.

2.6. Student Friendly:

Karary University's Faculty of Pharmacy is committed to students having an exceptional educational experience. It will seek feedback from students about improving the process of education; learn from their ideas; and provide educational services in a manner that respects students, supports their efforts to be good pharmacists and scientists, and provides a quality educational experience. Students will be partners in their education. The faculty of pharmacy at Karary University will try to get students to find a healthy balance between work and other activities.

2.7. Community Health:

Karary University Faculty of Pharmacy is committed to playing a role in improving the pharmaceutical services and care of the community and to contributing to the development of the community. It will involve students, faculty, and staff in creating projects to increase awareness of community health and working with other organizations that strive for the same goal.

2.8. Social Responsibility:

Our students, faculty members, and staff are part of a community, region, state, and world. Karary University's Faculty of Pharmacy will encourage all to get involved with their area, contribute to its wellbeing, and be active volunteers in bettering their lives. The Faculty of Pharmacy's educational focus will emphasize service to the community.

2.9. Best Practices:

Karary University's faculty of pharmacy will not only teach our students that pharmacy is best if supported by sound scientific evidence but will also disseminate information to faculty and community pharmacists that will enable them to change practice as evidence dictates through the provision of access to library resources and continuing pharmaceutical information.

2.10. Quality:

Karary University's faculty of pharmacy seeks to produce an educational experience of quality: quality in the delivery of pharmaceutical care and quality in our research and service efforts.

Also, the faculty and staff want to help students learn how to improve the quality of pharmacy practice.

2.11. Innovation:

Innovation is the heart of the Faculty of Pharmacy, and thus it will be open to new ideas from faculty, students, and staff. It will seek out new ideas and evaluate them with open minds in order to continue to improve the efficacy of pharmaceuticals and health care and the health system.

2.12. Stewardship:

The Faculty of Pharmacy has been entrusted with a great responsibility for the education of the next generation of pharmacists. This means that we have to live by our values and stay focused on our mission, which is to help people through education, research, health care, and community service.

2.13. Communication:

The Faculty of Pharmacy wants to instill in our students an understanding that good communication is a large part of being a good pharmacist. It will work to develop communication skills in students. It will also remember that many people support the college from throughout the region, and we will work to not only communicate our progress but to listen to their feedback and hopes for the college. It will also communicate with students, faculty, other members of the healthcare team, and staff by listening to their ideas and sharing their plans.

2.14. Lifelong Learning:

The Karary University faculty of pharmacy encourages students to understand that the process of growth and learning is continuous. It will look for faculty members who show a desire to learn and improve their work, create continuing education programs for the area, and teach students how to change their work based on new evidence.

3. Objectives:

To enable the student to:

1. Practice according to the internationally accepted code of ethics.
2. Accept the responsibility of continuing your professional education so that you can use advances in pharmaceutical sciences and get more postgraduate training in Sudan or elsewhere.

3. Start looking into local health problems, traditional medicinal plants, and other areas of medicine and/or pharmacy that interest you.

4. Rationale and Justification:

1. Provision of an innovative pharmacy education program by a Medical Education Institute with a very high calibre.
2. A good addition to the delivery of high-quality pharmaceutical services in a densely populated area such as Khartoum State.
3. Availability of a large number of pensioners with a wealth of experience in innovative pharmaceutical education and pharmaceutical service delivery.
4. Provision of extra chances in an innovative program of pharmaceutical education for a large number of Sudan General Certificate students who obtained very high percentages (> 75%) and yet failed to get a chance at university education.

Bachelor of Pharmacy

Program Specification

1. **Program Title:** Bachelor of Pharmacy
2. **Program Type:** Single
3. **Faculty / University:** Faculty of Pharmacy, Karary University.
4. **Department (s):**

a- ***Departments affiliated to faculty of pharmacy:***

- Department of Pharmaceutics
- Department of Microbiology & Immunology
- Department of Pharmaceutical Chemistry
- Department of Pharmacognosy and Phytochemistry
- Department of Pharmacology & Toxicology
- Department of Clinical Pharmacy and Pharmacy Practice

b- ***Departments not affiliated to faculty of pharmacy:***

- Anatomy, Physiology, Pathology, Research methodology and Biostatistics (Faculty of Medicine)
- Mathematics, Physics, General Chemistry department (Faculty of Science)
- English Language, Islamic studies, Arabic language (Faculty of Arts)
- Computer skills and information technology (Faculty of computer sciences)

Introduction:

The establishment of a modern pharmacy program is a unique idea leading to the creation of complementary biomedical disciplines, which will be a model for the integration of health care education as well as for inter-disciplinary research. This will enable pharmacy students to study certain subjects of a clinical nature. Such studies and clinical rounds would make it easier for people to talk to each other and agree on what each knows. They would also make sure that the future pharmacist is seen as an important part of the healthcare team.

To keep peace and to meet the changing needs and demands of society and the profession, the pharmacy program is embarking on a teaching program to enable hospital settings. As both the theoretical and practical courses are intended to provide the opportunity for students to gain greater experience in patient-centered learning environments and to work cooperatively with other healthcare practitioners as practicing members of the health care team, it is the goal of the program to prepare pharmacists who can assume expanded responsibilities for the clinical use of drugs and assist in the provision of rational drug therapy.

The course is set up so that future pharmacists get a good education. It is based on a good inter-disciplinary science degree course that connects chemistry and biology.

This program aims to: -

1. Provide the community with highly qualified and professional pharmacists with skills and ethical values.
2. Give students a wide range of knowledge and experience so that they can use the scientific knowledge they've learned in their chosen area of pharmacy and put their knowledge of pharmacy into a wider social and scientific context.

3. Develop communication skills, time management skills, critical thinking skills, problem solving skills, decision-making skills, teamwork skills, and other skills using modern information technology to design and conduct research and develop the student's ability to learn, work effectively both independently and as part of a health care team, design and carry out experiments, assemble, analyze, and assimilate information, and disseminate information.
4. Promote a good understanding of the pharmacy profession and the role of pharmacists in multidisciplinary teams.
5. Apply the criteria of good laboratory practice (GLP) and good pharmaceutical manufacturing practice (GPMP) to various qualitative and quantitative analytical techniques to assure the quality of raw materials, procedures, and pharmaceutical products.
6. Get the knowledge and skills you need for designing, formulating, making, calculating, managing, promoting, and selling pharmaceutical products.
7. Learn the basic rules of disease pathophysiology and how to use medicine in a smart way to improve healthcare services based on evidence.
8. Provide information and awareness to the community and the patients concerning medication.
9. Implement the sense of self-learning for continuous improvement of professional knowledge and skills.

Program structure and contents

A. Program duration: Five years into ten semesters (Total credit hours = 197).

B. Program structure: The Bachelor of Pharmacy program is completed in five years (ten semesters); each semester is made up of 14 weeks of full-time study.

C. Admission policy: The faculty complies with the admission regulations and requirements released by the Sudanese Ministry of Higher Education. The

admission to the program requires a general secondary school certificate with a major in biology and chemistry or an equivalent certificate from a foreign institute recognized by the Sudanese Ministry of Higher Education.

D. Regulation for progression and program completion:

- Pharmacy students spend five educational years, divided into ten semesters (each of 14 weeks), and each semester is followed by a practical, written, and oral exam.
- Students must attend lectures and practical lessons; their attendance in practical lessons must be not less than 75 % otherwise, and the department council prevents him/her from entering the written exam after approval from the faculty council.
- A minimum of 50% of the maximum grade is the passing grade for all courses.
  - ***Course grades are as follows;***

Less than 50%	***F***
From 50%-59%	***D***
From 60%-69%	***C***
From 70%-75%	***B***
Above 75%	***A***

  - For the students to be transferred from one academic year to the next, he/she is required to have successfully passed in all subjects.

E. Study plan:

Item	Number of hours
Program credit hours	197 credit hours
Field training program	720 contact hours
Program level	Five years / ten semesters

F. Continuous Training:

- This training program is a compulsory program that is managed and regulated by the faculty staff according to the student summer training guide (Appendix 1).
- Every student should complete 720 contact hours of training in one of the following pharmacy settings:
  1- Community- or hospital-based pharmacies-based training.
  2- Field training in pharmaceutical factories.
  3- Clinical pharmacy department.
- *The training hours are classified as follow:*
  1- **Continuous Training-1:** A total of 160 contact hours in a community pharmacy (8 hours/5 days for 4 weeks) after completion of the second year.
  2- **Continuous Training-2:** A total of 240 contact hours, divided into training in a community and/or hospital pharmacy (8 hours/5 days for 4 weeks) and training in a pharmaceutical factory (8 hours/5 days for 2 weeks) after completion of the third year.
  3- **Continuous Training-3:** A total of 320 contact hours divided into training in a community and/or hospital pharmacy (8 hours/5 days for 6 weeks) and training in a pharmaceutical factory (8 hours/5 days for 2 weeks) after completion of the 4th year.
- The faculty training committee will evaluate each student individually based on the rules in the training guide.

G. Assessment:

Intended Learning Outcomes (ILOs)	Method of achievement and assessment
• Knowledge and Understanding • Intellectual Skills	• Written and oral Exam
• Professional and practical Skills • Intellectual Skills	• Practical Exam • Summer Training
• Intellectual Skills • General and Transferable Skills	• Oral Exam • Team Work • Assignment

The curriculum structure

The college runs a B. Pharm. (Honours) degree in ten semesters of 14 weeks each, and an additional three weeks per semester are used for assessment.

First Year

Semester 1			Semester 2		
Code	Title	Cr.	Code	Title	Cr.
PH111	Biology (zoology)	3	PH121	Gross Anatomy	2
PH112	Physics	3	PH122	Pharmaceutics I	3
PH113	General chemistry	3	PH123	Pharmacognosy 1	3
PH114	Pharmaceutical Botany	3	PH124	Physical chemistry	3
PH115	Scientific English I	2	PH125	Scientific English II	2
PH116	Arabic writing skills	2	PH126	Mathematics	2
PH117	Computer skills	2	PH127	Organic chemistry I	2
			PH128	Sudanese studies	2
Total		18	Total		19

Second Year

Semester 3			Semester 4		
Code	Title	Cr.	Code	Title	Cr.
PH231	Physiology I	2	PH241	Physiology II	3
PH232	Pharmacognosy II	3	PH242	Pharmacognosy III	3
PH233	Pharmaceutics II	3	PH243	Pharmaceutics III	3
PH234	Organic Chemistry II	3	PH244	Organic chemistry III	3
PH235	Analytical chemistry I	3	PH245	Analytical chemistry II	3
PH236	Biochemistry I	3	PH246	Biochemistry II	3
PH237	English for Pharmacy	2	PH247	Pharmacology I	2
PH239	Jurisprudence of Transactions	2			
Total		21	Total		20

Continuous training-1
A total of 160 contact hours in a community pharmacy (8 hours/5 days for 4 weeks) after completion of the second year

Third Year

Semester 5			Semester 6		
Code	Title	Cr.	Code	Title	Cr.
PH351	Phytochemistry I	3	PH361	Phytochemistry II	3
PH352	Pharmaceutics IV	3	PH362	Pharmaceutics V	3
PH353	Organic chemistry IV	3	PH363	Medicinal chemistry I	2
PH354	Analytical chemistry III	3	PH364	Analytical chemistry IV	3
PH355	Pharmacology II	3	PH365	Pharmacology III	3
PH356	Pathology	2	PH366	Pharmaceutical Microbiology I	3
PH357	First Aid	2	PH367	Pharmacy Practice II (Forensic)	2
PH358	Pharmacy Practice I	2			
Total		21	Total		19

Continuous training-2

A total of 240 contact hours, divided into training in a community and/or hospital pharmacy (8 hours/5 days for 4 weeks) and training in a pharmaceutical factory (8 hours/5 days for 2 weeks) after completion of the third year,

Fourth Year

Semester 7			Semester 8		
Code	Title	Cr.	Code	Title	Cr
PH471	Phytochemistry III	3	PH481	Nutraceutical and poisonous plant	2
PH472	Pharmaceutics VI	3	PH482	Pharmaceutics VII	2
PH473	Medicinal chemistry II	2	PH483	Medicinal chemistry III	3
PH474	Pharmaceutical Analysis I	3	PH484	Pharmaceutical Analysis II	3
PH475	Pharmacology IV	3	PH485	Pharmacology V	3
PH476	Pharmaceutical Microbiology II	3	PH486	Pharmaceutical Microbiology III	3
PH477	Pharmacy practice III (Pharmacy ethics)	2	PH487	Pharmacy practice IV	2
			PH488	Clinical Pharmacy I	2
Total		19	Total		20

Continuous training-3

A total of 320 contact hours were divided into training in a community and/or hospital pharmacy (8 hours/5 days for 6 weeks) and training in a pharmaceutical factory (8 hours/5 days for 2 weeks) after completion of the 4th year.

Fifth Year

Semester 9			Semester 10		
Code	Title	Cr.	Code	Title	Cr.
PH591	Phytochemistry IV	2	PH5101	Phytotherapy	2
PH592	Pharmaceutics VIII	4	PH5102	Pharmaceutics IX	3
PH593	Medicinal chemistry IV	3	PH5103	Toxicology	2
PH594	Pharmaceutical Analysis III (Radio pharmacy)	2	PH5104	Clinical Pharmacy III	3
PH595	Pharmacology VI	2	PH5105	Research Project	4
PH596	Pharmaceutical Microbiology IV	3	PH5106	Pharmaceutical Biotechnology	2
PH597	Clinical Pharmacy II	3	PH5107	Continuous training	3
PH598	Biostatistics and research methodology	2			
Total		21	Total		19

Total Credit Hours= 197

Total summer training contact hours = 720

First Year

Semester I

1. Biology (zoology)

Course code	**PH111**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	This course aims to: • Provide students with sufficient basic concepts and information on different aspects of animal life. • Describe the different types of tissues and their relevance to drugs.
Course content	• Cell biology (structure, organelles, functions) and the cell cycle. • Genetics: Mendelian genetics, Mutations. • General histology, epithelial tissues, connective tissues, muscular tissues, nerve tissues.
Practical	• Microscopes. • Molecular structure. • Mitosis and meiosis.
Evaluation	• Attendance, assignments: 10% • Practical exam: 20% • Final exam: 70%
References	• Fowler S, Roush R, Wise J. Concepts of biology. OpenStax College, Rice University; 2013 Apr 25. • Alberts B, Bray D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K, Walter P. Essential cell biology. Garland Science; 2015.

2. Physics

Course code	**PH112**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	At the end of this course, the student should be able to: • Acquaint himself with the essential physics that would introduce him to instrumentation. • Demonstrate his understanding and knowledge of specific physical facts, terminology, principles, and methods.

Course content	• Electricity and magnetism (electrostatics, electrodynamics, and electromagnetics). • Optics (reflection of light, reflection by plane surfaces, lenses and optical instruments) heat (thermometers, temperature, measuring devices, and scales). expansion of liquids and solids). • Atomic and nuclear physics (atomic structure, electromagnetic radiation, photo-electronic effect, thermos-ionic emission, natural radioactivity, isotopes and radioactivity, Decay Law). • Biological fluids: blood pressure, surface tension in the lungs and respiratory distress syndrome, blood viscosity, and flow. • The nervous system: the neuron, the neuron's electric potential, and the physiological effect of electricity. • Medical instruments: ECG, EEG Ultrasonic sound and hearing tests. • Radioactivity, radiotherapy, and associated hazards.
Evaluation	• Attendance, assignment and mid exam: 20% • Final exam:80%
References	• Jones ER, Childers RL, Huber TM. POST-USE REVIEW: Contemporary College Physics. American Journal of Physics. 1992 Jan;60(1):92-3. • Nelkon M, Parker P. Advanced level physics. East African Educational Publ.; 1993.

3. General chemistry

Course code	PH113
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	At the end of this course the student should be able to: • Understand the atomic and molecular structures. • Understand the classification of elements and the periodic table and draw chemical structures. • Understand the different types of chemical equilibrium. • Understand the concepts of electrochemistry.
Course content	**1. Structure of the atom** • Atomic elementary particles. • Quantum theory. • Energy levels. • Atom orbitals. • Types of bonds. • Drawing chemical structures. **2. Classification of the elements**

	• Build-up of the periodic table • Periodic properties, **3. States of matter:** • Solid state and Gaseous state. • Liquid state, solutions and solubility **4. Introduction to electrochemistry** • Acids, b) Bases, c) Indicators • Ionization activity of ions • Lowery-Bronsted idea of acids and bases. • Lewis acids and bases. • Solvation of ions, • Ionization constants, pKb and pKa • pH and buffer solutions i Calculation of pH ii Titration curves of pH vs. neutralization. iii Buffer solution preparation and buffer capacity.
Practical	• Physical properties of the states of matter. • The phase diagram of water. • Quantum theory and Energy levels explanation by the use of spectroscope taking hydrogen atom (lamp) as a model (Palmer's series) • Physicochemical properties of elements • Preparing acids and bases solutions and how to check acidity and basicity. • Determination of pKa, pKb and pH. • Preparation of buffer solutions and the use of pH meters.
Evaluation	• Class tests, seminars and practical work: 20% • Mid-semester exam: 20% • Final exam: 60%
References	• Housecroft CE, Sharpe AG. Inorganic chemistry. Pearson Education; 2008. • Mortimer RG. Physical chemistry. Academic Press; 2000 Apr 28. • Bahl A. Essentials of physical chemistry. S. Chand Publishing; 2008. • Physical Chemistry by Ira Dunne TG. Physical Chemistry, (Levine, Ira N.).N. Levine, sixth edition.

4. Pharmaceutical botany

Course code	**PH114**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)

Objectives:	By the end of this course student will be familiar with; • The principle of plant classification and the major classes of the plant kingdom. • The difference between the plant and animal cells. • The morphology and histology of plant organs.
Course content	**1. Introduction: characteristics of living things** • Difference between plants and animals • Importance and scope of Botany **2.Plant nomenclature** • Subdivision of the phyla • Botanical systems of classifications • Taxonomic characters • Chemical plant Taxonomy **3.The plant cell: Plant cell structure** • Cell differentiation and Ergastic cell contents **4.Plant Morphology and Anatomy** • Macroscopic and microscopic characters of the main plant organs: leaves, flower, seeds, fruites, roots and rhizome, barks &woods **5.Plant physiology:** • Introduction: diffusion, osmosis & photosynthesis
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Practical	• Root modification • Stem modification and buds • Leaves • Flowers • Inflorescences. • Fruits • Types of tissues, anatomy of root and stem anatomy of flower and leaves
References	• O'Neill MJ. Trease and Evans' Pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacopbiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008.4. Essential of Pharmacognosy by Dr.S.H.Ansari. • Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976.

	• Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

5. Scientific English I

Course code	**PH115**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28hours)
Objectives	• This course is mainly study skills. It aims to give students a comprehensive guide to help them study effectively at university level. It also includes the most important grammatical items, which are the tenses. Besides some basic skills needed for writing effectively.
Course content	**Suggested Reading Topics:** • The importance of learning English language. • Reading Effectively. • Time Management. • Good Listening in Classroom. • Using The Dictionary. • Writing Skills (punctuation marks and topic Sentence). • Note Taking. • Presentation. • Preparing and Taking Exams. • Using Library **Grammar:** • The grammar tenses.
Evaluation	• Attendance, assignment, and mid exam: 20% • Final exam: 80%
References	• Angela B. The A to Z of correct English. ANGELA BURT; 2002. • Chesla E. Write better essays in just 20 minutes a day 2nd edition.3-Glenn D. (200). • Darragh G. A to Zed, A to Zee-A guide to the differences between British and American English. Editorior Stanley; 2000.

6. Arabic writing skills

إسم المقرر	مهارات الكتابة العربية
الرمز	PH116
ساعات معتمدة	ساعتان
ساعات الإتصال	28

وصف المقرر:
يعمل هذا المقرر علي معالجة مشكلات الطلاب الأساسية في اللغة العربية من خلال وحدات متكاملة في الصوت والكلمة والتركيب والدلالة .

الأهداف :

1. تعريف الطالب بالتطبيق العملي لدروس النحو والصرف .
2. أن يتعرف الطالب على الكتابة العلمية .
3. أن يتعرف الطالب علي ضروب فن الترجمة وصياغة المصطلحات العلمية .
4. أن يتمكن الطالب من التفريق بين الأساليب العربية المختلفة.
5. أن يتعرف الطالب علي وظائف الأدوات اللغوية في النصوص.
6. أن يتمكن الطالب من معرفة الأخطاء وتصحيحها

محتوى المقرر:

- الكتابة وأنواعها (الإجرائية ،الوظيفية ،الفنية ، الإبداعية) .
- الكتابة الإنشائية .
- الكتابة العلمية .
- التدوين وأنواعه .
- عناصر البناء التعبيري.
- الوصل والفصل في الكتابة العربية .
- الترجمة وأنواعها.
- كتابة المصطلح العلمي .
- الدلالة والمعاني.
- ضوابط الرسم الكتابي.
- الحذف والإضافة".
- التلخيص ، الرسالة ، التقرير ، التعليق ، المقال العلمي ،البحث العلمي .
- المحاضرة العلمية، الندوة العلمية.
- تحليل النصوص المكتوبة .
- تصحيح الأخطاء الكتابية اللغوية .
- أنماط الأجناس الكتابية وأغراضها .
- تطبيقات .

إستراتيجية التدريس:

المحاضرة، المناقشة، الواجبات .

أساليب التقويم:

- الامتحان التحريري 70%
- أعمال السنة 30%

مصادر ومراجع:

- القرآن الكريم.
- كتب السنة النبوية.
- تاريخ الأدب العربي: العصر الإسلامي/ الأموي/ العباسي، لشوقي ضيف.
- ديوان أبي الطيب المتنبي.
- وحي القلم، لمصطفى صادق الرافعي.
- ديوان حافظ إبراهيم.
- فن التحرير العربي ضوابطه وأنماطه للدكتور محمد صالح الشنقيطي .
- الدلالة وعلم المعاني ، إبراهيم أنيس .
- فن الترجمة وأنواعها د. محمد عناني .
- المصطلح العلمي وكيفية صياغته ، د. صالح العوة .
- ضروب الكتابة في اللغة العربية ، د. أحمد قبش .
- تاريخ الأدب العربي د . شوقي ضيف .

7. Computer Skills

Course code	**PH117**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objectives:	By the end of this course student will be able to: • Understand the concept, development, applications, types, and components of computer systems. • Discuss the representation and processing digital computers. • Learn the basics of computer programming.
Course content	• The computer concept. • The history of computer. • Overview of computer in human life (i.e. the effect of computer in human life), computer in (business, education, industry, medicine, entertainment and sport, home, communication, research and scientific fields). • Overview for the components of the computer systems: 1. Hardware (input devices, output devices, memories, storage media, central processing unit, buses and etc.) 2. Software i system software, application software ii Microsoft office (Word, PowerPoint, Excel). iii Opteron system windows. iv Network. v Security and safety. • An Overview of computers (digital computers, analogue computers, hybrid computers, supper computers, mainframe computers, minicomputers, personal computers, multi-user computers, etc.) 1. Information representation in digital computers (characters, numeric information, machine instructions, images, etc.)

	2. Introductions to computer programming a. Review for development of programming language b. Review of programming methods. c. Simple discussion for algorithm concept, variable and control structure) 3. Definition and benefits of computer network and internet.
References	• Commowick O, Istace A, Kain M, Laurent B, Leray F, Simon M, Pop SC, Girard P, Ameli R, Ferré JC, Kerbrat A. Objective evaluation of multiple sclerosis lesion segmentation using a data management and processing infrastructure. Scientific reports. 2018 Sep 12;8(1):1-7. • Introduction to Computer Science. Pearson Education India; 2004.

Semester II

1. Gross Anatomy

Course code	**PH121**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28hours)
Objectives	• At the end of this course the student will be able to describe the human body systems and relate them to the function.
Course content	• General introduction to anatomy • Skeletal system, Muscular system, Nervous system, Cardiovascular system • Gastrointestinal system, genitourinary system, Endocrine system. • Respiratory system, Lymphatic system, Immune system
Evaluation	• Attendance, assignment, mid exam: 20% • Final exam: 80%
References	• Warwick R, Williams PL, Dyson M, Bannister L. Gray's anatomy.

2. Pharmaceutics I

Course code	**PH122**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical (42 hours)
Objectives	• At the end of this course the student should be able to: • Give an account of how pharmacy originated • Mention the basic reference materials • List down the most common delivery systems • Know and describe the systems of measurements • Calculate doses of drugs • Calculate isotonicity, osmolarity, sodium chloride equivalency and osmolality of liquid pharmaceutical preparations • Understand the distinction between different dosage forms • Practice the basic dispending techniques • Perform standard weighing and measuring techniques • Read, interpret and obtain the formula for the prescription given • Compounding preparations • Label the preparation accordingly -writing reports.
Course content	• Introduction and history of pharmacy • Pharmaceutical reference systems • Interpretation **of prescriptions or medication orders**

	✓ Systems of measurements: metric system, common systems ✓ Posology geriatric and paediatric dose adjustment ✓ Reducing and enlarging formulas ✓ Dilutions and concentrations ✓ Density, specific gravity and specific volume ✓ Alligation alternate and medial ✓ Calculations concerning sterile solutions Isotonic ✓ Electrolytes and sodium chloride equivalents ✓ Osmolality,osmolarity and equivalent weights • **Rate of flow of intravenous fluids (Insulin dosage, Heparin dosage)** • **Calculations involving reconstitution of dry powders** ✓ Definition of generally used expressions ✓ Dispensing a preparation, Storage of preparations ✓ Containers labelling and package inserts ✓ Preservation, sterilization and aseptic compounding ✓ Colorants and flavours ✓ Basic dispensing techniques • **Weighing: Measurement of liquids**
Practical	• Introduction and different sources of information • Basic equipment and instrumentation • Accuracy and measurement of pharmaceutical liquids and weights • Density, specific gravity and specific volume • Examples of dosage forms, syrups • Examples of dosage forms, aromatic water and spirits • Examples of dosage forms, suspensions • Examples of dosage forms, ointment and cream bases • Mixtures and lotions
Evaluation	• Class tests, Seminars and Practical work: 20% • Mid-semester examination: 20% • End semester examination: 60%
Reference	• Pharmaceutical practice, latest edition, Churchill Livingstone, A. J. Winfield & R. M. Richards • Aulton ME, Taylor K, editors. Aulton's pharmaceutics: the design and manufacture of medicines. Elsevier Health Sciences; 2013. • Brown HT. Remington's Practice of Pharmacy, 1956. Edited by Eric W. Martin and E. Fullerton Cook.Pharmaceutical Calculations, 10th edition, Williams & Wilkins, M.J.Stoklosa & H.C.Ansel • Calculation for pharmaceutical practice,1st edition, Elsevier, A, Winfield &I.Edafiogho

3. Pharmacognosy I

Course code	**PH123**
Credit hours	4Cr. (3+1)
Contact hours	• Lectures (42hours) • Practical (42 hours)
Objectives	• To introduce the students to world of natural drugs. • To enable the student to know the official source, geographical origin, chemical constituents and medicinal value of the official and famous medicinal plants. • To make use of the students' knowledge in botany to enable them to describe the microscope and microscopical characters of medicinal plants.
Course content	• General introduction to Pharmacognosy and its history: i- Definition and scope of Pharmacognosy. ii- Role of traditional and herbal systems of medicine and its importance in modern pharmacy.
	• Classification of crude drugs. i- Alphabetical classification. ii- Taxonomical classification iii- Morphological classification. iv-Chemical classification. v- Pharmacological classification. vi-Chemotaxonomic classification.
	• Sources of drugs. i- Crude drugs used in digestive tract problems. a- Laxatives. b- Anti-diarrhoeal herbs. c- Carminative and anti-spasmodic herbs. d- Demulcent herbs e- Bitter tonic herbs f- Anti-ulcer herbs. g- Anti-haemorrhoids herbs. h- Emetic herbs. i- Hepatics and cholagogues herbs. ii- Crude drugs used in respiratory tract problems. a- Bronchial asthma. b- Antitussive herbs. iii- Crude drugs used in kidney, urinary tract and prostate problems. a- Diuretic herbs. b- Antiseptic herbs. c- Anti-infective herbs.

	d- Prostate enlargement "Prostate hyperplasia". iv- Crude drugs used in arthritic and skeletal muscle disorder. a- Arthritis. b- Muscle pain. c- Gout. v- Crude drugs used in cardiovascular system problems. a- Congestive heart failure. b- Hypertension. c- Arteriosclerosis and hyperlipidaemia. d- Angina. vi- Crude drugs used in skin and mucous membranes problems. a- Dermatitis. b- Contact dermatitis. c- Burns and wounds. d- Lichens and infections of oral cavity and throat. vii- Crude drugs used in nervous system problems. a- Anxiety and sleep disorders. b- Depression. c- Headache. d- Toothache. e- Sexual impotence. f- Parasympatholytic herbs. g- Para-sympathomimetics herbs. h- Narcotic herbs. viii- Crude drugs used in performance and immune deficiencies. a- Performance and endurance enhancers. b- Anticancer herbs. c- Immune system enhancers. ix- Crude drugs used in metabolic and endocrine system problems. a- Gynaecological disorders. b- Antidiabetic herbs.
Practical	• Introduction to Pharmacognosy, plant taxonomy and herbarium • Introduction to the microscopy and mounting techniques. • Microscopic identification for starches (potato, rice, wheat and maize) • Microscopic identification for calcium oxalate crystals (senna folium + cinchona and cinnamon barks) • Microscopic characters of crude drugs containing volatile oils (Peppermint folium, clove flos, anise fructus and cinnamon barks) • Microscopic identification for Cinchona cortex + chamomile Flores • Microscopic identification for Aniseed +linseed • Microscopic identification for Liquorice + ginger roots

	• Field trip to the Medicinal & Aromatic Plants National Centre. • Field trip to the national botanical gardens
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 10% • Assignment 10% • End semester examination 60%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996.. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008. • Essential of Pharmacognosy by Dr.S.H.Ansari. Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

4. Physical chemistry

Course code	**PH124**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical (42 hours)
Objectives	At the end of this course the student should be able to: • Explain the phenomenon of radio-activity • Understand chemical kinetics • Understand the laws of thermodynamics and their applications.
Course content	**a. Chemical kinetics** • Simple reactions, • Rate of chemical reaction

	• Kinetic equation • Order of reaction: - Zero-order reaction - First-order reaction - Second-order reaction • Reaction half-life **b. Chemical thermodynamics** • Introduction: - Isolated, Open, & Closed systems - Heat, work and thermodynamic processes • First law of thermodynamics • Second law of thermodynamics • Third law of thermodynamics **c. Nuclear chemistry** • Nucleons and nuclear structure • Radioactivity • Nuclear equations • Nuclear stability and radioactive decay • Half-life • Natural radioactive series • Stimulated nuclear reactions (nuclear fission & fusion) • Nuclear binding energy • Nuclear reactors • Detection and measurement of radioactivity • Uses of radioactivity **D. Chemical equilibria** • Basic terms, equilibrium constant • Dependence of the equilibrium constant on temperature & pressure. • Le Chatelier's principle • Ionic theory and ionic equilibrium , Ksp, Qsp Acid/base equilibria
Practical	• Determination of b.p & m.p • Crystallization, Reflux & distillation, • Elemental analysis • Selected simple physical chemistry experiments
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Housecroft CE, Sharpe AG. Inorganic chemistry. Pearson Education; 2008. • Mortimer RG. Physical chemistry. Academic Press; 2000 Apr 28.

	• Bahl A. Essentials of physical chemistry. S. Chand Publishing; 2008. • Dunne TG. Physical Chemistry, (Levine, Ira N.).

5. Scientific English II

Course code	**PH125**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28hours)
Objectives	The course aims at improving students" language generally and providing reading and listening material that encounter them while studying at the university and afterwards, bedside reading and listening to lectures in English.
Course content	**Reading:** • Hospitals. • Taking Medical History I. • Taking Medical History II. • Examining patient. • Special Examinations • X- rays Dept. • ER Dept. • Investigations. • Making Diagnosis. • Treatment. • Nursing. • Lab Safety. **Grammar:** • Word Formation • The Passive Voice. • Part of Speech: Adjectives & Adverbs **Writing skills:** • Technical & Medical Reports. • Formal Letters & CV. • Listening skills (Many Situations that may take place in Hospital).
Evaluation	• Attendance, assignment, mid exam: 20% • Final exam: 80%
References	• Angela B. The A to Z of correct English. ANGELA BURT; 2002. • Chesla E. Write better essays in just 20 minutes a day 2nd edition.3-Glenn D. (200). • Darragh G. A to Zed, A to Zee-A guide to the differences between British and American English. Editorial Stanley; First Edition, Irun-Spain

6. Mathematics

Course code	**PH126**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objectives:	At the end of this course the student should be able to: • Know the principles of applied mathematics.
Course content	• Mathematical fundamentals • Dimensions • Introduction to calculus • Differentiation • Integration
Evaluation	• Attendance, assignment, mid exam: 20% • Final exam: 80%
References	• Bittinger ML, Beecher JA, Johnson BL. Introductory and Intermediate Algebra. Pearson; 2015.

7. Organic chemistry I

Course code	**PH127**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objectives:	At the end of this course the student should be able to: • Understand the stereochemistry • Understand chemistry of alkanes, alkenes and alkynes, and to be able to describe their stereochemical properties.
Course content	**1.Fundamentals of organic chemistry:** • Intermolecular forces, • Tautomerism • Electronic displacement; • Inductive & mesomeric effect • resonance • Lewis Structures • Formal charge • Determining Molecular Shape • Electronegativity and Bond Polarity • Polarity of Molecules • Hybridization (sp3, sp2, & sp) **2.Introduction to Stereochemistry** • Chiral and Achiral Molecules • Stereogenic Centers

	• Stereogenic Centers in Cyclic Compounds • Labelling Stereogenic Centers with R or S • Diastereomers • Meso Compounds • R and S assignments in compounds with 2 or more stereogenic centers • Disubstituted cycloalkanes • Conformational and Configurational isomers • Physical Properties of Stereoisomers • Chemical Properties of Enantiomers **3.Alkanes** • Alkanes and Alkyl Groups: Isomers • Naming Branched-Chain Alkanes • Common Names • Properties of Alkanes • Conformations of Ethane • Drawing Chemical Structures • Cycloalkanes • Substituted Cycloalkanes • Cis–Trans Isomerism in Cycloalkanes • Conformations of Some Cycloalkanes • Axial and Equatorial Bonds in Cyclohexane • Conformational Mobility of Cyclohexane • Reactions of alkanes: • Oxidation of Alkanes • Halogenation of Alkanes • The Mechanism of Halogenation - The Stereochemistry of Halogenation - Chlorination versus Bromination - Halogenation as a Tool in Organic Synthesis
Tutorials	• Computer based tutorials in stereochemistry
Evaluation	• Class tests, Seminars and tutorials: 20% • Mid-semester examination: 20% • End semester examination: 60%
References	• McMurry JE. Fundamentals of organic chemistry. Cengage Learning; 2010. • Gorzynski JS. Organic chemistry. McGraw-Hill/Higher Education; 2008. • Solomons TG. Fundamentals of Organic Chemistry, 1997. • Block JH, Beale JM. Wilson and Gisvold, s textbook of organic medicinal and pharmaceutical chemistry, 2004.

8. Sudanese Studies:

إسم المقرر	**دراسات سودانية**
الرمز	**PH128**
ساعات معتمدة	**ساعتان**
ساعات الإتصال	**28**

وصف المقرر:

يقوم المقرر علي مسألة إدراك أو معرفة المكونات الجغرافية والتاريخية والأجتماعية والثقافية لجمهور السودان.

الأهداف العامة:

1. تزويد الطالب فى بداية مرحلته الجامعية بالمعارف الأساسية عن وطنه وقضاياه.
2. صياغة الدارس وإعداده من خلال تقوية وتنمية روح الجماعة والمواطنة للإسهام الفاعل فى بناء الوطن وتنميته والزود عنه .
3. إبراز مكونات وخصائص المجتمع السوداني من تنوع وتعدد إثنى وثقافي وديني كعنصر قوة ومدى تأثير ذلك في بناء الشخصية السودانية وإمكانية توظيفه في تمتين النسيج الاجتماعى وتحقيق الوحدة الوطنية .
4. كما يهدف إلى تعريف الدارس بقيمة وطنه المتمثلة في مُثله وقيمه وموارده الطبيعية والبشرية.

- **مفردات المقرر :**
  1. جغرافية السودان والموقع المتميز للسودان .
  2. الموارد الطبيعية والصناعية في السودان .
  3. نهر النيل .
  4. تاريخ السودان القديم .
  5. دخول الإسلام واللغة العربية إلي السودان .
  6. المماليك الإسلامية في السودان .
  7. أنظمة الحكم في السودان .
  8. مصادر الاقتصاد في السودان .
  9. الثقافة السودانية .
  10. ملامح من الأخلاق السودانية .
  11. الأدب الشعبي السوداني .
  12. ملامح من العادات والتقاليد السودانية .
  13. الهوية والشخصية السودانية .
  14. الذهب في السودان .
  15. التعليم العالي في السودان .
  16. الاتصالات في السودان .
  17. نمازج من مشاريع التنمية في السودان .

أساليب التقويم:

- الامتحان التحريري 70%
- أعمال السنة 30%

- **المصادر والمراجع :**
  1. القرآن الكريم.
  2. السنة الشريفة.

المراجع :

1. إبراهيم محمد خليل ، تسويق الماشية واللحوم فى السودان ، الخرطوم مارس1995م .
2. الزبير عبد الرحمن يوسف ، إستراتيجية وبرامج عمل إدخال الحيوان فى الدورة الزراعية فى مشروع الجزيرة ، الخرطوم يونيو 1990
3. أسامه الشيخ يس ، إستراتيجية بحوث الإنتاج الحيوانى ، الخرطوم يناير 1991م .
4. النعيم التوم محمد أحمد ، أثر اللغة التركية على اللهجة العامية السودانية ، الخرطوم 2002م
5. جابر محمد جابر ، مفهوم التدخل اللغوى من منظور وحدوي ، مركز الدراسات الإستراتيجية ، الخرطوم 1998م .
6. جوليت عدلى غابيوس ، علاقات دولة الفونج ببلاد العرب ، الطبعة الأولى ، دار العربية للنشر ، القاهرة ، 2009م .
7. زين العابدين عبد المقصود ، قضايا بيئية معاصرة ، الطبعة الثانية دار الكتاب لبنان بدون تاريخ .
8. حسب الله محمد أحمد ، قصة الحضارة فى السودان ، الطبعة الأولى ، دار يوليو للترجمة والنشر بالقاهرة 1996م .
9. حسن بكر ، المنظور المائى للصراع العربي الإسرائيلي ، الطبعة الأولي ، القاهرة 2006م .
10. حسن سعيد سليمان ، إستراتيجية الثروة الحيوانية ، الطبعة الأولي ، الخرطوم 1987م .
11. حسن صالح عمر محمدين ، السودان فى الإستراتيجية الأمريكية بين الشرق الأوسط وأفريقيا جنوب الصحراء ، الطبعة الأولي ، الخرطوم دارس السداد 2006م .
12. حسن محمد حسن ، نظم الإنتاج الحيوانى ، الخرطوم 1992م .
13. موسى المبارك الحسن ، تاريخ دارفور السياسى ، الطبعة الثانية ، دار الخرطوم للطباعة والنشر ، الخرطوم 1995م .
14. محجوب عمر باشرى ، معالم تاريخ السودان ، الدار السودانية للكتب ، الخرطوم ، بدون تاريخ .
15.محمد إبراهيم بكر ، تاريخ السودان القديم ، مكتبة الأنجلو المصرية ، القاهرة 1998م .
16.محمد إبراهيم أبو سليم ، فى الشخصية السودانية ، الطبعة الأولى ، شركة مطابع العملة المحدودة .
17.سامية بشير دفع الله ، تاريخ الحضارات السودانية القديمة منذ أقدم العصور وحتى قيام مملكة نبتة ، دار جامعة السودان المفتوحة للطباعة ، الخرطوم 2011م ,
18.سير هارولد ماكمايكل ، السودان ، ترجمة محمود صالح ، أنرست بنى المحدودة ، الطبعة الأولي ، لندن 1954م .
19.عاطف العبد ، الأنظمة الإذاعية فى الدول العربية ، الطبعة الأولي ، دارس الفكر العربى ، القاهرة 2007م .
20.عبد الله محمد قسم السيد ، الهوية وتمزق الدولة السودانية ، دار عزة للنشر ، الخرطوم 2008م.
21.عبد المجيد عابدين ، تاريخ الثقافة فى السودان ، الطبعة الأولى دار الكتاب بيروت 1967م .
22.عبد الحميد محمد أحمد ، القيم الإجتماعية فى التراث الأدبي السوداني ، الدار السودانية للكتب الطبعة الأولى 2002م .
23.عبد العزيز خالد ، مستقبل الإندماج الوطني فى السودان ، جبال النوبة نموذجاً ، مؤسسة الصالحانى للطباعة ، سوريا ، دمشق 1966م .
24.عـــــوض أحمد حسين ، الدلالات التاريخية للعمليات النوبية ، بدون تاريخ .
25.عبد العزيز خالد ، مياه النيل ، وحسابات الأوض ، الطبعة الأولى ، الخرطوم شركة مطابع السودان للعملة المحدودة 2007م.
26. عبد الله إبراهيم الشكرى ، وآخرون ، الأخلاق السودانية فى منظور الأخر ، وسلسلة ندوات التنوير ، مركز التنوير المعرفي ، الطبعة الأولي 2005م.
27.على دراج على ، إعادة تأهيل الموارد الرعوية الطبيعية ، الخرطوم 1988م .
28.على عبد الواحد وافي ، اللغة والمجتمع ، دار النهضة مصر ، القاهرة 1970م .
29.على عيسى عبد الرحمن ، الصراع الحضارى وأدواته المعاصرة الطبعة الأولى الخرطوم مطبعة الشهيد عثمان عمر 2006م .
30.عون الشريف قاسم ، الإسلام والعربية فى السودان ، الدراس السودانية للكتب ، الخرطوم الطبعة الأوى 1972م .
31. عون الشريف قاسم ، اللهجة العامية فى السودان ، الدار السودانية للكتب 1989م .
32. فتحى على حسن ، المياه وأوراق اللغة السياسية فى الشرق الأوسط ، مركز الدراسات الإستراتيجية والسياسية ، القاهرة 1980م .
33. فريدرك نيتشة ، أصل الأخلاق ، ترجمة حسن قبيس ، الطبعة الثانية ، 1983م المؤسسة الجامعية للدراسات، النشر والتوزيع لبنان بيروت 2004م .

34. صلاح الدين عامر ، النظام القانوني للأنهار الدولية ، معهد الدراسات والبحوث العلمية ، القاهرة 2001م .
35. صلاح الدين عبد البديع شلبي ، مشكلة المياه العزبة فى إطار الإتفاقية الدولية الجديدة ، الطبعة الأولي ، القاهرة 1999م .
37. ترى نورنستام ، الأخلاق السودانية ، ترجمة أحمد على محمد المهدى ، الطبعة الأولى ، مطبعة جامعة كررى ، الخرطوم 1996م .
38. يوسف فضل حسن ، دراسات فى تاريخ السودان وأفريقيا وبلاد العرب ، الجزء الثالث ، الوطنية ، الخرطوم ، الطبعة الأولي ، سوداتيك المحدودة 2007م .

Second Year

Semester III

1. Physiology I

Course code	**PH231**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical (42 hours)
Objectives	To provide knowledge and skills concerned with normal functions of different organs, tissues and the body systems.
Course content	• Introduction (body fluids, pH, buffers, membrane physiology) • Blood • Cardiovascular system • Respiratory system • Urinary system • Gastrointestinal system
Practical	**Topics for consideration are:** • Units and concentrations (body fluids). • Blood collection and blood film. • Differential leucocytes count. • Hb estimation • Total leucocytes count. • Total erythrocytes count. • Blood groups. • Blood pressure. • ECG and its interpretation
Evaluation	• Class tests, Seminars and Practical work 20% • Assignment 10% • End semester examination 70%
References	• Guyton AC, Hall JE. Textbook of medical physiology. Philadelphia: Saunders; 1986 Sep 20 • Barrett KE. Ganong's review of medical physiology. • Sherman JH, Luciano DS, Vander AJ. Human physiology: the mechanisms of body function. McGraw-Hill; 1985.

2. Pharmacognosy II

Course code	**PH232**
Credit hours	3Cr. (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	**At the end of these courses the student will be able to:** • Describe and perform extraction and isolation of drugs from natural sources. • Use different chromatographic methods for the separation, isolation, purification, and identification of chemical constituents of plant extracts. • Determine physical and chemical data of pure drugs. • Apply different spectroscopic techniques for structure elucidation and characterization of different classes of natural products.
Course content	• **Extraction of crude drugs.** i. Cold extraction methods. a- Maceration. b- Percolation. c- Liquid -liquid extraction. d- Electrical mixer. ii. Hot extraction methods. e- Digestion. f- Infusion. g- Decoction. h- Continuous soxhlet extraction. • **Isolation and purification of chemical constituents.** - Physical methods. - chemical methods. - general principles of chromatography. i. chromatographic methods: a- Adsorption chromatography. b- Partition chromatography. c- Paper chromatography. d- Thin layer chromatography (TLC). e- Preparative TLC. f- Column chromatography. g- Ion exchange chromatography. h- Gel filtration chromatography. i- Gas chromatography. j- HPLC. k- Electrophoresis.

Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 10% • Assignment 10% • End semester examination 60%
Practical	• Basic phytochemical procedures, "extraction methods I" (maceration, infucion and decoction) • Basic phytochemical procedures "extraction methods II" (soxhelt) • Basic phytochemical procedures "extraction methods III" (volatile oils distillation) • Basic phytochemical procedures, Chromatography I (PC) • Basic phytochemical procedures, Chromatography I (TLC) • Extraction of plant sample with solvents of different polarity and TLC analysis of the extracts • Separation of the plant sample by column chromatography and • TLC analysis of the fractions • Isolation of eugenol from clove buds with distillation and liquid-liquid extraction • Purity examination of the isolated eugenol by TLC. • Isolation of Eugenol by preparative TLC • Characterization and elucidation of eugenol structure using spectroscopic methods
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008. • Essential of Pharmacognosy by Dr.S.H.Ansari. Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. pharmacopoeial standards for ayurvedic formulations. central council for research in Indian medicine & homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

3. Pharmaceutics II

Course code	PH233
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours). • Practical and tutorials (42 hours)
Objective	• To determine the state of matter • To define a solution and describe all types of solution and know the term solubility and its various expression • To understand the dissolution process and factors affecting it • To study the phase rule and phases degrees of freedom as it relates to the number of components • To study the surface and interfacial tensions • And determine the disperse system • To study the rheology • To explain the basic principles underlying fluid mechanics, heat transfer, mass transfer, evaporation drying mixing and separation techniques
Course content	• Solid state properties • Solution • Phase equilibria • Phase equilibria • Interfacial phenomena • Dispersed systems • Rheology • Rheology • Introduction to unit operations • Heat transfer • Mass transfer • Evaporation • Drying • Filtration • Centrifugation, distillation, and extraction
Practical	• Crystallization • Solubility (factors which affect the solubility) • Two phase system (Determination of the critical solution temperature of phenol / water system)
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%

Reference	• Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. Philadelphia: Lea & Febiger; 1976. • Ganderton D. Unit Processes in Pharmacy: Pharmaceutical Monographs. Elsevier; 2014 May 20. • McCabe WL, Smith JC, Harriott P. Unit operations of chemical engineering. New York: McGraw-hill; 1993. • Remington JP. Remington: the science and practice of pharmacy. Lippincott Williams & Wilkins; 2006. • Allen L, Ansel HC. Ansel's pharmaceutical dosage forms and drug delivery systems. Lippincott Williams & Wilkins; 2013 Dec 23.

4. Organic chemistry II

Course code	**PH234**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • Understand different types of functional groups • Writing Equations for Organic Reactions • Describe Kinds of Organic Reactions
Course content	**1. Alkenes & Alkynes** • Nomenclature and Physical Properties • Calculating Degrees of Unsaturation • Preparation • Addition Reactions • Alkenes in Organic Synthesis • Hydrohalogenation—Electrophilic Addition of HX • Markovnikov's Rule • Stereochemistry of Electrophilic Addition of HX • Stereochemistry of Halogenation • Halohydrin Formation • Hydroboration–Oxidation • Reaction of Acetylide Anions **2. Alkyl halides** • Nomenclature • Physical Properties • The Polar Carbon–Halogen Bond • General Features of Nucleophilic Substitution • The Leaving Group • The Nucleophile

	• Mechanisms for Nucleophilic Substitution SN2 & SN1 • Carbocation Stability • Vinyl Halides and Aryl Halides • General Features of Elimination reactions • The Mechanisms of Elimination E1 & E2 • The Zaitsev Rule • Stereochemistry of the E2 Reaction • E2 Reactions and Alkyne Synthesis **3. Alcohols, Ethers and Epoxides** • Nomenclature • Physical Properties • Preparation of Alcohols, Ethers, and Epoxides • Reactions of Alcohols, Ethers, and Epoxides • Carbocation Rearrangements • Conversion of Alcohols to Alkyl Halides with HX • Conversion of Alcohols to Alkyl Halides with $SOCl_2$ and PBr_3 • Reaction of Ethers with Strong Acids
Practical	• Reaction of alkenes and alkynes. • Classification and identification of organic compounds • Functional group reactions: • Alcohols, Ethers, Epoxides and Alkyl halides
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• McMurry JE. Fundamentals of organic chemistry. Cengage Learning; 2010. • Gorzynski JS. Organic chemistry. McGraw-Hill/Higher Education; 2008. • Solomons TG. Fundamentals of Organic Chemistry, 1997. • Block JH, Beale JM. Wilson and Gisvold, s textbook of organic medicinal and pharmaceutical chemistry, 2004.

5. Analytical chemistry I

Course code	**PH235**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	• To equip the students with both theoretical and practical experience that • would enable him/her to carry out the analysis, and how to handle the basic laboratory equipment and glassware and the proper way for

	calculation and data analysis to be more efficient and competent in the area of pharmaceutical analysis.
Course content:	**Quantitative analysis:** **The theoretical basis of quantitative titrimetric analysis** • Aqueous acid-base titration, • Non-aqueous titration, • Precipitation titration, • Gravimetric analysis,
Practical	• **Classification of quantitative analysis:** - Treatment of quantitative data, - Common apparatus for quantitative analysis • **Quantitative titrimetric analysis** - Preparation of Standard solution - Direct Titration - Back Titration - Back Titration with Blank Determination - Non-aqueous Acid/Base titration - Precipitation Titration - Gravimetry
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Watson DG. Pharmaceutical analysis E-book: a textbook for pharmacy students and pharmaceutical chemists. Elsevier Health Sciences; 2020 Jun 10. • Vogel AI, Jeffery GH. Vogel's textbook of quantitative chemical analysis. Wiley; 1989. • Kar A. Pharmaceutical drug analysis. New Age International; 2005.

6. Biochemistry I

Course code	**PH236**
Credit hours	4Cr (3+1)
Contact hours	• Lectures (42hours) • Practical (42 hours)
Objectives:	• By the end of this course the students should be able: • To understand the cell structure and its functions. • To learn and understand the role of amino acids as the building blocks of proteins and the nutritional importance of essential amino acids. • To learn the various functions of proteins. Protein structure function relationships (hemoglobin).

	• To study the enzymes, their catalytic abilities and kinetics (significance of Km values and the effect of inhibitors on Km, drugs as enzyme inhibitors) • To understand the importance of vitamins, as enzyme cofactors. • Be familiarized with the chemistry of sugars, lipids, and understand their metabolic and medical importance.
Course content	• Introduction to biochemistry • The cell structure • Amino acids chemistry, ionizations, pKa and pI values, reactions, the peptide bond formation. • Protein structure, native and denatured proteins. Structure function relationships. Haemoglobin as a model protein. • Enzymes and enzyme kinetics, Km, Vmax, effect of inhibitors, Drugs as enzyme inhibitors. Enzyme activity synthesis regulations, effect of hormones. • Carbohydrates chemistry of mono, di, oligo, polysaccharides and heteropolysaccharides glycoproteins and glycosaminoglycans, heparin. • Lipid chemistry of fatty acids, triglycerides and phospholipids, steroids, sphingolipids, Lipoproteins, chylomicrons, VLDL, LDL and HDL • Nucleic acid (DNA and RNA), components and structure - DNA organization. - RNA types and roles. • Vitamins: Fat soluble and water soluble vitamins and their metabolic importance, deficiency symptoms, daily requirements, natural sources in food.
Practical	**<u>Experiments of Carbohydrates - Qualitative Tests</u>** • Test (1): Molisch Test • Test (2a): Benedicts's Test • Test (2b): Fehling's Test • Test (3): Iodine Test • Test (4): Barfoed's Test • Test (5): Bial's Test • Test (6): Seliwanoff's Test • Test (7): Hydrolysis of Disaccharides (Sucrose). • Test (8): Hydrolysis of polysaccharides (Starch). **<u>Experiments of lipids - Qualitative Tests</u>** • Test (1): Solubility Test • Test (2): Sudan III Test • Test (3): Saturation and Unsaturation via addition of iodine Test • Test (4): Saponification of triglycerides Test

	• Test (5): Acrolein Test • Test (6): Phospholipids (lecithin) Test • Test (7): Cholesterol Test by (Two methods:-Liebermann-Burchard test and Salkowski test). **Experiments of Amino Acids - Qualitative Tests** • Test (1): Ninhydrin Test • Test (2): Xanthoproteic Acid Test (Aromatic amino acids). • Test (3): Lead sulphide Test (Sulphur amino acids). **Experiments of proteins - Qualitative Tests** • Lab (1): Biuret Test • Lab (2): Denature of proteins (Precipitation) Test by • A/ Heat. B / Strong acid. C/ Heavy metal. D/ Organic solvent. **Experiments of Nucleic Acids - Qualitative Tests** • Lab (1): Hydrolysis of Nucleic Acids Test by (Two methods: Short method test and Long method test). • Test (1): Molisch Test • Test (2): Benedicts's Test • Test (3): Bial's Test • Test (4): Ammonium molybdate Test • Test (5): Ammonium silver nitrate Test **Experiments of Enzymes - Qualitative Tests** • Lab (1): Effect of Salivary Amylase enzyme activity (Increase no Heat, decrease by Heat or optimum on RT) in Substrate (Starch).
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • Assignment 10% • End semester examination 50%
References	• Murray K, Rodwell V, Bender D, Botham KM, Weil PA, Kennelly PJ. Harper's illustrated biochemistry. 28. Citeseer, New York, United States. 2009.. • Cusanovich MA. Biochemistry (Stryer, Lubert).

7. English for Pharmacy

Course code	**PH237**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objectives	• To help student to acquire new medical and pharmacy-related language. • To enable students practicing and reinforcing new skills in an interactive and engaging manner.

	• Exposing students to different vocabulary in the field of pharmacy.
Description	• English for Pharmacy is a language skill that joins the knowledge of pharmacy and the medical students in a way the make them use English effectively in their career. The textbook is intended for pharmacy students, pharmacy technicians, and practicing pharmacists whose first language is not English. The book integrates vocabulary, listening, reading, and writing skills, along with communicative language in the field of pharmacy. The course will focus on selected related readings, writing and oral communication activities
Course content	• Unit One: Vocabulary in Text (Skin, Hair, Nails, Ears Eyes Mouth and Nose) • Unit Two: Reading Comprehension: (Drugs pros & cons) • Unit Three: Word Morphology: (medical terms, suffixes and prefixes) • Unit Four: Writing Pharmacy Documentation • Unit Five: Communication Skills: (Pharmacist and patient communication) • Unit Six: Selected short paragraphs about: (Human body systems) • Unit Seven: Reading Comprehension: (chemical compounds) • Unit Eight: Language: (Advanced Grammar) • Unit Nine: Medical Vocabulary: (used in the field of pharmacy) • Unit Ten: speaking skills (presentations, dialogues , conversations and debates)
Evaluation	• Mid exam, assignment, attendance 20% • Final exam 80%
References	• Miriam Diaz-Gilbert (2010). English for pharmacy and oral communication • McCarter S. Oxford English for careers: Medicine 1. Oxford University Press; 2009. • Curtis L. Oxford Concise Medical Dictionary. Reference Reviews. 2010 Oct 26.

8. Jurisprudence of Transactions

إسم المقرر	**فقه المعاملات(صيغ الاستثمار الإسلامي)**
الرمز	**PH238**
ساعات معتمدة	**ساعتان**
ساعات الإتصال	**28**
الأهداف العامة: 1. توضيح أهمية الاستثمار في الإسلام وكيف أنه يحث عليه . 2. توضيح أن أهم ما يميز الاستثمار الإسلامي ، انطلاقة من عقيدة الإسلام .	

3. توضيح أن النظام الإسلامي يحرم الاستثمار في إنتاج المحرمات ، وصيغ المعاملات المالية المحرمة .
4. توضيح بعض صيغ الاستثمار الإسلامي (الشراكات ،المضاربة ، المرابحة ، نظام الضرائب ، نظام الجمارك) .

- **مفردات المقرر :**

1. أهمية الاستثمار في الإسلام وحثه عليه .
2. انطلاقة الاستثمار من عقيدة الإسلام .
3. تحريم الإسلام للاستثمار في إنتاج المحرمات (الخمور ، المخدرات ، لحم الخنزير والتعامل مع صيغ التمويل المحرمة مثل الربا) .
4. بعض صيغ الاستثمار الإسلامي مثل :-

- الشراكات :-

أ / الشراكات (شركة العنان ،تعريفها ، أركانها)
ب / المضاربة (تعريفها لغة واصطلاحا) و(الدليل علي مشروعيتها من الكتاب والسنة والإجماع)

- المضاربة:-

ـــ شروط المضاربة (تنصب علي رأس المال والربح)
ـــ شروط رأس المال :-

1. أن يكون من الأثمان المطلقة .
2. أن يكون رأس المال عينا لا دينا في ذمة المضارب .
3. أن يكون رأس المال معلوما .
4. التخلية بين المضارب والمال .

ـــ شروط الربح :-

1. أن يكون معلوما .
2. أن يكون نصيب كل من المتعاقدين جزءا شائعا في الربح
3. الربح علي ما اصطلحا عليه ، والوضعية علي رب المال .

ـــ حالات فسخ عقد المضاربة .

ـــ نفقة المضارب .

- المرابحة :-

(حقيقة المرابحة ، وصورها ، ومشروعيتها .)
ـــ شروط صحة المرابحة:-

1. أن يكون رأس المال معلوما .
2. أن يكون رأس المال من ذوات الأمثال .
3. أن لا يكون الثمن في العقد الأول مقابلا بجنسه من أموال الربا .
4. صحة العقد الأول .

ـــ ما يجب بيانه في المرابحة .

ـــ نظام الضرائب في الإسلام .

ـــ نظام الرقابة الشرعية (أسسه ، وشروط عضويته .)

اساليب التقويم

- **اعمال السنه 20%**

الامتحان النهائي 80%

Semester IV

1. Physiology II

Course code	**PH241**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28hours)
Objectives:	To provide knowledge and skills concerned with normal functions of different organs, tissues and the body systems.
Course content	• Autonomic nervous system • Central nervous system • Endocrine system • Immune and lymph system • Musculoskeletal system
Evaluation	• Mid-semester examination 20% • Assignment 10% • End semester examination 70%
References	• Guyton AC, Hall JE. Textbook of medical physiology. Philadelphia: Saunders; 1986 Sep 20 • Barrett KE. Ganong's review of medical physiology. • Sherman JH, Luciano DS, • Vander AJ. Human physiology: the mechanisms of body function. McGraw-Hill; 1985.

2. Phytochemistry I

Course code	**PH242**
Credit hours	3Cr. (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	**At the end of these courses the student will be able to:** • Describe and perform extraction and isolation of drugs from natural sources. • Determine physical and chemical data of pure drugs. • Apply different spectroscopic techniques for structure elucidation and characterization of different classes of natural products. • Know the origin, chemistry and medicinal use of some drugs.

Course content	• Carbohydrates containing drugs. • Lipids containing drugs i. Fixed oils. a- Saturated fixed oils (coconut oil, palm oil). b- Monounsaturated fixed oils (olive oil, castor oil, peanut oil). c- Polyunsaturated fixed oils (cotton seed oil, almond oil, sesame oil, corn oil, cod liver oil). ii. Fats. a- Theobroma oil. b- Lanolin. iii. Waxes. a- Bees wax. b- Carnuba wax. c- Spermaceti. • Enzymes and proteins drugs. i. Pancreatin. ii. Diastase. iii. Pepsin. iv. Papain. v. Heparin. vi. Streptokinase. vii. Gelatin.
Practical	• General identification tests of simple sugars • Quantitative analysis of simple sugars. • Tests for Gossypii lana “Cotton” • Extraction of pectin from orange peels • Isolation of polysaccharide from • Lini semen • Hydrolysis of polysaccharides &TLC analysis of the mono-Saccharides. • Alginates & agar tests for identity & determination of agar swelling value • Acaciae gummi and Tragacantha Tests for identification and purity • Drugs with fixed oil content I • Drugs with fixed oil content II
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • Assignment 10% • End semester examination 50%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and

	pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008. • Essential of Pharmacognosy by Dr.S.H.Ansari. Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

3. Pharmaceutics III

Course Code	**PH243**
Credit Hours	**3 Cr (2+1)**
Contact Hours	• Lectures (28 hours) • Practical and tutorial (42hours)
Objectives	At the end of the course student should be able to: • Define a powder and appreciate particle. size, size distribution • Describe and use the various methods available for particle size reduction, size distribution and its implication • Identify fundamental properties of powders formulation • Define the powder mixing and the factors which affect the mixing process • Understand the granulation and the methods used for granulation • Differentiate extrusion and spheroniuzation • Define the coating and describe the pellet technique
Course Content	• Introduction of powder technology • Particle size reduction • Particle size distribution • Powder flowability • Powder mixing • Powder dosage form • granulation

	• Extrusion and spheronization • Granule dosage form • Introduction of coating • Coating of granule and pellet
Practical	• Particle size reduction, analysis and importance (factors affecting size reduction) • Powder flow (factors affecting the flowability) • Powder mixing and factors affecting a powder mixing • Powder and granules as a dosage form
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. Philadelphia: Lea & Febiger; 1976. • Allen L, Ansel HC. Ansel's pharmaceutical dosage forms and drug delivery systems. Lippincott Williams & Wilkins; 2013 Dec 23.

4. Organic chemistry III

Course code	**PH244**
Credit hours	3Cr.(2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • Understand different types of functional groups • Writing Equations for Organic Reactions • Describe Kinds of Organic Reactions • Understand reactions Kinetics • Understand Catalysis
Course content	**1. Aromaticity** • The Structure of Benzene and Nomenclature of Benzene Derivatives • Benzene's Unusual Stability • The Criteria for Aromaticity—Hückel's Rule • What Is the Basis of Hückel's Rule? • Electrophilic Aromatic Substitution • Halogenation, Nitration and Sulfonation • Friedel–Crafts Alkylation and Friedel–Crafts Acylation • Substituted Benzenes • Electrophilic Aromatic Substitution of Substituted Benzenes • Why Substituents Activate or Deactivate Benzene ring • Limitations on electrophilic substitution reactions with substituted

	benzene • Synthesis of Benzene Derivatives • Halogenation of Alkyl Benzenes • Oxidation and Reduction of Substituted Benzenes • Multistep Synthesis **2. Aldehydes and ketones** • Nomenclature and Physical Properties • Preparation of Aldehydes and Ketones • Reactions of Aldehydes and Ketones • Nucleophilic Addition of H– and R– • Nucleophilic Addition of –CN • Addition of H2O—Hydration • Addition of Alcohols—Acetal Formation • Acetals as Protecting Groups and Cyclic Hemiacetals **3. Carboxylic acids and Derivatives** • Nomenclature and Physical Properties • Carboxylic Acids and the Acidity of the O–H Bond • Preparation of Carboxylic Acids • Reactions of Carboxylic Acids • Inductive Effects in Aliphatic Carboxylic Acids • Substituted Benzoic Acids • Sulfonic Acids • Reduction of Carboxylic Acids and Their Derivatives • Reaction of Organometallic Reagents with Carboxylic • Acid Derivatives • Nucleophilic Acyl Substitution • Esters and Amides • Acid Chlorides • Anhydrides • Nitriles
Practical	• Functional group reactions
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• McMurry JE. Fundamentals of organic chemistry. Cengage Learning; 2010. • Gorzynski JS. Organic chemistry. McGraw-Hill/Higher Education; 2008. • Solomons TG. Fundamentals of Organic Chemistry, 1997. • Block JH, Beale JM. Wilson and Gisvold, s textbook of organic medicinal and pharmaceutical chemistry, 2004.

5. Analytical chemistry II

Course code	**PH245**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	• To equip the students with both theoretical and practical experience that would enable him/her to carry out the analysis, and how to handle the basic laboratory equipment and glassware and the proper way for calculation and data analysis to be more efficient and competent in the area of pharmaceutical analysis.
Course content	**1. Titrimetric analysis:** • Complexiметric titration, • Oxidation-reduction titration • Miscellaneous **2. Electrochemical methods of Analysis:** • Theoretical background of electro-chemical methods and application in pharmaceutical analysis **3. Polarimetry** **4. Refractometry**
Practical	• Quantitative titrimetric analysis - Complexiметric titration, Oxidation-reduction titration, Miscellaneous • Potentiometric titration (Titration curves) • Polarimetry and Refractometry
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Christian GD, Dasgupta PK, Schug KA. Analytical chemistry. John Wiley & Sons; 2013 Oct 7. • Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of analytical chemistry. Cengage learning; 2013. • Watson DG. Pharmaceutical analysis E-book: a textbook for pharmacy students and pharmaceutical chemists. Elsevier Health Sciences; 2020 Jun 10. • Vogel AI, Jeffery GH. Vogel's textbook of quantitative chemical analysis. Wiley; 1989. • Pavia DL, Lampman GM, Kriz GS, Vyvyan JA. Introduction to spectroscopy. Cengage learning; 2014. • Kar A. Pharmaceutical drug analysis. New Age International; 2005. • Harvey D. Modern analytical chemistry. New York: McGraw-Hill; 2000 Jan.

6. Biochemistry II

Course code	**PH246**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	**By the end of this course the students should be able to**: • Understand the body various energy transformations • Understand the molecular nature of metabolic disorders leading to glycogen storage diseases, fructosemias, galactosemias, diabetes mellitus, ketoacidosis, lipid storage diseases, gangilliosidoses and atherosclerosis. • know how the body catabolizes amino acids and the associated disorders such as parkinsonism and albinism.
Course content	• Metabolism of carbohydrates, aerobic and anaerobic glycolysis, TCA cycle, substrate level phosphorylation, the electron transport chain and oxidative phosphorylation, regulation of glucose catabolism. Fructose and galactose catabolism, fructosemias and galactosemias. The various pathways of glucose utilizations. • Metabolism of lipids, the β-oxidation of fatty acids, the energy gains • Metabolism of proteins, the catabolism of amino acids, the urea cycle, the fate of the carbon skeletons, glucogenic and ketogenic amino acids. Production of specialized biomolecules, epinephrine, melanin, here etc • The role of hormones, insulin, glucagon, epinephrine and glucocorticoids on the integration of metabolism. • The molecular explanations of the metabolic disorders, glycogen storage diseases, diabetes mellitus, ketoacidosis, lipid storages, hyperlipidaemias, parkinsonism, PKU, sickle cell anaemia, thalassemia etc. the therapeutic approach to deal with these disorders. Body fluids (blood, urine, CSF, seminal fluid etc.) abnormal constituents as diagnostic markers for disease processes. • Kidney functions tests, Liver function tests, muscle and heart function tests. • Diagnostic biochemical tests using CSF. • Hormones, the endocrine glands, their chemical nature, role in regulation of body homeostasis and metabolism, hormonal receptors.
Practical	(Nutrition and Metabolism Quantitative Tests) • Bio-saftey (Methods of Sterilization). • How to collection samples (Body fluids) and equipment. Urine Tests • Urinalysis by (Dipstick" method). • Physical and Chemical properties for (Normal and Abnormal cases).

	Bloods Tests Carbohydrates catabolism • Glucose Tolerance Test (GTT by GO / PAP enzymatic kit method). • Types of curves (normal and abnormal curves: Diabetic, Lag and flat). Renal Function Tests (RFT) • Estimation of Serum Uric acid by (uricase test by enzymatic kit method). • Estimation of Serum Creatinine by (Jaffe by kit method). • Estimation of Serum Urea by (urease test by enzymatic kit method). Liver Function Tests (LFT) Lipids profile • Estimation of serum total cholesterol by (Estrase/CHOD/ PAP by enzymatic kit method). • Estimation of serum triglyceride. (Lipase/GPO/PAP by enzymatic kit method). • Estimation of serum high density lipoprotein (HDL by enzymatic kit method). • Estimation of serum low density lipoprotein (LDL by enzymatic kit method). Proteins and amino acids catabolism • Estimation of Serum Total protein (Biuret by enzymatic kit method). • Estimation of Serum Albumin. (Bromo-cresol green (BCG) at pH 4.1 kit method). • Estimation of Serum Alanine Aminotransferase (ALT by enzymatic kit method). • Estimation of Serum Aspartate Aminotransferase (AST by enzymatic kit method). • Estimation of Serum Total Bilirubin (BILT2 by enzymatic kit method).
Evaluation	• Class tests, Seminars and Practical work 20% • Assignment 10% • Mid-semester examination 20% • End semester examination 50%
References	• Murray K, Rodwell V, Bender D, Botham KM, Weil PA, Kennelly PJ. Harper's illustrated biochemistry. 28. Citeseer, New York, United States. 2009. • Cusanovich MA. Biochemistry (Stryer, Lubert).

7. Pharmacology I

Course code	**PH247**
Credit hours	**2 Cr (2+0)**
Contact hours	• Lectures (30hours) • Practical experiments, videos, computer simulation & tutorials(45hours)
Objectives	Upon completion of this course students should be able to gain more knowledge on: • Define the main terminology used in Pharmacology • Explain the basic principles of drug receptor interactions • Explain the molecular aspects of drug receptor interactions • Identify the importance and use of pharmacokinetic principles • Identify the basic physiology and anatomy of Autonomic Nervous system (ANS) and the drug that affect the ANS. • Understand the pharmacological principles of drugs modifying their actions including antihistamines, anti-serotonins and NSAIDs.
Course content	• Drug-receptor interactions 6 hrs • Molecular aspects of drug-receptor interactions 4 hrs • Pharmacokinetics 4hrs • Autonomic Nervous system 8 hrs • Autacoids and non-steroidal anti-inflammatory drugs 8 hrs
Evaluation	• Mid exam 20% • Final exam 80%
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology. • Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7. • Howland RD, Mycek MJ, Harvey RA, Champe PC. Lippincott's illustrated reviews: Pharmacology. Philadelphia: Lippincott Williams & Wilkins; 2006. • Burgen (Author), Gordon C. K. Roberts (Editor) Topics in Molecular Pharmacology • Palmer M. Biochemical pharmacology. John Wiley & Sons; 2012 Apr 9. • Kulkarni SK. Hand book of experimental pharmacology. Vallabh prakashan; 1987. • Ghosh MN. Fundamentals of experimental pharmacology, Kolkata. India: Hilton and company. 1984:195.

	• MacLeod LJ. Pharmacological Experiments on Intact Preparations. 1975.. • Vogel HG, Müller G, Sandow J, Schölkens BA. Drug discovery and evaluation: pharmacological assays. Vogel HG, Vogel WH, editors. Berlin: Springer; 1997 Jan.

Third Year

Semester V

1. Phytochemistry II

Course code	**PH351**
Credit hours	3Cr. (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	**At the end of these courses the students will gain more knowledge on:** The origin, chemistry, and medicinal value active principles belonging to different phytochemical groups.
Course content	• Drugs containing glycosides. • Simple phenolic glycosides. • Anthraquinone glycosides. • Cardiac glycosides. • Saponin glycosides. • Cyanogenic glycosides. • Isothiocyanate glycosides. • Flavonoid glycosides. • Coumarin glycosides. • Tannins.
Practical	Chromatography (TLC) for glycosides: • Extraction &identification of Anthraquinone glycosides • Extraction &identification of Cardiac glycosides • Extraction &identification of Cardiac glycosides ii • Extraction &identification of Coumarin glycosides • Extraction &identification of flavonoidal glycosides • Extraction &identification of flavonoidal II glycosides • Extraction &identification of Saponin glycosides • Extraction &identification of tannin glycosides
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • Assignment 10% • End semester examination 50%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and

	pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008. • Essential of Pharmacognosy by Dr.S.H.Ansari. Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

2. Pharmaceutics IV

Course Code	**PH352**
Credit Hours	**3 Cr (2+1)**
Contact Hours	• Lectures (28 hours) • Practical and tutorial (42hours)
Objectives	At the end of the course student will be able to: • Define a solution and describe all types of solution • Determine solution route of administration • Define the additives in solution preparation and explain it uses • Understand the different vehicles used in pharmaceutical solution and its medicinal indications • Define the suspension and its different types • Explain the different between flocculated ad de flocculated system • Understand the stability of the suspension • Define the emulsion and the choice of emulsion type • Understand the emulsion consistency • Explain the choice of emulsifying agent • Understand stability testing of the emulsion
Course Content	• Introduction to liquid dosage form • Definition of the solution • Type of vehicles use in solution

	• Solution rout of administration • Solution stability • Enhancement of drug solubility • Definition of suspension formulation and excipient • Stability of the suspension • Development of emulsion • Emulsion pharmaceutical uses • Different emulsifying agent • Nano-emulsion
Practical	• Syrups • Aromatic water and spirit • Elixirs, tincture, and linctus • Suspension • w/o and o/w Emulsion
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• Winfield AJ, Rees J, Smith I, editors. Pharmaceutical Practice E-Book. Elsevier health sciences; 2009 Jul 21. • Aulton ME, Taylor K, editors. Aulton's pharmaceutics: the design and manufacture of medicines. Elsevier Health Sciences; 2013. • Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. Philadelphia: Lea & Febiger; 1976. • Mahato RI, Narang AS. Pharmaceutical dosage forms and drug delivery. CRC Press; 2017 Nov 22.

3. Organic chemistry IV

Course code	**PH353**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objective	At the end of this course the student should be able to: • Understand different types of functional groups • Writing Equations for Organic Reactions • Describe Kinds of Organic Reactions • Understand Poly-nuclear & Heterocyclic chemistry
Course content	**1.Amines** • Nomenclature • Physical Properties • Preparation of Amines • Reactions of Amines

	• Relative Basicity of Amines and Other Compounds • Amines as Nucleophiles • Hofmann Elimination • Reaction of Amines with Nitrous Acid • Substitution Reactions of Aryl Diazonium Salts • Coupling Reactions of Aryl Diazonium Salts **2.Phenols** • Nomenclature • Physical Properties • Preparation of Phenols • Reactions of Phenols **3.Malonic acid esters** • Nomenclature • Physical Properties • Preparation of Malonic acid esters • Reactions of Malonic acid esters **4.Aromatic Poly-nuclear hydrocarbons**
Practical	• Organic synthesis of drug molecules
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• McMurry JE. Fundamentals of organic chemistry. Cengage Learning; 2010. • Gorzynski JS. Organic chemistry. McGraw-Hill/Higher Education; 2008. • Solomons TG. Fundamentals of Organic Chemistry, 1997. • Wilson CO, Gisvold O, editors. Textbook of organic medicinal and pharmaceutical chemistry. Lippincott; 1962.

4. Analytical chemistry III

Course code	**PH354**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective:	• To equip the students with both theoretical and practical experience that would enable him/her to carry out the analysis, and how to handle the basic laboratory equipment and glassware and the proper way for calculation and data analysis to be more efficient and competent in the area of pharmaceutical analysis.

Course content	Spectroscopic methods of analysis • Atomic absorption and atomic emission spectrometry • U.V and visible spectrophotometry • Spectroflurimetry,
Practical	• Applications of instrumental techniques (UV-Visible spectroscopy, Spectrofluorimetry, AAS, AES and ICP) in pharmaceutical analysis.
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Christian GD, Dasgupta PK, Schug KA. Analytical chemistry. John Wiley & Sons; 2013 Oct 7. • Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of analytical chemistry. Cengage learning; 2013. • Watson DG. Pharmaceutical analysis E-book: a textbook for pharmacy students and pharmaceutical chemists. Elsevier Health Sciences; 2020 Jun 10. • Vogel AI, Jeffery GH. Vogel's textbook of quantitative chemical analysis. Wiley; 1989. • Pavia DL, Lampman GM, Kriz GS, Vyvyan JA. Introduction to spectroscopy. Cengage learning; 2014. • Kar A. Pharmaceutical drug analysis. New Age International; 2005. • Harvey D. Modern analytical chemistry. New York: McGraw-Hill; 2000 Jan.

5. Pharmacology II

Course code	**PH355**
Credit hours	**3 Cr (2+1)**
Contact hours	• Lectures (30hours) • Practical, videos, computer simulation & tutorials (45hours)
Objectives	**Upon completion of this course students should be able to:** • Acquire basic knowledge on the pharmacological principles and therapeutic uses of the different pharmacological groups of drugs affecting the cardiovascular system. • Be aware about the regulation of fluids and electrolytes by the kidney. • Know the pharmacology of different diuretics classes and other renal drugs. • Recognize different classes of drugs used in treatment of asthma, chronic obstructive pulmonary disease(COPD), cough and allergic rhinitis, and to describe the strategies employed for treating pulmonary diseases.

	• Achieve adequate knowledge on different agents used in the treatment of peptic ulcer disease (PUD), vomiting, constipation, diarrhea, irritable bowel disease (IBD) and inflammatory bowel syndrome (IBS).
Course content	• Diuretics and renal drugs 4 hrs • Cardiovascular pharmacology 16hrs • Antihypertensive drugs: Drugs used in heart failure: • Anti anginal and myocardial infarction drugs: Antiarrhythmic drugs: • Drugs used in shock: Drugs used in dyslipidemia: Drugs used to treat anemia: Hemostasis and thrombosis: • Drugs used in respiratory tract disorders 4 hrs • Pharmacology of antitussive agents Drugs used for allergic rhinitis Pathophysiology of asthma. • Pharmacology of drugs used in the treatment of asthma. Pathophysiology of COPD. • Pharmacology of drugs used in the management of COPD. • Drugs used in GIT disorders 6 hrs • Laxatives and anti diarrheal drugs Emetics and antiemetic agents: • Drugs used in treatment of peptic ulcer disease (PUD): • Drugs used in treatment of Gastroesophageal reflux disease(GERD). • Drugs used in the treatment inflammatory bowel disease(IBD). • Drugs used in the treatment of irritable bowel syndrome(IBS).
Practical	• Demonstrate the effects of histamine, oxytocic and tocolytic drugs on isolated preparations • Determine the stimulant or relaxant effect of an unknown drugs on isolated rabbit jejunum • Illustrate the pharmacological properties of unknown diuretics and to compare potencies of different classes • Evaluate the effect of autonomic drugs on rats and contraction of animal's heart. • Topics to be covered are: - Histamine and anaphylaxis. - Direct agonist. - Effects of drugs on isolated rat uterus. - Spasmogens and their specific antagonists on isolated guinea pig ileum. - Determination of pharmacological properties of unknown drug I. - Determination of pharmacological properties of unknown drug II. - Determination of the properties of unknown diuretics. - Isolated perfused heart (Langendorff's technique). - Effects of autonomic drugs on frog heart in situ.

Evaluation	• Class tests & year work (Practical, Tutorials & Assignments) 20 marks • End semester examination 80 marks
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology. • Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7. • Howland RD, Mycek MJ, Harvey RA, Champe PC. Lippincott's illustrated reviews: Pharmacology. Philadelphia: Lippincott Williams & Wilkins; 2006. • Kulkarni SK. Hand book of experimental pharmacology. Vallabh prakashan; 1987. • Ghosh MN. Fundamentals of experimental pharmacology, Kolkata. India: Hilton and company. 1984:195. • MacLeod LJ. Pharmacological Experiments on Intact Preparations. 1975.

6. Pathology

Course code	**PH356**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28hours)
Objectives:	To provide students with knowledge concerned with different disorders in the different body system
Course content:	• Core of pathophysiological concepts • Cellular function • Genetic and developmental disorders, neoplasia • Defence – Inflammation and Immunity – Alternation in immune function – Malignant disorders of white blood cells • Blood and cardiac function – Alterations in homeostasis and blood coagulation – Alterations in blood pressure – Alterations in cardiac function (heart failure and dysrhythmia) • Respiratory function – Obstructive pulmonary disorders – pathophysiology of asthma • peptic ulcer, vomiting, diarrhoea, constipation, irritable bowel

	syndrome • Liver disease
Evaluation	• Mid exam, tutorials 20% • Final exam 80%
References	• Zdanowicz MM. Essentials of pathophysiology for pharmacy. Routledge; 2019 Feb 13. • Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy: a pathophysiologic approach, ed. Connecticut: Appleton and Lange. 2014;4:141-2. • Hammer GD, McPhee SJ, Education MH, editors. Pathophysiology of disease: an introduction to clinical medicine. McGraw-Hill Education Medical; 2014.. • Cotran RS, Kumar VN, Stanley RL. Robbins pathologic basis of disease. WB Saunders CompHny, Philadelphia, USA.; 2004.

7. First Aid:

Course code	**PH357**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Course content	• First aids • Basic life support • Adult CPR, Child & Infant CPR • Artificial breathing • Choking • EAD • What is resuscitation • Change of survival • Transmission of disease
Evaluation	• Mid exam, tutorials 20% • Final exam 80%
References	• Sprayberry KA. Current therapy in equine medicine. Elsevier Health Sciences; 2009.

8. Pharmacy practice I

Course code	**PH358**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (24hours)
Objectives	At the end of this course students should be able to: • Define professional ethics and explain the principles of ethics

	• Differentiate ethics from law • State principles of essential drug concept • Identify constraints in policy implementation • List the problems of donated supplies and possible solutions. • Describe how to handle drug supply during disaster and epidemics.
Course content	• Ethics and professional ethic definitions. • Ethical principles and their delegations applied to all pharmaceuticals. • Comparison between professional ethics and law. • What profession-discussed and defines? • Specific objectives of pharmacy ethics. • Pharmacist liability to torts. • Discipline and authority. • Personal relationship. • Social skills hallmarks of a pharmacy profession. • Prescribing practice and effective dispensing. • Patient education in effective drug use. • Co-operation between pharmacists, doctors, nurses and other health care professionals. • Concept of Essential drugs. • Need and objectives for a formulated drug policy. • Element of national drug policy. • Drug supply and management system. • List the problems of donated supplies and possible solutions. • Describe how to handle drug supply during disaster and epidemics.
Evaluation	• Class tests and year work (Tutorials and Assignments) 20 marks • End semester examination, one three hours paper 80 marks
References	• Appelbe GE, Wingfield J, editors. Dale and Appelbe's Pharmacy and Medicines Law. Pharmaceutical Press; 2013. • Managing drug supply. The selection, procurement distribution and use of pharmaceutical in primary health care. Management Sciences for Health Boston, Massachusetts. USA1986. • Standard Treatment Guideline (STG), The National Essential Drug list for Sudan.

Semester VI

1. Phytochemistry III

Course code	**PH361**
Credit hours	3Cr. (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	At the end of these courses the student will be able to: • Describe and perform extraction and isolation of drugs from natural source. • Determine physical and chemical data of pure drugs. • Use different chromatographic methods for the separation, isolation, purification, and identification of chemical constituents of plant extracts. • Apply different spectroscopic techniques for structure elucidation and characterization of different classes of natural products. • Know the origin, chemistry and medicinal use of some drugs.
Course content	- Volatile oils and terpenoids • Classification of chemical constituents of volatile oils. • methods of obtaining volatile oils. • chemical tests for volatile oils. • examples of volatile oils containing drugs. • general properties of terpenoids. • Classification of terpenoids. - Resins & resin combinations. • Resins. • Oleo-resins. • Gum- resins. • Oleo-Gum resins. • Balsams. - Bitter principles.
Practical	• Analysis of drugs with volatile oil content, I • Analysis of drugs with volatile oil content, II • Analysis of drugs with volatile oil content, III • Phytochemical analysis of monoterpenes • Analysis of Sesquiterpenes & Proazulenes • Drugs with miscellaneous terpene content • Drugs with triterpene saponin content • Identification test of Resins • Extraction of ginger oleoresin & Isolation of gingerols and shogaols

Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 50%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008. • Essential of Pharmacognosy by Dr.S.H.Ansari. Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

2. Pharmaceutics V

Course code	**PH362**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	By the end of the course, students should be able to: • Have a detailed knowledge about the formulation of different types of tablets, the function of the excipients, the manufacturing procedure and evaluation. • Know the different types of tablet coating and their uses. • Know about the formulation of different types of capsules, their excipients and the manufacturing procedure and equipment. • Know in details the formulation of suppositories and the function of the excipients used and the manufacturing procedure and equipment.

Course content	1. Tablets: definition and types • Tablet excipients • Granulation and tablet production • Tablet coating • Tablet quality control 1 • Tablet quality control 2 2. Capsules: definition, types, raw materials used in capsule shell formation • Hard gelatine capsules • Soft gelatine capsules • Capsule production and quality control 3. Suppositories and pessaries; definition, rectum anatomy and drug absorption from rectum. • Suppositories formulation and production, suppository bases • Vaginal drug delivery, pessaries and suppository quality control 4. Modified drug delivery systems
Practical	• Demonstration of the tableting machine and preparation of Sodium Chloride tablets by direct compression method • Manufacturing of compressed tablets by wet granulation method • Manufacturing of compressed tablets by dry granulation • Double compression – Slugging • Quality standards of tablets (physical tests) • Quality standards of tablets (dissolution test) • Formulation of effervescent tablets • Formulation of Hard Gelatine Capsules (filling) • Formulation and inspection of suppositories
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• Winfield AJ, Rees J, Smith I, editors. Pharmaceutical Practice E-Book. Elsevier health sciences; 2009 Jul 21. • Aulton ME, Taylor K, editors. Aulton's pharmaceutics: the design and manufacture of medicines. Elsevier Health Sciences; 2013., • Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. Philadelphia: Lea & Febiger; 1976. • Mahato RI, Narang AS. Pharmaceutical dosage forms and drug delivery. CRC Press; 2017 Nov 22.

3. Medicinal chemistry I:

Course code	**PH363**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objective	• The general objective of medicinal chemistry is to provide students with a solid background in the discipline and in-depth experience in a specific area of research. Research in medicinal chemistry encompasses a broad spectrum of activities including studies pursuant to investigations of the interaction of both drugs and toxic substances with biological systems, and the relationship of chemical structure and dynamics to biological effect and function.
Course content	• Heterocyclic chemistry • Chemistry of Steroids • Introduction **to medicinal chemistry:** - Drug discovery - How natural products are used for the development of synthetic and derivatives - Principles of use of quantitative structure-activity relationships to design new drugs - Design new drugs - Physicochemical aspects of mode of action of drugs - Drug metabolism - Drug target and drug-target interactions - Drug modifications - New trends in medicinal chemistry e.g. drug design/combinatorial chemistry
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Foye WO. Foye's principles of medicinal chemistry. Lippincott Williams & Wilkins; 2008. • Woster PM. Fundamentals of Medicinal Chemistry by Gareth Thomas. John Wiley and Sons, Ltd., West Sussex, UK. 2003. xv+ 285 pp. 19× 24.5 cm. ISBN 0-4708-4307-1. • Patrick GL. An introduction to medicinal chemistry. Oxford university press; 2013 Jan 10. • Delgado JN, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. Lippincott; 1991. • Abraham D. Burger's Medicinal Chemistry and Drug Discovery, Volume 1,

	• Salerni OL. Natural and Synthetic Organic Medicinal Compounds, CV Mosby, St. Louis, MO. 1976:166-224. • Katritzky AR, Ramsden CA, Joule JA, Zhdankin VV. Handbook of heterocyclic chemistry. Elsevier; 2010 Aug 24.

4. Analytical chemistry IV

Course code	**PH364**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	• To equip the students with both theoretical and practical experience that would enable him/her to carry out the analysis, and how to handle the basic laboratory equipment and glassware and the proper way for calculation and data analysis to be more efficient and competent in the area of pharmaceutical analysis.
Course content	• Infrared spectroscopy, • Nuclear magnetic resonance spectroscopy • Mass spectrometry • Structure elucidation
Practical	• Application of physical methods for identification of compounds and structure elucidation.
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Christian GD, Dasgupta PK, Schug KA. Analytical chemistry. John Wiley & Sons; 2013 Oct 7. • Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of analytical chemistry. Cengage learning; 2013. • Watson DG. Pharmaceutical analysis E-book: a textbook for pharmacy students and pharmaceutical chemists. Elsevier Health Sciences; 2020 Jun 10. • Vogel AI, Jeffery GH. Vogel's textbook of quantitative chemical analysis. Wiley; 1989. • Pavia DL, Lampman GM, Kriz GS, Vyvyan JA. Introduction to spectroscopy. Cengage learning; 2014. • Kar A. Pharmaceutical drug analysis. New Age International; 2005. • Harvey D. Modern analytical chemistry. New York: McGraw-Hill; 2000 Jan.

5. Pharmacology III

Course code	**PH365**
Credit hours	**3 Cr (2+1)**
Contact hours	• Lectures (28hours)
Objectives	Upon completion of this course students should be able to gain more knowledge on: • Be aware about the major endocrine disorders and their management concerning anti-diabetics, thyroid and anti-thyroid, glucocorticoids, mineralocorticoids, contraceptive agents, and the role of hormonal regulators, gonadal hormones and inhibitors, erectile dysfunction, uterine stimulants and relaxant and non-hormonal agents on bone minerals homeostasis. • Understand the mechanism of action, clinical uses and adverse effects of immunosuppressant's, and identify the cytokine-based therapies and other immune modulators. • Grasp the basic knowledge about gene therapeutic aspect for cancer ,HIV, epilepsy, C.V. and infectious diseases.
Course content	• Endocrine pharmacology 20hrs • Introduction to endocrine pharmacology: Hypothalamic and pituitary hormones: Thyroid and antithyroid agents. • Adrenocorticoids and adrenocortical antagonists: Pancreatic hormones and anti-diabetic drugs: Agents affecting bone mineral homeostasis: • The reproductive system: The gonadal hormones and inhibitors: Immunopharmacology, uterine stimulants and relaxant • Immunopharmacology • Genetherapy 10hrs
Practical	• Organize, validate, analyse the data obtained from experiments. • Determine the concentration of different agonist using three and four-point assay and to determine the potency of antagonist using PA2 value • Topics to be consider are: 1. Introduction: bioassay 2. Three-point assay. 3. Four-point assay. 4. Determination of PA2value. 5. Bioassay of histamine. 6. Bioassay of oxytocin. 7. Extraction and detection of poisons 8. Urine pH and excretion of poisons

Evaluation:	• Class tests & year work (practical, tutorials and assignments): 20% • End semester examination, one three hours paper 80%
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology. • Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7. • Howland RD, Mycek MJ, Harvey RA, Champe PC. Lippincott's illustrated reviews: Pharmacology. Philadelphia: Lippincott Williams & Wilkins; 2006. • Rappa L, Viola J. Condensed psychopharmacology 2013: a pocket reference for psychiatry and psychotropic medications. RXPSYCH LLC; 2012. • Preston JD, O'Neal JH, Talaga MC, Moore BA. Handbook of clinical psychopharmacology for therapists. New Harbinger Publications; 2021 Jan 2. • Kulkarni SK. Hand book of experimental pharmacology. Vallabh prakashan; 1987. • Ghosh MN. Fundamentals of experimental pharmacology, Kolkata. India: Hilton and company. 1984:195. • MacLeod LJ. Pharmacological Experiments on Intact Preparations. 1975.

6. Pharmaceutical Microbiology I

Course code	**PH366**
Credit hours	3 Cr. (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objectives	At the end of this course about the student will: • Have adequate knowledge about the medical approach to infectious diseases. • Acquire essential knowledge on the pathogenesis of common bacterial infections. • Gain basic knowledge about the principles of sterilization and grasp the theoretical as well as practical ground on the methods of sterilization and sterility testing

Course content	1. Introduction. 1.1. Histological developmental 1.2. Importance and relevance of microbiology to pharmacy. 2. Bacteriology 2.1. Bacterial morphology 2.2. Bacterial structure 2.3. Bacterial reproduction and growth. 2.4. bacterial cultivation and culture media 2.5. Bacterial metabolism and genetics 2.6. Bacterial taxonomy 2.7. General properties of bacterial including clinically important bacteria. 3. Sterilization 3.1. General introduction 3.2. Sterilization by heat 3.2.1. Moist heat sterilization (steam sterilization) 3.2.2. Heating with a bactericide 3.2.3. Dry heat sterilization 3.3 Radiation sterilization 3.4. Gaseous and vapour sterilization 3.5. Sterile filtration 3.6. Sterility testing
Practical	• Laboratory safety measures and Aseptic techniques • Isolation of bacteria from environment • Bacterial colony and morphology • Aseptic technique for transferring microorganisms • Microscopy • Use of the microscope • Visualization of microorganisms by staining • Simple satin • Negative stain • Endospore stain • Gram stain • The acid-fast stain • Hanging drop technique for motility • Isolation of a mixture by streak plate method • Culture media (Types and preparation) • Sterility testing
Evaluation	• Assignment, Seminar, Attendance, Practical Exam. 20% • Mid Exam 20% • Final Exam 60%

References	• Warren L. Review of medical microbiology and immunology. 2016. • Berlanga M. Microbiología. LM Prescott, JP Harley, DA Klein. International Microbiology. 2000;3(3):198-9. • Denyer SP, Hodges NA, Gorman SP, editors. Hugo and Russell's pharmaceutical microbiology. John Wiley & Sons; 2008 Apr 15. • Harvey RA. Microbiology. Lippincott Williams & Wilkins; 2007.

7. Pharmacy practice II (Forensic)

Course code	**PH367**
Credit hours	• 2Cr (2+0)
Contact hours	Lectures (20hours)
Objectives	At the end of this course students should be able to: • Familiarize with the Sudanese pharmacy law. • Define and explain laws governing control of narcotics and psychotropic drugs. • Identify and define drug abuse. • Acquire skills and knowledge on how to prevent and control drug abuse.
Course content	• Definitions: • Law constitution, Statute and act, Ordinance, Curts and felony, Treaty and convention. • Sudanese Pharmacy and Poisons Act (the most recent) Control of Narcotic Drugs. • The Convention on psychotropic substances (Vienna convention1971). • The drugs and prevention of illicit traffic in Drugs (Its aims). • Definition and classification of the major psychoactive substances. • Tobacco and alcohol - effects/common complications. • The Pharmacist and control of psychoactive substances. • Preventive education against substance abuse. • Opiates, cocaine and cannabis.
Evaluation	• Class tests and year work (Tutorials & Assignments) 20 marks • End semester examination, one three hours paper 80 marks
References	• Alfadl AA, Ali GK, Yousif MA, Babekir MF. Pharmacy practice in Sudan. InPharmacy Practice in Developing Countries 2016 Jan 1 (pp. 319-341). Academic Press. • Kokate CK, Gokhale SB. Textbook of Forensic Pharmacy. 5th Ed. Edward Arnold; 1959. • Control of Narcotics Substances Act; 1997.

Fourth Year

Semester VII

1. Phytochemistry IV

Course code	**PH471**
Credit hours	3Cr. (2+1)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	At the end of these courses the students will gain more knowledge on the origin, chemistry, and medicinal value active principles belonging to different phytochemical groups.
Course content	Alkaloids. • General introduction & definition. • Occurrence & distribution. • Alkaloids properties. • Chemical test for alkaloids. • Extraction & isolation of alkaloids. • Classification of alkaloids: a- Non-heterocyclic alkaloids. b- Heterocyclic alkaloids. • Pyridine-piperidine alkaloids. • Tropane alkaloids. • Quinoline alkaloids. • Iso-quinoline alkaloids. • Indole alkaloids. • Imidazole alkaloids. • Purine alkaloids. • Steroidal alkaloids.
Practical	• Chromatography for alkaloids (different plants) • Extraction and specific identification of datura strammonium- • Extraction and specific identification of cinchona bark- • Extraction of alkaloids &application of general alkaloidal colourants • Extraction of alkaloids &application of general alkaloidal precipitants • Specific identification of atropine alkaloids • specific Identification of caffeine alkaloids • Specific identification of pipperine alkaloids

Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008. • Essential of Pharmacognosy by Dr.S.H.Ansari. Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

2. Pharmaceutics VI

Course Code	**PH472**
Credit Hours	**3 Cr (2+1)**
Contact Hours	• Lectures (28 hours) • Practical and tutorial (42hours)
Objectives	At the end of the course student will be able to: • Identify semisolid preparation • Illustrate different ointment bases and its pharmaceutical uses • Understand semisolid evaluation test and stability • Identify pulmonary rout of administration • Understand the different types of propellant • Determine different evaluation test • Identify parenteral rout of administration and rout of administration and main classification • Understand Manufacture of parenteral

	• Understand total parenteral nutrition advantages and complication • Understand ophthalmic preparation and the important of sterility
Course Content	• Introduction to semisolid preparation • Ointment bases • Semisolid quality control • Inhalation and aerosols definition • Type of vehicles • Dry powder inhalation • Type of propellant • Parenteral rout of administration • Solvent for injection • Parenteral general requirement • Packaging and labelling • Total parenteral nutrition • Ocular drug
Practical	• Ointment preparation and assessment • cream preparation and assessment • gel preparation and assessment • semisolid quality control
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• Winfield AJ, Rees J, Smith I, editors. Pharmaceutical Practice E-Book. Elsevier health sciences; 2009 Jul 21. • Aulton ME, Taylor K, editors. Aulton's pharmaceutics: the design and manufacture of medicines. Elsevier Health Sciences; 2013., • Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. Philadelphia: Lea & Febiger; 1976. • Mahato RI, Narang AS. Pharmaceutical dosage forms and drug delivery. CRC Press; 2017 Nov 22.

3. Medicinal chemistry II

Course code	**PH473**
Credit hours	2Cr (2+0)
Contact hours	• Lectures (28 hours)
Objective	At the end of this course the student should be able to: • Understand the structure activity relationship of various drugs and describe their main functional groups & their interactions with biological systems.

Course content	**1. Drug acting on Autonomic nervous system:** • Cholinergic Agonists • Cholinergic Receptor Antagonists • Cholinergic Blocking Agents • Parasympathetic Postganglionic • Solanaceous Alkaloids and Analogs • Ganglionic Blocking Agents • Neuromuscular Blocking Agents • Drugs Affecting Adrenergic Neurotransmission • Sympathomimetic Agents • Adrenergic Receptor Antagonists (Blockers) **2. Drug acting on Cardiovascular system:** • Antianginal Agents and Vasodilators. • Antiarrhythmic drugs • Antihypertensive agents • Anti-hyperlipidaemia agents • Anticoagulants **3. Diuretics** **4. Antihistamines** • Inhibition of Histamine Release: Mast Cell Stabilizers • Histamine H1 & H2-Antagonists • Histamine H3- and H4-Receptors **5. Blood pharmacology:** • drug used to manage anaemia • anticoagulants, antiplatelets, • fibrinolytic and antifibrolytic drugs. • Management of hyperlipidaemia.
Evaluation	• Class tests, Seminars and tutorials 20% • Mid-semester examination 20% • End semester examination 60%
References	• Foye WO. Foye's principles of medicinal chemistry. Lippincott Williams & Wilkins; 2008. • Woster PM. Fundamentals of Medicinal Chemistry By Gareth Thomas. John Wiley and Sons, Ltd., West Sussex, UK. 2003. xv+ 285 pp. 19× 24.5 cm. ISBN 0-4708-4307-1.. • Patrick GL. An introduction to medicinal chemistry. Oxford university press; 2013 Jan 10. • Nogrady T, Weaver DF. Medicinal chemistry: a molecular and biochemical approach. Oxford University Press; 2005 Aug 11. • Delgado JN, editor. Wilson and Gisvold's textbook of organic

	medicinal and pharmaceutical chemistry. Lippincott; 1991. • Abraham D. Burger's Medicinal Chemistry and Drug Discovery, Volume 6, Nervous System Agents. • Salerni OL. Natural and Synthetic Organic Medicinal Compounds, CV Mosby, St. Louis, MO. 1976:166-224.

4. Pharmaceutical analysis I & Quality control

Course code	**PH474**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • To qualify the students to understand the responsibility and position of quality control in pharmaceutical manufacturing companies and other similar organization. • To equip the students with both theoretical and practical experience that would enable him/her to assist and participate in research and development (R & D) • perform different tasks in pharmaceutical & biopharmaceutical analysis.
Course content	• Chromatographic techniques & their applications in pharmaceutical analysis: ▪ Gas chromatography, ▪ Liquid chromatography, ▪ LC/Mass and GC/Mass spectrometry. • Drug quality control: ▪ Principles of pharmaceutical quality control ▪ Analytical criteria for drug quality assessment ▪ Chemical purity and its control ▪ Assay of bulk and pharmaceutical preparation
Practical	• Quality control of various pharmaceutical dosage forms: • Analysis of different dosage forms tablets, suspension, solution, capsules and injection from the market. • Training in QC department in pharmaceutical plant
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Christian GD, Dasgupta PK, Schug KA. Analytical chemistry. John Wiley & Sons; 2013 Oct 7. • Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of

	analytical chemistry. Cengage learning; 2013. • Watson DG. Pharmaceutical analysis E-book: a textbook for pharmacy students and pharmaceutical chemists. Elsevier Health Sciences; 2020 Jun 10. • Vogel AI, Jeffery GH. Vogel's textbook of quantitative chemical analysis. Wiley; 1989. • Skoog DA, James F. Holler, and Stanley R. Crouch. Principles of instrumental analysis. • Pavia DL, Lampman GM, Kriz GS, Vyvyan JA. Introduction to spectroscopy. Cengage learning; 2014. • Kar A. Pharmaceutical drug analysis. New Age International; 2005. • Harvey D. Modern analytical chemistry. New York: McGraw-Hill; 2000 Jan. • Cazes J. Encyclopedia of Chromatography 2004 Update Supplement. CRC press; 2004 Aug 11. • Meyer VR. Practical high-performance liquid chromatography. John Wiley & Sons; 2013 Mar 25. • Dietrick JM, Loftus BT. Regulatory basis for process validation. InPharmaceutical Process Validation 2003 Mar 27 (pp. 44-49). CRC Press. • Hibbert DB. Quality assurance in the analytical chemistry laboratory. Oxford University Press; 2007 Mar 29. • Bolton S, Bor S. Pharmaceutical Statistics: Practical and Clinical Applications, Revised and Expanded. CRC press; 2003 Oct 17.

5. Pharmacology IV

Course code	**PH475**
Credit hours	**3 Cr (2+1)**
Contact hours	• Lectures (28hours)
Objectives	Upon completion of this course students should be able to gain more knowledge on: • Be aware about the central neurotransmitters and their relations to different CNS diseases. • Achieve adequate knowledge on pathophysiological aspects of CNS disorders and the most effective drugs used for their management.
Course content	• CNS Pharmacology 30 hrs • Introduction to CNS pharmacology Sedatives, hypnotics and anxiolytics • Anti-epileptic drugs

	• Treatment of CNS degenerative disorder (Parkinson's and Alzheimer's diseases) • Opioid agonist and antagonist Psychopharmacology (Antipsychotic and anti-depressants) • General anaesthetics • Local anaesthetics • Drug of abuse
Practical	• Understand the ethics of laboratory practice and animal ethics. • Assess the activity of analgesics anti-inflammatory, local anaesthetics and some CNS depressants. • Demonstrate the hypo-/hypothermic effects of various drugs.
Evaluation	• Midterm Exam & (Practical, tutorial & assignments) 20% • End semester examination, one three hours paper 80%
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology. • Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7. • Howland RD, Mycek MJ, Harvey RA, Champe PC. Lippincott's illustrated reviews: Pharmacology. Philadelphia: Lippincott Williams & Wilkins; 2006.. • Kulkarni SK. Hand book of experimental pharmacology. Vallabh prakashan; 1987. • Ghosh MN. Fundamentals of experimental pharmacology, Kolkata. India: Hilton and company. 1984:195. • MacLeod LJ. Pharmacological Experiments on Intact Preparations. 1975.

6. Pharmaceutical Microbiology II

Course code	**PH476**
Credit hours	3 Cr. (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)

Objectives	At the end of this course the student will: • Understand the basic principles of mycology, virology & parasitology. • Have good knowledge on the pathogenesis of fungal, viral and parasitic infections. • Acquire basic information on Rickettsia ,Chlamydia and Mycoplasmas.
Course content	1. Mycology 1.1. The fungi, moulds and yeasts Structure, Growth. 1.2. Reproduction and classification of fungi of pharmaceutical importance. 2. Rickettsiae, chlamydiae and mycoplasmas. 2.1. General, Characteristics, Cultivation, Laboratory diagnosis & important, typical rickettsiae, chlamydiae and mycoplasmas. 3. Virology: Introduction, Classification, Characteristics, Cultivation, & Bacteriophages Interferance with viral multiplication and infectivity. Interferons, Important viruses, Chemical inhibition of viral multiplication. 4. Parasitology: General introduction, Classification, Important typical protozoa.
Practical	1. Identification of fungi 2. Laboratory methods in medical parasitology • Faecal specimen collection and fixation • Examination of faecal specimen (Microscope and stain) • Urine examination (*Schistosoma haematobium*) • Blood examination using Giemsa stain (Malaria) 3. Intestinal protozoa • *Amebae* • Intestinal flagellates (*Giardia lamblia)* 4. Blood and tissue protozoa • *Plasmodium & Leishmania* species 5. Helminths • *Trematodes* (Flukes) • *Cestodes* (Tapeworms) 6. Arthropods • *Class Insecta* • *Class Arachnida*
Evaluation	• Assignment, Seminar, Attendance, Practical Exam. 20% • Mid Exam 20% • Final Exam 60%

References	• Warren L. Review of medical microbiology and immunology. 2016. • Berlanga M. Microbiología. LM Prescott, JP Harley, DA Klein. International Microbiology. 2000;3(3):198-9. • Denyer SP, Hodges NA, Gorman SP, editors. Hugo and Russell's pharmaceutical microbiology. John Wiley & Sons; 2008 Apr 15. • Harvey RA. Microbiology. Lippincott Williams & Wilkins; 2007.

7. Pharmacy practice III (communication skills)

Course code	**PH477**
Credit hours	2Cr (2+1)
Contact hours	• Lectures (20hours) • Tutorials (10 Hrs.)
Objectives	At the end of the course students should be able to: • Define communication and factors affecting it. • Understand and describe the basics of communication and its types • Know and explain the pharmacist-patient communication process • Know the components of effective interview
Course content	• Introduction. • Definition and goals: • Basics of communication process models types of communication fidelity and skills of communications Listening and meaning and communication. • Non-verbal communication: • Functions and types. • Barriers to communication. • Listening and empathic responding. • Assertiveness. • Communication with children about medicines. • Pharmacist patient communication and interview: • Effective interview for components essential skills for counselling Pharmacist as a patient helper.
Evaluation	• Class tests and year work (Tutorials and Assignments) 20 marks • End semester examination, one three hours paper 80 marks
References	• Berger BA. Communication skills for pharmacists: building relationships, improving patient care. Amer Pharmacists Assn; 2005. • Harman RJ, editor. Handbook of pharmacy health education. Pharmaceutical Press; 2001.1

Semester VIII

1. Nutriceutical and poisonous plant

Course code	**PH591**
Credit hours	2Cr. (2+0)
Contact hours	• Lectures (28hours) • Practical (42 hours)
Objectives	At the end of these courses the students will gain more knowledge on: • Understand raw material as source of herbal drugs from cultivation to herbal drug product. • Know the WHO and ICH guidelines for evaluation of herbal drugs • Know the herbal cosmetics, natural sweeteners, nutraceuticals • Appreciate patenting of herbal drugs, GMP. • The origin, chemistry, and medicinal value active principles belonging to different phytochemical groups.
Course content	**1- Herbs as raw materials (5 hrs)** • Definition of herb, herbal medicine, herbal medicinal products, herbal drug preparation. • Source of Herbs. • Selection, identification and authentication of herbal materials. • Processing of herbal raw material. • Biodynamic Agriculture • Good agricultural practices in cultivation of medicinal plants including Organic farming. • Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. **2- Nutraceuticals (9hrs)** • General aspects, Market, growth, scope and types of products available in the market. • Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. • Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina. • Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. • Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

	3- Herbal Cosmetics (5 hrs) • Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products. • Herbal Excipients – Significance of substances of natural origin as excipients –colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavours & perfumes. • Herbal formulations: Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes. **4- Evaluation of Drugs (5hrs)** • WHO & ICH guidelines for the assessment of herbal drugs. • Stability testing of herbal drugs. • Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. • Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs. **5- Herbal Industry (6 hrs)** • Herbal drugs industry: Present scope and future prospects. • A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants globally. • Schedule T – Good Manufacturing Practice of Indian systems of medicine. • Components of GMP (Schedule – T) and its objectives. • Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and records.
Evaluation	• Assignment 10% • Mid-semester examination 20% • End semester examination 70%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008.4. Essential of Pharmacognosy by Dr.S.H.Ansari. • Rangari VD. Pharmacognosy & phytochemistry. Career publications;

	2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

2. Pharmaceutics VII

Course code	**PH482**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • Demonstrate an understanding and assess factors which affect the absorption, distribution, metabolism and excretion of drugs • To define various terms relating to bioavailability studies • To evaluate components and results of a bioavailability
Course content	**1. Introduction of biopharmaceutics** **2. Dosage form factors influencing bioavailability** • Drug absorption • Factors influencing absorption • Physicochemical factors affecting absorption • Drug Distribution • Drug Metabolism • Drug Excretion **3. Bioavailability and bioequivalence** **4. Methods to assess bioavailability**
Practical	• Effect of pH, particle size, viscosity and formulation factor on drug dissolution in the GIT • Evaluation of gastrointestinal absorption (Workshop) • Bioavailability and bioequivalence (Workshop) • Evaluation of non-oral drug delivery

	• Dissolution
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy. Philadelphia: Lea & Febiger; 1976. • Shargel L, Yu AB. Applied Biopharmaceutics & Pharmacokinetics 7th edition.

3. Medicinal chemistry III

Course code	**PH483**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • Understand the structure activity relationship of various drugs and describe their main functional groups & their interactions with biological systems.
Course content	Chemotherapy: 1. Anti-infective agents • Historical Background • Commercial Production • Spectrum of Activity • Mechanisms of Action • Chemical Classification • Microbial Resistance • Antibacterial Sulfonamides • Dihydrofolate Reductase Inhibitors • B-Lactam Antibiotics • The Penicillins • B-Lactamase Inhibitors • Cephalosporins • Monobactams • Aminoglycosides • Tetracyclines • Macrolides • Lincomycins • Polypeptides • Unclassified Antibiotics • Newer Antibiotics

	• New Directions in Antibiotic Discovery 2. Antiprotozoal & Anti-malarial 3. Antifungal, Antiviral & Anthelmintic 4. Anticancer drugs • Antimetabolites • Antibiotics and Natural Products • Protein Kinase Inhibitors • Miscellaneous Compounds
Practical	• Synthesis of simple pharmaceutical compounds • 3D modelling and drug design
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Foye WO. Foye's principles of medicinal chemistry. Lippincott Williams & Wilkins; 2008. • Woster PM. Fundamentals of Medicinal Chemistry by Gareth Thomas. John Wiley and Sons, Ltd., West Sussex, UK. 2003. xv+ 285 pp. 19× 24.5 cm. ISBN 0-4708-4307-1. • Patrick GL. An introduction to medicinal chemistry. Oxford university press; 2013 Jan 10. • Nogrady T, Weaver DF. Medicinal chemistry: a molecular and biochemical approach. Oxford University Press; 2005 Aug 11. • Delgado JN, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. Lippincott; 1991. • Abraham D. Burger's Medicinal Chemistry and Drug Discovery, Volume 6, Nervous System Agents. • Salerni OL. Natural and Synthetic Organic Medicinal Compounds, CV Mosby, St. Louis, MO. 1976:166-224

4. Pharmaceutical analysis II

Course code	**PH484**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to understand theoretical and practical applications of: • Pharmaceutical analysis • Biopharmaceutical analysis • Radiopharmaceuticals

Course content	**Biopharmaceutical analysis:** • Principles of methods used to measure plasma/serum, urinary and saliva levels of drugs and metabolites **Radiopharmaceuticals and Radio assay** • Nuclear structure, radioactive decay, half-life radionuclide radiations and properties • Method of nuclear decay, interaction of radiation with matter, shielding • Production of radio-nuclides • Detection and measurement of radiation • Biological hazards, protection, handling of radionuclides. • Control of radiation exposure • Radiotracers, Radio-assay • Radio-pharmaceuticals
Practical	• Quality control of various pharmaceutical dosage forms: • Analysis of different dosage forms tablets, suspension, solution, capsules and injection from the market. • Training in QC department in pharmaceutical plant • Hospital Training in radio pharmacy
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of analytical chemistry. Cengage learning; 2013. • Harvey D. Modern analytical chemistry. New York: McGraw-Hill; 2000 Jan. • Skoog DA, James F. Holler, and Stanley R. Crouch. Principles of instrumental analysis. • Owunwanne A. The handbook of radiopharmaceuticals. Springer; 2012 Dec 6. • Rhodes BA, Croft BY. Basics of radiopharmacy. Mosby; 1978.

5. Pharmacology V

Course code	PH485
Credit hours	**2 Cr (2+0)**
Contact hours	• Lectures (30 hours)
Objectives	• Upon completion of this course students should be able to gain more knowledge on: • Have sufficient knowledge on pharmacology, therapeutic uses, and adverse effects of antibacterial, antiviral, antifungal, antiprotozoal,

	anthelminthic and anticancer agents. • Be aware about development of resistance to chemotherapeutic agents.
Course content	• Clinical chemotherapy 30hrs • Basic principles of chemotherapy Antibacterial agents • Anti-mycobacterial agents • Antifungal drugs • Antiviral drugs • Antiprotozoal drugs • Anthelmintic drugs • Cancer chemotherapy
Evaluation	• Class tests and year work (Tutorials and Assignments) 20% • End semester examination, one three hours paper 80%
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology.. • Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7.

6. Pharmaceutical Microbiology III

Course code	**PH486**
Credit hours	3 Cr. (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student will: • Have a good background about antibiotics and chemotherapeutic agents used in the treatment of bacterial, fungal and viral infections as well as anti-parasitic agents • Be acquainted with the problem of antibiotic resistance, its implications and methods employed to avert its emergency.
Course content	1. Antibiotics and chemotherapeutic agents 1.1. General introduction 1.2. Bacterial cell-wall inhibitors 1.2.1. Beta- lactams, penicillins, cephalosporins and other Beta-lactam antibiotics 1.2.2. Other cell-wall inhibitors 1.3. Bacterial protein synthesis inhibitors 1.3.1. Aminoglycosides, Tetracyclines, Chloramphenicol, Macrolides, Lincomycins, Rifamycins, Quinolones, Miscellaneous antibacterial agents

	2. Urinary tract antiseptics 3. Chemotherapy of tuberculosis 4. Chemotherapy of leprosy 5. Antifolate drugs 6. Antiviral agents 7. Antifungal agents 8. Antiparasitic agents 9. Antibiotic resistance 9.1. Natural resistance 9.2. Acquired resistance 9.3. Genetic mechanism of resistance 9.4. Biochemical mechanism of resistance 9.5. Containment measures
Practical	1. Antimicrobial susceptibility (sensitivity) testing • Disc diffusion assay • Agar well diffusion • Serial dilution method 2. Assay of mixture of antibiotics 3. Determination of minimum bactericidal concentration 4. Determination of minimum inhibitory concentration 5. Determination of antibiotic synergism and antagonism 6. Turbidimetric assay of antibiotics 7. Determination of antibiotic in body fluids 8. Other methods for assaying antibiotics • High performance liquid chromatography (HPLC) • Urease assay • Lucipherase assay • Radiotransferase assay
Evaluation	• Assignment, Seminar, Attendance, Practical Exam. 20% • Mid Exam 20% • Final Exam 60%
References	• Warren L. Review of medical microbiology and immunology. 2016. • Berlanga M. Microbiología. LM Prescott, JP Harley, DA Klein. International Microbiology. 2000;3(3):198-9. • Denyer SP, Hodges NA, Gorman SP, editors. Hugo and Russell's pharmaceutical microbiology. John Wiley & Sons; 2008 Apr 15. • Harvey RA. Microbiology. Lippincott Williams & Wilkins; 2007.

Fifth Year

Semester IX

1. Phytochemistry V

Course code	**PH598**
Credit hours	2Cr. (2+0)
Contact hours	• Lectures (28hours)
Objective	Upon completion of this course students should be able to gain more knowledge on: • The different biogenetic pathways leading to important secondary metabolites. • The origin and biogenetic pathways of some important antibiotics. • The role of the different civilizations in the development of herbal medicine. • Understand all the steps to be followed to obtain herbal drugs of good quality. • Understand basic principles of herbal medicine and proposed mechanisms of action. • Explain how herbal drugs can be used clinically for different indication. • Acquire a greater knowledge of plant-based products as the alternative to other therapies. • Discuss several clinical studies on herbal medicine and their strengths and deficits.
Course content	1. Biogenesis of secondary metabolites • Methods of investigation in biogenic studies. • interrelationships of biosynthetic pathways leading to secondary constituents in plants • aromatic biosynthesis: • the shikimic acid pathway. • The acetate pathway. • Biosynthesis of some glycosides: a- biosynthesis of anthraquinone glycosides. b- Biosynthesis of cyanogenic glycosides. c- Biogenesis of flavanoids glycosides. • Biogenesis of phenolic compounds. • Biogenesis of terpenoids. • Biogenesis of some alkaloids: a- Tropane alkaloids.

	b- Isoquinoline alkaloids. c- Indole alkaloids. 2. Antibiotics • Antibiotics screening. • Antibiotic commercial production. • Antibiotics recovery and isolation. • Biological and biochemical classification of antibiotics 3. Examples of biosynthesis of some antibiotics. • Penicillins and cephalosporins. • Chloramphenicol. • Cephamycins • Polypeptide antibiotics. • Tetracyclines. • Macrolides antibiotics. • Polyenes. • Griseofulvin. • Streptomycin. • Neomycin and paromomycin. • Kanamycin. • Gentamycin. • Tobramycin. 4. Allergens and allergenic reactions.
Evaluation	• Assignment 10% • Mid-semester examination 20% • End semester examination 70%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008.4. Essential of Pharmacognosy by Dr.S.H.Ansari. • Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical Publishers. New Delhi. 2002. • Quality control and standardization of medicinal plants and their

	formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

2. Pharmaceutics VIII

Course code	**PH592**
Credit hours	4Cr (3+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	• By the end of the course, the students should be able to: • Estimate the concepts of rate, order of processes and different pharmacokinetic processes occurred in the body. • Discuss the meaning of each parameter such as clearance, volume of distribution, area under the curve. • Explain the concept of models and the purpose of their use. • Appreciate the role played by pharmacokinetics in therapeutics. • Describe the recent pharmacokinetic models and its advantages and limitations compared to classical compartmental models. • Evaluate biopharmaceutics studies involving drug product equivalency. • Apply basic pharmacokinetic concepts to solve the pharmacokinetic problems. • Evaluate doses and dosage adjustment according to the therapeutic window of the drug, fluctuation, and time intervals of multiple dosages. • Derive the pharmacokinetic models and parameters that best describe the process of drug absorption, distribution and elimination. • What's drug stability • Different instability problems (chemical, physical and microbiological) • Pharmaceutical packaging technology and different materials used. • GMP and quality assurance
Course content	**1. Background mathematical material and pharmacokinetic introduction** • One compartment IV Bolus • Analysis of urine data • Intravenous infusion

	• Pharmacokinetics of oral administration • Calculation of bioavailability parameters • Multiple IV Bolus dose administration • Multiple oral dose administration • Renal disease considerations • Multi-Compartment pharmacokinetic models • Non-Linear pharmacokinetic models **2. Introduction to drug stability** • Chemical degradation of pharmaceutical products • Pathways of chemical degradation • Physical instability problems • Microbial spoilage of pharmaceutical products **3. Introduction to pharmaceutical packaging technology and packaging materials** **4. GMP and quality assurance**
Practical	• Stability tests under accelerated conditions. • Effect of temperature on drug stability. • Kinetics of chemical decomposition in solution. • Photochemical decomposition. • Evaluation of packaging materials.
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• William J. Spruill, William E. Wade, Joseph T. DiPiro, Robert A. Blouin, and Jane M. Pruemer (2010). Concepts in clinical Pharmacokinetics, 6 th edition,American Society of Health-System Pharmacist. • Sunil S. Jambhekar and Philip Breen(1994), Basic pharmacokinetics, 2nd edition, Pharmaceutical Press

3. Medicinal chemistry IV

Course code	**PH593**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • Understand the structure activity relationship of various drugs and describe their main functional groups & their interactions with biological systems.

Course content	**1. Drugs acting on the central nervous system** • Anxiolytic, Sedative, and Hypnotic Agents • Antipsychotics • Anticonvulsants • Analeptics • Methyl-xanthines • Central Sympathomimetic Agents • Antidepressants • Miscellaneous CNS-Acting Drugs **2. Drugs acting on the endocrine system** • Disorders of glucose metabolism: diabetes & metabolic syndrome • Gonadotropins, Gonadotropin-Releasing hormone, and GNRH Receptor Agonists & Antagonists • Chemical Contraceptive Agents • Androgens • Adrenal Cortex Hormones • Neuro-steroids
Practical	• Synthesis of simple pharmaceutical compounds
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
References	• Foye WO. Foye's principles of medicinal chemistry. Lippincott Williams & Wilkins; 2008. • Woster PM. Fundamentals of Medicinal Chemistry by Gareth Thomas. John Wiley and Sons, Ltd., West Sussex, UK. 2003. xv+ 285 pp. 19× 24.5 cm. ISBN 0-4708-4307-1. • Patrick GL. An introduction to medicinal chemistry. Oxford university press; 2013 Jan 10. • Nogrady T, Weaver DF. Medicinal chemistry: a molecular and biochemical approach. Oxford University Press; 2005 Aug 11. • Delgado JN, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. Lippincott; 1991. • Abraham D. Burger's Medicinal Chemistry and Drug Discovery, Volume 6, Nervous System Agents. • Salerni OL. Natural and Synthetic Organic Medicinal Compounds, CV Mosby, St. Louis, MO. 1976:166-224

4. Pharmaceutical analysis III

Course code	**PH594**
Credit hours	• 2Cr (2+0)
Contact hours	• Lectures (28 hours)
Course content	• Advanced pharmaceuticals analysis (e.g., multicomponent analysis, stability studies, stress tests, kinetic method of analysis, stability indicating method of analysis) • Basic statistics in pharmaceutical analysis • Introduction to Analytical method development and validation. • Introduction to Analytical equipment qualification • Fundamentals of Good laboratory practices.
Evaluation	• Class tests, Seminars and tutorials 20% • Mid-semester examination 20% • End semester examination 60%
References	• Christian GD, Dasgupta PK, Schug KA. Analytical chemistry. John Wiley & Sons; 2013 Oct 7. • Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of analytical chemistry. Cengage learning; 2013. • Harvey D. Modern analytical chemistry. New York: McGraw-Hill; 2000 Jan. • Hibbert DB. Quality assurance in the analytical chemistry laboratory. Oxford University Press; 2007 Mar 29. • Bolton S, Bor S. Pharmaceutical Statistics: Practical and Clinical Applications, Revised and Expanded. CRC press; 2003 Oct 17.

5. Pharmacology VI

Course code	**PH 595**
Credit hours	**2 Cr (2+0)**
Contact hours	• Lectures (30 hours)
Objectives	At the end of the course students will: • Be equipped with necessary knowledge for safe, effective, and rational drug therapy with special emphasis on pregnant and lactating women, new-borns, children and old-aged patients. • Be familiar with different classes of drugs used in treating eye, ear and skin diseases especially acne and psoriasis. • Be familiar with common veterinary drugs. • Appreciate the possible drug-drug, drug-food, drug-herbal interactions and identify the underlying mechanisms for these interactions. • Understand the mechanism of action, clinical uses and adverse

	effects of immune-suppressants, and identify the cytokine-based therapies and other immune-modulators.
Course content	• Drugs in pregnancy and lactation: • Drug deposition in pregnancy and placental transfer of drugs, Drug safety during pregnancy and lactation, FDA categorization of drugs during pregnancy, Drugs used during breast feeding. • Drug at extreme of age: • Drugs in neonates and children, Drugs in old age. • Dermatotherapy and drug induced skin disorders (2 hrs): • Treatment of acne, Treatment of psoriasis, Treatment of dermatitis (Atopic dermatitis/ Allergic contact dermatitis/ seborrheic dermatitis), Treatment of idiosyncratic/allergic reactions/ Stevens-Johnson syndrome, Treatment of drug eruptions/acneiform eruptions, Treatment of erythema multiforme/Erythema nodosum, Treatment of drug hypersensitivity syndrome, angioneurotic edema, urticaria and purpura, Treatment of photosensitivity (Erythema and sunburn, Photocarcinogenesis, Photoprotection and evaluation of sunscreens). • Drugs used in eye and ear (2 hrs) • Drugs used in eye diseases (Overview of ocular anatomy, physiology and biochemistry, Pharmacokinetic and toxicology of ocular therapeutic agents, Therapeutic and diagnostic application of drugs in ophthalmology, Antibacterial, antiviral, antiprotozoal, autonomic agents and immunomodulators, Drugs and biological agents used in ophthalmic surgery, and Agents used in ocular diagnosis), Drugs used in ear diseases • Drug interactions • Basic mechanism of drug interaction, Drug interaction in vivo (Drug interaction in the intestine, Drug interaction involving drug metabolizing enzymes, Drug interaction at plasma and receptor-binding sites, Drug interaction and excretory mechanisms), Detailed study of drug-drug, food-drug and herb-drug interactions, Management and prevention, Drug interaction of clinical advantages. • Immunopharmacology: • Overview of immune response • Innate and adaptive immune responses • Hypersensitivity reactions • Types of hypersensitivity reactions • Autoimmune diseases • Tissue transplantation

	• Immunomodulators • Monoclonal antibodies and therapies based on cytokines. • Drugs used in gout • Drugs used in rheumatoid arthritis
Evaluation	• Class tests and year work (Tutorials and Assignments) 20% • End semester examination, one three hours paper 80%
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology. • Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7.

6. Pharmaceutical Microbiology IV

Course code	**PH596**
Credit hours	3 Cr. (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objectives	At the end of this course the student will: • Gain basic knowledge on immunology • Acquried essential knowledge on the preparation and use of immunological products • Grasp the basic principles and practices of disinfection and preservation
Course content	1 Immunology: 1.1. Basic immunology 1.2. Types of immunity: 1.2.1. Natural immunity, 1.2.2. Acquired immunity 1.3. Antigens, chemistry, specificity, types and haptens 1.4. Antibodies, chemistry, specificity, types and blood groups. 2. Immunological products: 2.1. Vaccines, types, preparation, quality control and uses. 2.2. Antisera and immunoglobulins, preparation, quality control and uses. 2.3. Diagnosis agents. 3. Disinfection and preservation 3.1. General introduction, 3.2. Theory of disinfection, 3.3. Factors affecting disinfection, 3.4. Chemical disinfectant,

	3.5. Evaluation of disinfectants 3.6. Hygiene and contamination control, 3.7. microbial contamination and preservation, 3.8. Types of preservation 3.9. Preservation of pharmaceuticals 3.10. Preservation of food 3.11. Evaluation of preservatives
Practical	**(Immunology)** • In vitro Antigen antibody reactions • Blood grouping (ABO & Rh typing) • Complement fixation test • The Ouchterlony gel diffusion test (Precipitation reactions) • Serological kits: 1. Kit 1: Widal antigen set: O, H, AH and BH for slide and tube tests (TYDAL) 2. Kit 2: Antistreptolysin O (ASO) slide agglutination 3. Kit 3: Stanbio RPR (Rapid Plasma Reagin) quick test (Syphilis). • Western blot • Immunofluorescence • Enzyme Linked Immuno-Sorbent Assay (ELISA) • Radioimmunoassay (RIA) **Non-antibiotics antimicrobials: (Disinfectants, preservatives and antiseptics)** • Phenol coefficient 1. Rideal-Walker test 2. Chick-Martin test • Capacity use dilution test • Viable count technique • Evaluation of fungicidal activity • Evaluation of sporicidal activity • Evaluation of mycobactericidal activity • Evaluation of virucidal activity • Evaluation of oral antiseptics by extinction time technique • Evaluation of preservatives by challenge test.
Evaluation	• Assignment, Seminar, Attendance, Practical Exam. 20% • Mid Exam 20% • Final Exam 60%
References	• Flaherty D. Immunology for Pharmacy-E-Book. Elsevier Health Sciences; 2014 Jun 25. • Katenkamp D. Cellular and Molecular Immunology, Abul K.

	Abbas, Andrew H. Lichtman, Jordan S. Pober (Eds.), WB Saunders Company, Philadelphia-London-Toronto-Sydney-Tokyo (1994), 457 pages with numerous figures, coloured schemating drawings and tables. Softcover£ 21.50 ISBN 0-7216-5290-X. • Denyer SP, Hodges NA, Gorman SP, editors. Hugo and Russell's pharmaceutical microbiology. John Wiley & Sons; 2008 Apr 15...

7. Clinical pharmacy II

Course code	**PH597**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (30hours)
Course content:	• Clinical pharmacokinetics • Perioperative Care • Asthma • Chronic Obstructive Pulmonary Disease • Upper Gastrointestinal Disorders • Complications of End-Stage Liver Disease • Principles of Infectious Diseases • Respiratory Tract Infections • Urinary Tract Infections • Acute Kidney Injury • Chronic Kidney Disease
Practical	• Hospital rounds • Introduction to the course (one week) • Internal medicine (Four week) • Case presentation (Two week) • Surgery (Two week) • Case presentation (One week)
Evaluation	• Mid exam 20% • case presentation 20% • final exam 60%
References	• DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, Pharmacotherapy 3rd A. A pathophysiologic approach. Pharmacotherapy. Nova York. 2008;7:385-400. • Young LY, Koda-Kimble MA, Kradjan WA, Guglielmo BJ, editors. Applied therapeutics: the clinical use of drugs. Vancouver, WA: Applied therapeutics; 1995. • Whittlesea C, Hodson KD, editors. Clinical pharmacy and therapeutics e-book. Elsevier Health Sciences; 2018 Sep 11.

8. Biostatistics and research methodology

Course code	**PH598**
Credit hours	**2 Cr (2+0)**
Contact hours	• Lectures (28 hours)
Objectives	• To get knowledge about the word processing and data analysis. • The course aims to introduce the student to the concept and applications of statistical methods as applicable to the biological sciences. • It deals with the principles and concepts of biostatistics as well as method of analysis and evaluation of biological data. • The course includes qualitative and quantitative data presentation, sampling variability and significance, special emphasis is laid on the use of these methods in the decision making process. • Real life example from areas such as quality control biological testing and assay. • Clinical studies and pharmaceutical drug development are extensively covered.
Course content	• Data collection, sampling techniques, summarization of data, population & samples, probability statement, tests of hypothesis & significance, small sample test, simple linear correlation & regression, non-parametric tests, introduction to SPSS for windows, data transformation; selecting; weighting & ordering cases, data analysis with SPSS for windows, using the SPSS chart facility. • Introduction: to know the operating system of the computer, the word processing and the database. • Presentation of the data and determination of the variables. • Calculations of the units of the normal distribution. • To deal with the bases of the normal distribution. • To perform hypothesis testing and variable comparison. To deal with the bases of probability, to deal with simple regression and correlation. • To deal with questionnaire…etc.
Evaluation:	• Class tests and year work (Tutorials and Assignments) 20% • End semester examination, one three hours paper 80%
References	• Milton JS, McTeer PM, Corbet JJ. Introduction to statistics. • Brase CH, Brase CP. Understandable statistics. Cengage Learning; 2014.

Semester X

1. Phytotherapy

Course code	**PH5101**
Credit hours	2Cr. (2+0)
Contact hours	• Lectures (28hours)
Objectives	Upon completion of this course students should be able to gain more knowledge on: • The different biogenetic pathways leading to important secondary metabolites. • The origin and biogenetic pathways of some important antibiotics. • The role of the different civilizations in the development of herbal medicine. • Understand all the steps to be followed to obtain herbal drugs of good quality. • Understand basic principles of herbal medicine and proposed mechanisms of action. • Explain how herbal drugs can be used clinically for different indication. • Acquire a greater knowledge of plant-based products as the alternative to other therapies. • Discuss several clinical studies on herbal medicine and their strengths and deficits.
Course content	1. Introduction and definitions. • Types of drugs derived from plants. • Reasons why people use herbs. • Advantages of phytomedicines. • iv- Risks of using phytomedicines. 2. Medicinal plants through history. • Ancient Egyptian medicine. • Ancient Greek medicine. • Ancient Roman medicine. • Traditional Chinese medicine. • Indian ancient medicine. • Islamic medicine. 3. Cultivation, collection, and processing medicinal plants. 4. Standards applicable herbal drugs. 5. Assay of crude drugs. 6. Herbal preparations.

	• Internal preparations. • External preparations. 7. Pharmacodynamics of the key chemical groups in plants. • Simple phenols and glycosides. • Cyanogenic glycosides. • Mucilages. • Essential oils. • Glucosinolates. • Flavanoids. • Tannins and oligomericprocyanidins (OPC). • Resins. • Bitters. • Pungent constituents. • Saponins. • Cardiac glycosides. 8. Anthraquinones . 9. Coumarins. 10. Phytoestrogens. 11. Alkaloids. 12. Pharmacokinetics of herbal drugs. • Alcohol glycosides. • Anthraquinone glycosides. • Flavonoid glycosides. • Tannins. 13. Cases study.
Evaluation	• Assignement 10% • Mid-semester examination 20% • End semester examination 70%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996.. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008.4. Essential of Pharmacognosy by Dr.S.H.Ansari. • Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976.. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical

Semester X

1. Phytotherapy

Course code	**PH5101**
Credit hours	2Cr. (2+0)
Contact hours	• Lectures (28hours)
Objectives	Upon completion of this course students should be able to gain more knowledge on: • The different biogenetic pathways leading to important secondary metabolites. • The origin and biogenetic pathways of some important antibiotics. • The role of the different civilizations in the development of herbal medicine. • Understand all the steps to be followed to obtain herbal drugs of good quality. • Understand basic principles of herbal medicine and proposed mechanisms of action. • Explain how herbal drugs can be used clinically for different indication. • Acquire a greater knowledge of plant-based products as the alternative to other therapies. • Discuss several clinical studies on herbal medicine and their strengths and deficits.
Course content	1. Introduction and definitions. • Types of drugs derived from plants. • Reasons why people use herbs. • Advantages of phytomedicines. • iv- Risks of using phytomedicines. 2. Medicinal plants through history. • Ancient Egyptian medicine. • Ancient Greek medicine. • Ancient Roman medicine. • Traditional Chinese medicine. • Indian ancient medicine. • Islamic medicine. 3. Cultivation, collection, and processing medicinal plants. 4. Standards applicable herbal drugs. 5. Assay of crude drugs. 6. Herbal preparations.

	• Internal preparations. • External preparations. 7. Pharmacodynamics of the key chemical groups in plants. • Simple phenols and glycosides. • Cyanogenic glycosides. • Mucilages. • Essential oils. • Glucosinolates. • Flavanoids. • Tannins and oligomericprocyanidins (OPC). • Resins. • Bitters. • Pungent constituents. • Saponins. • Cardiac glycosides. 8. Anthraquinones . 9. Coumarins. 10. Phytoestrogens. 11. Alkaloids. 12. Pharmacokinetics of herbal drugs. • Alcohol glycosides. • Anthraquinone glycosides. • Flavonoid glycosides. • Tannins. 13. Cases study.
Evaluation	• Assignement 10% • Mid-semester examination 20% • End semester examination 70%
References	• O'Neill MJ. Trease and Evans' pharmacognosy. The Lancet. 1996 Dec 14;348(9042):1645. • Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996.. • Kokate CK, Purohit AP, Gokhale DS. Pharmacognosy. Nirali prakashan; 2008.4. Essential of Pharmacognosy by Dr.S.H.Ansari. • Rangari VD. Pharmacognosy & phytochemistry. Career publications; 2009. • Raghunathan K. Pharmacopoeial standards for Ayurvedic formulations. Central Council for Research in Indian Medicine and Homoeopathy; 1976.. • Mukherjee PK. Quality Control of Herbal Drugs-An Approach to evaluation of Botanical: Business Horizons Pharmaceutical

	Publishers. New Delhi. 2002.. • Quality control and standardization of medicinal plants and their formulations: (a) WHO guidelines (b) British Herbal Pharmacopoeia monograph (c) Modern herbal monograph (d) Japanese Standard for Herbal Medicines (e) Ayurvedic Pharmacopoeia monograph

2. Pharmaceutics IX

Course code	PH5102
Credit hours	**3Cr (2+1)**
Contact hours	• Lectures (28 hours) • Tutorials (42 hours)
Objective	By the end of the course, the students should be able to: • To provide students with updated knowledge concerning drug delivery systems • To define key terms and concepts regarding drug delivery systems • Differentiate between the different types of drug delivery systems • To define pro-drug and explain the mechanism by which pro-drugs work. • To define diffusion controlled delivery systems • To identify transdermal drug delivery principles • To define nanoparticle carriers and describe the formation of nanoparticle carriers • Explain Bio distribution and toxicity of nanoparticles • Explain the structure of Liposome drug carrier, micelle carriers and Nanocrystal • To define the radio pharmacy • To determine the radio pharmaceuticals • To describe the quality control of radio pharmaceuticals
Course content	• Introduction to modified release drug delivery system • Pro-drugs • Diffusion controlled delivery systems • Diffusion controlled delivery systems • Gastric retentive dosage forms • Osmotic controlled drug delivery system • Transdermal drug delivery systems • Introduction to Nano Particle drug carrier • Introduction to Nano Particle drug carrier

	• Pharmacokinetics of oral administration • Calculation of bioavailability parameters • Multiple IV Bolus dose administration • Multiple oral dose administration • Renal disease considerations • Multi-Compartment pharmacokinetic models • Non-Linear pharmacokinetic models **2. Introduction to drug stability** • Chemical degradation of pharmaceutical products • Pathways of chemical degradation • Physical instability problems • Microbial spoilage of pharmaceutical products **3. Introduction to pharmaceutical packaging technology and packaging materials** **4. GMP and quality assurance**
Practical	• Stability tests under accelerated conditions. • Effect of temperature on drug stability. • Kinetics of chemical decomposition in solution. • Photochemical decomposition. • Evaluation of packaging materials.
Evaluation	• Class tests, Seminars and Practical work 20% • Mid-semester examination 20% • End semester examination 60%
Reference	• William J. Spruill, William E. Wade, Joseph T. DiPiro, Robert A. Blouin, and Jane M. Pruemer (2010). Concepts in clinical Pharmacokinetics, 6 th edition,American Society of Health-System Pharmacist. • Sunil S. Jambhekar and Philip Breen(1994), Basic pharmacokinetics, 2nd edition, Pharmaceutical Press

3. Medicinal chemistry IV

Course code	**PH593**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (28 hours) • Practical and tutorials (42 hours)
Objective	At the end of this course the student should be able to: • Understand the structure activity relationship of various drugs and describe their main functional groups & their interactions with biological systems.

	• Assessment of anxiolytic and anticonvulsant activities. • Determination of LD50. • Poisons and their antidotes. • Corrosives, irritants and haemolytic poisons. • Pesticide toxicity, behavioural toxicity.
Evaluation	• Class tests & year work (Practical, Tutorials & Assignments) 20% • End semester examination, one three hours paper 80%
References	• Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology, Churchill Livingstone. New York. 2003:3-4. • Katzung BG, Trevor AJ, editors. Basic & clinical pharmacology Patrick KS. Goodman and Gilman's The Pharmacological Basis of Therapeutics. Edited by JG Hardman, LE Limbird, and AG Gilman. McGraw Hill, New York. 2001. xxvii+ 2148 pp. 21× 26 cm. ISBN 0-07-1354469-7. • Kulkarni SK. Hand book of experimental pharmacology. Vallabh prakashan; 1987. • Ghosh MN. Fundamentals of experimental pharmacology, Kolkata. India: Hilton and company. 1984:195. • MacLeod LJ. Pharmacological Experiments on Intact Preparations. 1975

4. Clinical pharmacy III

Course code	**PH5104**
Credit hours	3Cr (2+1)
Contact hours	• Lectures (30hours)
Course content	• Thyroid Disorders • Diabetes Mellitus • Women's health • Seizure Disorders • Cerebrovascular Disorders • Adult Parenteral Nutrition • Critical care • Major Depressive Disorders • Pain and its Management

Practical	Hospital round:- • Internal medicine (Renal & liver) (Three week) • Case presentation (One week) • Endocrine (Two week) • Obstetrics & gynaecology (Two week) • Case presentation (One week) • Emergency medicine (One week)
Evaluation	• Mid exam 20% • Case presentation 20% • final exam 60%
References	• DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, Pharmacotherapy 3rd A. A pathophysiologic approach. Pharmacotherapy. Nova York. 2008; 7:385-400. • Young LY, Koda-Kimble MA, Kradjan WA, Guglielmo BJ, editors. Applied therapeutics: the clinical use of drugs. Vancouver, WA: Applied therapeutics; 1995. • Whittlesea C, Hodson KD, editors. Clinical pharmacy and therapeutics e-book. Elsevier Health Sciences; 2018 Sep 11.

5. Research Project

Course code	**PH5106**
Credit hours	**2 Cr (2+0)**
Objectives	By the end of research project, the students should be able to: • Carry out a research project in one of the pharmaceutical field. • To plan, execute & report a research project. • Collect the data • Analyze the result, discuss and interpret the findings
Course content	• Setting research plan. • Gathering up-to-date literature review. • Analysis of data. • Presentation skills and tools. • Writing Process. • Elements of the Scientific Research Paper. • Citation style.

	• Referencing software.
Evaluation	A discussion committee will evaluate the following: • Research thesis • Research project presentation *The form used in thesis evaluation has been attached to the appendix section.

6. Pharmaceutical Biotechnology

Course code	**PH5107**
Credit hours	**2 Cr (2+0)**
Contact hours	• Lectures (28 hours)
Objective	• By the end of this course the students should be able to: • Understand the nature of DNA and RNA and its building blocks, organization and nature of chromosomes & cell division • Understand that DNA is the carrier of genetic information. • Understand the basis of the flow of genetic information. • Understand the mode of action of some drugs that interfere at the level of gene expression.
Course content	• The biosynthesis of nitrogenous bases, nucleosides and nucleotides, gout and therapeutics. DNA structure, DNA organization, the chromosome, RNA structure, types and roles. • The cell cycle, replication, antimetabolites, anticancer agents. • RNA synthesis, the genetic code, protein biosynthesis antibiotics as inhibitors of replication, transcription or translation. Gene regulation, • Genetic engineering, molecular techniques, plasmids, bacteriophages, cosmids, vectors, genomic libraries, shotgun cloning, screening genetic libraries. Optimizing expression of recombinant genes, transcription and translation. PCR, applications and limitations. • Biotechnology in the pharmaceutical industry, recombinant human insulin, somatostatin, growth hormones, hepatitis B- vaccine and recombinant antibiotics. Recombinant DNA in diagnosis of infectious diseases, genetic disorders, gene therapy and transgenic organisms.
Evaluation	• Mid exam, Assignment, lab related activities 30% • Assignment 10% • Final exam 60%

References	• Bradley JR, Johnson D, Rubenstein D. Lecture notes on molecular medicine. Wiley-Blackwell; 2001 Oct 18. • Denyer SP, Hodges NA, Gorman SP, editors. Hugo and Russell's pharmaceutical microbiology. John Wiley & Sons; 2008 Apr 15. Pharmaceutical Press

7. Continuous Training

Course code	**PH5108**
Credit hours	**3Cr (0+3)**
Contact hours	• Training program contains the following subprograms: 1. Continuous trainin-1: A total of 160 contact hours in a community pharmacy (8 hours/5 days for 4 weeks) after completion of the 2nd year. 2. Continuous training-2: A total of 240 contact hours divided into training in a community and/or hospital pharmacy (8 hours/5 days for 4 weeks) and training in a pharmaceutical factory (8 hours/5 days for 2 weeks) after completion of the 3rd year. 3. Continuous training-3: A total of 320 contact hours divided into training in a community and/or hospital pharmacy (8 hours/5 days for 6 weeks) and training in a pharmaceutical factory (8 hours/5 days for 2 weeks) after completion of the 4th year. • Structured forms fulfilling the requirement of training will be provided to the students and the logbooks are filled according to the rules of training program handbook.
Objective	• Be oriented with the various departments in the health centre or hospital and drug factories • Arrange and store medications in the pharmacy. • Read, prepare and label medications. • Dispense medications under supervision. • Have knowledge of generic names, brand names, adverse effects and precautions of drugs • Maintain inventory control. • Learn how to order medicaments from the P.H.C./Hospital store and from Medical Stores Supplies • Know about different vaccines, their methods of storage and transportation. (Moreover, the student must get a clear picture of the immunization programs that take place in P.H.C./Hospital) • Have good knowledge of controlled and emergency drugs • Be oriented with the new environment particularly in the hospital pharmacy, its organizational set-up, its work plan and the different

	areas of activities within the pharmacy. • To carry out activities in an outpatient pharmacy. The activities include: the arranging, filling and dispensing of drugs under supervision, dispensing controlled drugs and compounding some formulations under the pharmacist's supervision. • Be able to work in in-patient pharmacy with a particular reference to intravenous admixture programs by introducing the students to the sterile room under close supervision. • Getting involved in medication ordering, recording and maintaining inventory control. Experiencing the process of production of different dosage forms (liquid, solid, semisolid) • Getting familiar with different machines used in production • Experiencing the process of quality control and assurance • Sampling and testing raw materials and end products • Experiencing technology used in drug development • Perform researches related to drug development • Experiencing the factory validation scheme
Course content	**<u>Out-patients' pharmacy</u>** 1. Arrangement of medications in the pharmacy 2. Knowledge and listing medications by their generics and trade names 3. Reading the prescription 4. Filing the prescription and medication labeling in accordance with the policies adopted in the hospital 5. Dispensing drugs under supervision 6. Dispensing of controlled drugs to out-patients under strict supervision 7. Compounding under supervision 8. Medication recording and inventory control 9. Knowledge of materials storage conditions **<u>In-patient pharmacy:</u>** 1. Drug distribution systems a. Floor stock (bulk) b. Unit-dose drug distribution system 2. Sterile medication area (I.V. drug administration & I.V. nutrition area): a. Maintaining sterile conditions in the area c. Maintaining sterility of the entire room Practicing aseptic techniques under supervision d. Preparing I.V. additive solutions under supervision: i. Intravenous nutrition ii. Antibiotic preparation (reconstitution)

	iii. Chemotherapy **Manufacturing Facilities:** Pre-packaging area: a. Pre-packaging and labelling medications in unit-dose containers b. Practicing on repacking machines Narcotics and controlled medications area: a. Rules and inventory control of narcotics and controlled drugs b. Dispensing narcotics and controlled drugs under strict supervision Compounding different extemporaneous preparations 6. Store: a. Arrangement of drugs in the pharmacy store • Rules of procurement, inventory control, and storage conditions of drugs
Evaluation	***A total point of 100 divided as follows:*** 1. Continuous training-1 = 20% (50% field training committee & 50% field training supervisor). 2. Continuous training-2 = 30% (50% field training committee & 50% field training supervisor). 3. Continuous training-3 = 50% (50% field training committee &50% field training supervisor).
References	• Oxford handbook of clinical pharmacy by M Mitchell, M Snelling 2012. • Handbook of pharmacy healthcare: diseases and patient advice by P Mason 2002 • Good Quality Practice (GQP) in Pharmaceutical Manufacturing: A Handbook by J Botet 2015 • British National Formulary (BNF) (recent copy) • MIMS -Middle East (recent copy) • Pharmacy Practice by: Patricia Stone & Stephen J. Curtis • United states pharmacopeia (recent copy) • British pharmacopeia (recent copy)

ملحـــق (١)

نموذج تقييم رسالة بحث التخرج

لطلاب البكالريوس

Thesis Evaluation Form (Bachelor Degree)

Student Name	
Thesis Title	

Section	Grade
Introduction (8 marks): -Does the introduction motivate the goals of the thesis and explain the context of the work? -Does it point to existing solutions and their limitations? -Is the research question formulated clearly, and does the contribution become clear?	
Related Work/Background (12 marks): -Does the thesis describe relevant related work and relevant background information in an appropriate number of words and in sufficient detail?	
Theoretical/Practical Description (12 marks): -Is the proposed solution to the problem well described (e.g., theoretical approach, experiment, implementation)?	
Results/Discussion/Evaluation (20 marks): -Are the obtained results discussed with respect to the original goals of the thesis? -Are the results well discussed and compared to the results of similar approaches?	
Conclusion (8 marks): -Does the conclusion state the results concisely and does it explain their significance? -Does it restate limitations and open questions?	
Formality, Writing Style (12 marks): -Is the thesis well written, easy to read, and does it use appropriate wording? -Are graphs, tables, formulas, etc. well displayed? -Is the overall thesis and the single chapters and paragraphs well-structured? - Are all references cited correctly, and the bibliography formatted properly?	
Thesis presentation (8 marks): -Are the thesis contents well presented? -Student presentation skills	
Thesis supervisor evaluation (20 marks): -Evaluation of student academic and research performance during the research project	

Comments and decision:

Discussion Committee:

Name			
Signature			