FACULTY OF

CLINICAL & INDUSTRIAL PHARMACY

VISION AND MISSION

The Faculty of Pharmacy- National University- Sudan strives towards developing the highest standards o academic professional excellence in clinical and industrial pharmacy. The various parts of this College a produce ethically responsible, innovative, critically thinking professional pharmacists committed to meeti health and developmental needs of all communities in the Sudan and the rest of the world, appropriately efficiently. The programmed teach the students how to learn and continue as lifelong learners in pharma The College aims to be the most respected educational institution of pharmacy, as evidenced by high qu premises, up-to-date administration and governance, job- and research-directed instruction, quality of gra and their ethical, professional and scholarly contribution.

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Clinical and Industrial Pharmacy, has to:

1. Obtain pass mark in in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry and biology. International students who have not studied Arabic and religio studies may have more alternative subjects from an approved list of subjects published in the webpage of Ministry of Higher Education.
2. Achieve the percentage in Sudan School Certificate announced every year (International students may have 10% less in the School Certificate scores.
3. Apply electronically though the website of the Admission and Accreditation Office, Ministry of Higher Educat or apply directly in Admission Office in the National University, and pass the health examination, aptitude te and interview at the Faculty of Pharmacy.
4. Pay the published fees: 33,000 SDG or US $ 6,000[international students]

CAREER ADVICE

Students qualified with this Bachelor degree pass through a track decreed by the Sudan Medical Council and are so temporarily accredited as pharmacists. After working for a period specified by the Ministry of Health in each specialty/ students acquire a license of permanent registration with the Sudan Medical Council and may work in pharmacies or administrative pharmacist, clinical pharmacist or work in the industry. Pharmacy grads may pursue master's and doct

degrees in many disciplines of Pharmacy to qualify for university teaching or to work in medication, reagents or dyes factories. The graduate may be interested in managerial, commercial, industrial or charity career, related to one of the various specialties in the discipline.
International graduates can follow the same track if they preferred to stay in the Sudan, but may also start their registration and internship in their own countries or residence

OBJECTIVES [FACULTY OBJECTIVES]

The objectives of the Faculty of Pharmacy National University are to:

1. Emphasize values and ethical heritage of the Sudanese Nation in its curriculum, and follow strategies that lead to strengthening these values, as an important component of the National University philosophy and message.

2. Graduate a practitioner with a Bachelor of Pharmacy (B Pham), with strong community orientation and ethical components, in both the clinical and industrial aspects. Attempts will start with the accreditation authorities to introduce the Pharm. D option.

3. Contribute to community development through health services provided in its own health institutions and other institutions including pharmaceutical industries, co-operating with them, through the following: (a) partnership in designing health programmed and plans, and implement whatever is feasible in utilizing the experience of specialists, (b) Contribution in continuous education through short and long term courses, to improve efficiency of health workers and for the professionals to learn from each other for better mutual understanding and services, and (c) Provision of essential and appropriate equipments and supplies to improve quality of services, through partnership with the Ministry of Health, and Industry.

4. Strengthen pharmacy research, making use of the University's accessibility and communication privileges.

5. Strengthen medical and health research, making use of the College's accessibility and communication privileges.

CURRICULUM OBJECTIVES [Characteristics of the Pharmacy graduate]

A graduate of the Faculty of Pharmacy- National University should be able to

1. Adopt the strategies of the National University-Sudan and abide by its objectives and rules stated in its constitution and directives [the Student Guide].

2. Observe in his/her practice, the health professional ethics which agree with the Nation's values, beliefs and norms (as stated by Sudan Medical Council), and maintain good and honest relations with his/her patients, their families, his/her colleagues across

all sectors involved in health.

3. Appreciate the value of diversity and multi-ethnicity in solving clinical and industrial pharmacy problems with emphatic, humane and fair practice.

4. Assist in the diagnosis and management of cases related to drug side effects, dependence or deprivation, and other health problems prevalent at the level of the individual, family or society, with special emphasis on the nutritional and environmental problems common in developing countries, and plays an active role in health promotion.

5. Integrate basic pharmacy, community and clinical training, and industrial situation in solving community, family and individual health problems.

6. Use scientific knowledge in diagnosis and management of the relevant health problems, according to known methods of problem solving and integration, and explains the scientific structural (anatomical), functional (physiological, biochemical), morbid (microbiological, pathological), and therapeutic (pharmacological) background related to the problems.

7. Manage emergencies relevant to drug intake, and decide and act properly on cases needing referrals to specialized centres or personnel.

8. Accepts to work in all settings according to needs, and act to improve health service delivery systems both quantitatively and qualitatively.

9. Encourage community participation and act in recruiting various sectors in defining drug and health-related problems, planning and providing suitable solutions, recognizing the community beliefs, ethics, and traditional practices.

10. Adhere to “health team” approach, acting as an efficient member, capable of its leadership sometimes, dividing labor and responsibilities among its members, and ensuring both effectiveness and homogeneity among the members [in courses on education, communication, community practice and clerkships]

11. Administer a pharmacy “unit” or “centre”, or a pharmaceutical firm efficiently according to scientific, medical, statistical, economic and legal bases.

12. Continue to consider elements of efficiency, costing and economic implications in his/her therapeutic choices and advices.

13. Acquire the skills of teaching, learning and communication efficiently to carry out his/her duties in health education and in winning the confidence of patients and their families and societies.

14. Acquire the skills of self education, and contribute to availing opportunities for planning and implementing continuous education activities to upgrade his/her own abilities and those of his/her colleagues in the health team [in courses on education,

computer, research methodology and report writing].

15. Carry health or health-related research on drug therapy or industry, alone or with other member(s) of the health team, using scientific methods known in such activities [in courses on education, research methodology, statistics, computer and report writing, medical ethics].
16. Use computer in word processing, statistics and graphics to achieve success in other objectives of his/her career [in courses on computer, research methodology and report writing], and find out pharmacy information from the net.
17. Acquire postgraduate qualification in the discipline of his/her choice, recognizing the needs of the society for certain specialties, particularly the general clinical pharmacist [in clerkships].

EDUCATIONAL STRATEGIES AND METHODS

The learning strategies emphasize the following: (1) early acquisition of basic pharmacy skills, (2) student-centred learning, and maximum student responsibility in the learning process, (3) problem-based and problem-oriented learning, (4) community oriented and community-based activities, (5) integration of basic science, community and clinical pharmacy practice, and industrial pharmacy, in a multidisciplinary approach, (6) self- and peer education and evaluation, (7) team-work approach, (8) a wide range of electives, (9) continuous evaluation and (10) continuous education.

The University adopts the following methods in the daily College of activities: (1) problem-based learning (PBL) sessions- one problem/ week at most, (2) seminars and small group discussions – once/ week at least (3) field practice in rural and primary health care settings and societies not less than 1/5th of the timetable, (4) practical sessions (laboratory, clinical, pharmaceutical industries) not less than 1/4th of the curriculum timetable, (5) skill laboratory (weekly) sessions, (6) lectures -not more than 1/3rd of the curriculum timetable (not more than 3 lectures/day). (7) educational assignments, reports and research activities (as many as the College would allow- at least one per module), (8) electives -not more than 10% of the curriculum timetable, and (9) graduation project.

TIMETABLE

The College is of five years' (10 semesters') duration divided into three phases, comprising about 220 CHs CHs. A semester is 21-24 weeks in Phase 1 and 2, and 18-25 weeks in Phase 3. There are three compulsory Summer courses and three electives; credit hours of electives are included in the total.

Phase 1:Introductory courses and University requirements = Semester 1

Phase 2: Integrated basic pharmacy courses = Semesters 2-6

Phase 3: Clerkships in Industrial and Clinical Pharmacy = Semesters 7-8

Clerkships in Clinical and Industrial Pharmacy = Semesters 9-10

Semester 1 [24 CHs- 16 weeks]:

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
	Orientation week						
1	**English Language-1**	**PA-ENG-111**	**16 weeks**	3	-	-	**3**
2	**Medical Terminology in Pharmacy**	**PA-TERM-112**	**15 weeks**	2	-	-	**2**
3	**Introduction to Medical and Medical Education**	**PA-EDU-113**	**15 weeks**	2	-	-	**2**
4	**Computer Science -1**	**PA-COMP-114**	**16 weeks**	2	-	-	**2**
5	**Physics for Medical Equipment's and Investigation**	**PA-PHYS-115**	**16 weeks**	3	-	-	**3**
6	**Biostatistics**	**PA-STAT-116**	**15 week**	2	-	-	**2**
7	**Introduction to Medical Ethics**	**PA-ETHIC-117**	**16 weeks**	3	-	-	**3**
8	**Basic Biochemistry**	**PA-BIOCH-118**	**15 weeks**	4	-	-	**4**
9	**Organic Chemistry in Pharmacy -1**	**PA-ORG-119**	**16weeks**	2	-	1	**3**
			16	23	-	1	24

Examination of longitudinal courses (+re-sits) 2 weeks

Semester 2 [24 CHs- 19 weeks]:

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	English Language-2	PA-ENG-121	15 weeks	3	-	-	3
2	Behavioral Science	PA-BEHAV-122	16 weeks	3	-	-	3
3	Computer Science-2	PA-COMP-123	16 weeks	2	-	-	2
4	Human Body Structure	PA-HUMAN-124	4 weeks	3	-	-	3
5	Human Body Functions	PA-HUMAN-125	3 weeks	4	-	-	4
6	Principle of Disease-1	PA-DIS-126	3 weeks	3	-	-	3
7	Genetics and Molecular Biology	PA-GEN-127	3 weeks	3	-	-	3
8	Pharmacy Orientation and Pharmaceutical Calculation	PA-CAL-128	3 weeks	3	–	-	3
			16	2	-	-	24

Examination of longitudinal courses (+re-sits) 2 weeks

SUMMAR 1 AND ELECTIVES.

1. Pharmacy records and data collection (PA-SUM-131) 2 CHs
2. Medical genetics (E-131) 2CHs
3. Elective (E-132): A 1000 –word report on “Internet Sources of Pharmaceutical Sciences” 1CH 4. Repeat courses or examinations for late comers and failures.

Semester 3 [21CHs- 22 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skill-1: Communication skills	PA-SKIL-211	.Lomgit	1	-	1	2
2	General and physical chemistry	PA-CHEM-217	Longit	1	-	1	2
3	Principles of disease-2	ME-DIS-212-B	3	2	-	-	2
4	Pharmacology-1	PA-PHARM-226	4	2	-	-	2
5	Human endocrine and metabolism	PA-METAB-214	.5	2	2	1	5

6	Pharmaceutical organic chemistry-2	PA-ORG-216	4	2		1	3
7	Pharmacognosy & plant sciences-1	PA-COG-215	5	2	2	1	5
			21	12	4	5	21

Examination of longitudinal courses (+re-sits) 1 week

Semester 4 [21 CHs- 17 weeks]:

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skill-1: Laboratory skills	PA-SKIL-221	.Lomgit	1	-	1	2
2	Pharmaceutical microbiology-1	PA-MIC-213	3	2	-	1	3
3	Pharmacology -2	PA-PHAR-222	4	2	1	1	4
4	Medicinal chemistry	PA-CHEM—224	3	2	1	1	4
5	Pharmacognosy and plant sciences -2	PA-COG-225	3	2	1	1	4
6	Unit process	PA-UNPR-226	3	2	1	1	4
			16	11	4	6	21

Examination of longitudinal courses (+re-sits) 1 week

SUMMAR 2 AND ELEVTIVE MODULES

1. Rural Residence for field work data for PA-SUMMER-227
2. Repeat courses or examinations for late comers and failures.

Semester 5 [23 CHs- 22 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skills-3-laboratory skills	PA-SKIL-321	Longit.	1	-	1	2

2	Pharmaceutical analysis	ME-NAL-312	3	2	-	1	3
3	Physical pharmacy	PA-PH-317	4	2	1	1	4
4	Powder technology	PA-PWTEC-314	3	2	1	1	4
5	Pharmaceutical technology	PA-TEC-315	4	2	1	1	4
6	Pharmacy practice-1	PA-PRAC-313	4	2	-	1	3
7	Pharmaceutical microbiology-2	PA-MIC-316	3	2	-	1	3
			21	13	3	7	23

Examination of longitudinal courses (+re-sits) 1 week

Repeat courses or examinations for late comers and failures

Semester 6 [23 CHs- 18 week

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Professional skills-4- Drug supply management	PA-SKIL-321	Longit.	1	-	1	2
2	Introduction to Clinical pharmacy	PA-CLIN-322	Longit	1		1	2
3	Pharmaco-epidemiology & economics	PA-EPIC-327	3	2	-	1	3
4	Dosage form design/QC	PA-DOS-326	3	2	1	1	4
5	Pharmacy practice-2	PA-PRAC-323	3	2	1	1	4
6	Basic therapeutics	PA-TREAT-325	4	2	1	1	4
7	Pharmaco-informatics	PA-INFO-324	3	2	1	1	4
			17	12	4	7	23

Examination of longitudinal courses (+re-sits) 1 week

SUMMAR 3 AND ELECTIVES

1. Rural Hospital Residency (PA-SUM-331)2 CHs Block 2 weeks
2. Community pharmacies training and basic pharmacy skills 3. Repeat courses or examinations for late

comers and failures.

Semester 7 Industrial Pharmacy [25 CHs-22 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Drug Abuse	PA-DAB-411	Longit	1	-	1	2
2	Medical Ethics & Forensic pharmacy	ME-PAR-413	Longit	1		1	2
3	Drug design	PA-DRUG-421	5	2	1	2	5
4	Packaging technology	PA-PAC-424	2	1		1	2
5	Pharmaceutical analysis	PA-NAL-423	5	2	1	2	5
6	Quality assurance in pharmacy	PA-QUAL-422	2	1	1	-	2
7	Quality assurance in industry	PA-QUAL-426	2	1	-	1	2
8	Architectural design of drug factory	PA-FAC-425	3	2	-	1	3
9	Principles of marketing in pharmacy & pharmaceutical management	PA-MARK-414	2	2	-	-	2
			21	13	3	9	25

Examination of longitudinal courses (+re-sits) 1 week

Semester 8 Clinical Pharmacy [17 CHs-16 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Rational drug use	PA-RDU-427	Longit	1	-	1	2
2	Internal medicine	PA-MED-411	3	1	-	2	3
3	General surgery	PA-SURG-414	2	1	-	1	2
4	Emergency medicine	PA-MER-412	2	1	-	1	2
5	Chest and cardiology	PA-CVRS-413	2	1	-	2	2
6	Orthopedics	PA-ORTOP-415	2	1	-	1	2

7	Dermatology	PA-DERM-417	2	1	-	1	2
8	Ophthalmology	PA-OPTAL-416	1	-	-	1	1
9	Research methodology	PA-REC-429	2	2	-	-	2
			16	9		9	18

Examination of longitudinal courses (+re-sits) 1 week
Experience aboard (PA-FOREIEN-E-429):
Elective course during mid-semester (or end of year) vacation period

Semester 9 Clinical Pharmacy [21 CHs - 21 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Psychiatry	PA-SYC-522	3	2	-	1	3
2	Pediatric	PA-PED-524	3	2	-	1	3
3	Ear, Nose and Throat	PA-ENT-517	3	2	-	1	3
4	Obstetrics & Gynecology	PA-OBGYN-521	3	1	-	2	3
5	Family medicine	PA-FAM-523	3	1	-	2	3
6	Pharmaceutical Biotechnology	PA-BIOTEC-526	3	2	-	1	3
7	Medicinal chemistry-2	PA-CHEM-518	3	2	-	1	3
			21	12	0	9	21

Semester 10 Industrial Pharmacy [19 CHs-16 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Drug stability & Shelf-life study	PA-STAB-527	3	2	-	2	4
2	Biopharmaceutics & Pharmacokinetics	PA-BIOCEU-525	3	2	-	1	3

3	Herbal and alternative medicine and photochemical screening	PA-HERB-528	3	2	-	1	3
4	College drug mini factory design	PA-COLLAB-529	2	1	-	2	3
5	Home drug storage	PA-DRUG-530	1	1	-	1	2
6	Graduation Project	PA-REC-531	4	-	-	4	4
			16	8	-	11	19

CLERKSHIP EVALUATION is at the end of each clerkship= see ISO-9001 forms of evaluation.

COURSE OUTLINE

Detailed behavioural objectives, skills, assignments and problems are listed in each course book. The lists are too extensive to be included here:

Title	*Code*	*Semester/Duration*	*Credits*
ENGLISH LANGUAGE	ENG-113+123	1 and 2 Longitudinal	2

The sources of health information in the World are still in English. The Internet navigation to obtain information is basically in English. Some of the patients, attending clinics in Sudan, may only speak English language, especially with open-up of borders with economic development and of globalization. Passing the English language examination is an essential entry requirement to universities in Sudan. The general objectives of this course include: (1) correct pronunciation of medical terns, including those related to health services in the country, (2) correct reading and showing understanding of texts from medical books, (3) expressing one's self in good English describing his daily activities, career ambitions, present problems in health and current attempts at management, and (4) translating some pieces from English to Arabic, and three others from Arabic to English, both sets from medical literature.

Title	*Code*	*Semester/Duration*	*Credits*
INTRODUCTION TO MEDICINE AND MEDICAL EDUCATION	ME-EDU-114	1/Block 3 weeks	2

This is a three-week (2 CHs) block, starting with a simple medical problem that emphasize the meaning and message of health, health care delivery system in the country, the role of the physician in health care, role of other professional and administrative staff, priority health problems, concepts and principles of learning, adult education and learning, student centred and problem-based learning, instructional techniques (lecture, small group etc.), student assessment methods, holistic approach, interdisciplinarity and partnership concepts, curriculum development, College evaluation, leadership and professional ethics. Students are divided to groups to spend a week in a health facility, hospital theatre, hospital outpatient, health centre, various directorates and departments of Federal and State Ministries of Health, etc.. Meanwhile students are given discussion sessions on group dynamics and instructional methods, at the end of the course the groups present their field activity using a suitable audiovisual technique. Evaluation assesses the knowledge and attitudes of the students in these three areas: health system, group dynamics and instructional methods.

Title	*Code*	*Semester/Duration*	*Credits*
PHYSICS FOR MEDICAL EQUIPMENTS AND INVESTIGATIONS	ME-PHYS-115	1/Block 2 weeks	2

The basic principles of general physics are important for understanding certain mechanism that take part in the human body, and also, the technical background of many medical equipments. A medical professional is often confronted with a method of investigation or intervention that is based on simple physical or mechanical process in the human being and he/she has to deal cautiously with the machine and use it correctly

considering its proper maintenance and patient's and worker's safety. These include physical chemistry, gas laws, physics of light and sound, and radiation.

Title	Code	Semester/Duration	Credits
COMPUTER SCIENCE	COMP-116+124	1/Block 2 weeks	2

Most of the textbooks of medicine and allied sciences are available on CDs, in which a large volume of knowledge is saved and easily retrievable. There are many software packages demonstrating methods and techniques in clinical skills including patient rapport in history taking, clinical examination, investigations and management. Students and teacher can access the internet for the unlimited sources of health information, both at their professional level and public level for health education. Students and future doctors are educators who have to prepare smart documents and presentations for the health team and profession at large. Knowledge of programmed like Word, Excel, and PowerPoint are indispensable for anyone learner or teacher. Computer is important for students both in the developed or developing world, more so for the latter, who might not have inherited voluminous libraries in their Universities and have to utilize the virtual libraries available all over the world. Medical journal as hard copies are difficult to be owned by one institution, now almost all are available on-line for those who can use the computer efficiently. The course is intensive focusing on the basic principles of computer electronics and applications relevant to health science education. This is mainly on the hand on experience in dealing with famous programmed like DOS, Word, Excel, PowerPoint, Access and Internet Explorer. The use of CDs is stressed covered as well as having e-mails and navigating the internet for health information including how to access medical journals, and communicate with scientists worldwide.

Title	Code	Semester/Duration	Credits
BIOSTATISTICS	STAT-117	1/Block 2 weeks	2

A two-week course basic statistics as applied to health, to include: introduction to statistics, probabilities, data summary, presentation; measurement of central tendency; interpretation of variation (dispersion), population means, normal distribution; confidence interval, frequency distribution, sampling techniques, calculation and interpretation of the concept of confidence interval, the concept of p-value and its interpretation, the normal and skewed frequency distribution of biomedical data, and apply the appropriate test of significance for a given data set and a given research methodology (using t test as an example).

Title	Code	Semester/Duration	Credits

BASIC BIOCHEMISTRY	BIOCH-118	1/Block 3 weeks	2

A three-week block in Semester 1, to include: atomic structure, chemical bonding, chemical reactions, anabolism and catabolism, molecular formulae, solutions and solubility, molarity, molality, normality and molar fraction, acids and bases, buffers, hydrocarbons, isomerism, introduction organic compounds, classification of aliphatic and aromatic hydrocarbons, their properties and reactions; aldehydes and ketones, alcohols, phenols and ethers acids and amines benzenes and their derivatives; carbohydrates, lipids and proteins, vitamins and enzymes and coenzymes, carbohydrates, lipids, proteins, phospholipids, cholesterol, nucleic acids, nitrogen bases, enzymes and co-enzymes.

For students of pharmacy the course includes fundamentals of thermodynamics, and its application to chemical, biochemical and pharmaceutical systems.

Title	*Code*	*Semester/Duration*	*Credits*
GENETIC AND MOLECULAR BIOLOGY	ME-GET-119	2/Block 2 weeks	2

This is a detailed consideration of the functional aspects of cellular organelles and cyto-architecture with emphasis on eukaryotic cells, including signal transductional, neurotransmission, transport and processing of proteins, extracellular matrix proteins, cell adhesion. This is in addition to the synthesis of DNA, RNA and proteins, with special focus on DNA structure, transcription, translation, replication, recombinant DNA technology, eukaryotic viruses and control of cellular differentiation in normal and pathological states. Laboratory sessions include PCR techniques and applications.

Title	*Code*	*Semester/Duration*	*Credits*
COMPUTER SCIENCE-2	ME-COMP-124	2/Block 3 weeks	2

See ME-COMP-116

Phase 2: Semesters 2-6, Basic Pharmacy Courses

Islamic studies (ISLAM-121) - 2 CHs longitudinal (See ISLAM-111)
Arabic language (ARAB-122) - 2 CHs, longitudinal (See ARAB-112)
English language (ENG-123) -2 CHs longitudinal (See ENG-113)

Title	*Code*	*Semester/Duration*	*Credits*
ORGANIC CHEMISTRY	PA-CHEM-127 (216)	2,3/Block 3(4) weeks	3(4)

This includes systematic study of structure and function of organic material, including (1) Classification and nomenclature of organic compounds, chemical structure, physical and chemical properties. (2) Preparation and reactions, nucleophilic and electerophilic substitution reaction in aromatic system (Theory of resonance) (3) Orientation in electrophilic substitution reactions in benzene ring (4) Preparation and reactions of heterocyclic aromatic compounds, alkanes, alkenes and alkynes, the study of the functional groups such as alcohol, ether, epoxide amine, carboxylic acid, aldehyde and ketone, stereochemistry of organic molecules (5) Steriomerism, geometrical and optical isomerism and conformation, reaction mechanisms and stereochemistry of nucleophylic substitution, elimination and addition reactions, The theory and practice of UV, IR, NMR and mass spectroscopy.

(6) Free radicals: structure and stability.

For pharmacy it is introduction to pharmaceutical chemistry, the course includes the foundations for understanding drug action in terms of specific interactions drug molecules and biological targets. It focuses on the chemical and structural properties of major biological macromolecules that interact with drugs.

Title	*Code*	*Semester/Duration*	*Credits*
HUMAN BODY STRUCTURE AND FUNCTION	PA-ANAT-126	2/Block 4weeks	4

Upon the successful completion of this course the student will be able to describe and explain, at a basic level, the gross anatomy and introductory histology of the human body, especially the functional aspects of major tissues, organs, and systems including respiratory, cardiovascular, digestive, urinary, reproductive, endocrine and nervous with special emphasis on the interaction between these system and the major failures producing disease. More details are needed in neurobiology. There are some formal laboratory sessions. However a self-directed optional human anatomy laboratory is running all the time for independent study.

It also includes fundamentals of mammalian physiology in a systematic pattern: function of the nervous system (neurotransmitter, sensory and motor systems), endocrine gland and their secretions, bone and muscle physiology, cardiovascular, respiratory systems, gastrointestinal and renal physiology.

In addition it includes the characteristics, features and functions of neurons, ganglia, synapses, neuroeffector autonomic nervous system and somatic reflex arch.

The concepts, definitions, processes and mechanism of membrane potentials, somatic and autonomic transmission, receptor activation and production of response. The structure, organization and regulation of adrenergic and cholinergic systems. Mechanisms (pathophysiology) of diseases related to cholinergic system (e.g.

myasthenia gravis, peripheral neuropathy and diarrhea) and adrenergic system (e.g. hypotension, pheochromocytoma and asthma). Introduction to drugs affecting the autonomic system, their mechanism of action, metabolism, side effects, structure-activity relationships and clinical applications.

Title	*Code*	*Semester/Duration*	*Credits*
BEHAVIOURAL SCIENCE	BEHAV-119	2/Block 2 weeks	2

A two-week block during Semester 1, to include: (1) introducing psychology, psychoanalysis, defense mechanism manifesting as behaviours, (2) role of stress in the etiology of physical and psychological illness, (3) coping with loss, grief and death, (4) biological basis of behaviour (catecholamines, dopamine, neurotransmitters, neuropeptides, (5) cultural considerations in medical practice, (6) family structure and dynamics in health care, (6) health and illness behaviour, (7) personality, (8) terminology of psychiatric disease, (9) medical bases of substance and drug abuse.

Title	*Code*	*Semester/Duration*	*Credits*
PRINCIPLE OF DISEASE	ME-DIS-(212-213)	2,3/Block 3,3 weeks	3,3

This is a six-weeks divided into two blocks on general pathology and microbiology to include: (1) general histology, (2) morphology, classification, staining reactions, and pathogenicity of bacteria, viruses, fungi, (3) sterilization and disinfection, (4) basic concepts in immunity, (5) principles of inheritance, introduction to molecular biology, and genetic defects underlying inherited disorders, (6) general pathology of inflammation, neoplasia and abnormal cell growth, (7) parasites and parasitic diseases, (8) anti-microbial and anti-parasitic drugs.

Title	*Code*	*Semester/Duration*	*Credits*
PHARMACY ORIENTATION & CLACULATION	PA-CAL-128	2/Block 3 weeks	3

This is the first course introduced to the student about the pharmacy sciences. It is a three-week block in semester 1 to encompass: (1) Historical development of pharmacy: A survey of history of pharmacy through ancient, Greek and Arab periods with special reference to contribution of Muslim scientists to pharmacy and allied sciences. Introduction to pharmacy literature (pharmacopoeia, formularies, codices, abstracts, etc.) (2) Definition of pharmacy, different pharmaceutical sciences and role of pharmacist (3) Basic dispensing techniques and ethical communication with patients (4)

Introduction to dosage forms and routes of administration (5) Most of the important pharmaceutical calculations. (6) Introduction to prescription terminology, how can write, read and deal with prescription (main constituents of prescription).(7) Pharmacy abbreviations.(8)Preparation of simple dosage forms.(.(9)Types of measurements systems, conversion, percentage preparations.(10) Calculation of doses, dilutions, milliequivalents and millimoles.

Title	*Code*	*Semester/Duration*	*Credits*
PROFESSIONAL SKILLS-1,2,3 and 4	PA-SKIL-211, 221, 311, 321	3,4,5,6/Longitudinal	2

This course emphasizes oral communication skills to health professionals, including pharmacy for greater personal and professional confidence, in community pharmacy management or pharmacy owners and managers. It consists of small study groups presenting real life situations and role play. It involves communication skills, laboratory skills and pharmacy practices skills.

Title	*Code*	*Semester/Duration*	*Credits*
GENERAL AND PHYSICAL CHEMISTRY	PA-CHEM-217	3/Longitudinal	2

This course is deal with Solutions of non-electrolytes, concentration expressions ideal and real solutions, colligative properties of Solutions of electrolytes and ionic equilibria. Also it will broaden the student knowledge about modern theories of acids, bases and salts and methods of adjusting tonicity and pH.

Title	*Code*	*Semester/Duration*	*Credits*
PHARMACOLOGY -1&2	PA-PHARM- 2263 (222)	3(4)/Block 4 weeks	4(4)

These courses review the general principles of pharmacology, it includes: (1) History and scope of pharmacology, classification of pharmacology. Drug classification, nomenclature and sources (2) Drug delivery system: advantages and disadvantages of oral medication. Advantages and disadvantages of non-oral medications (3) pharmacokinetics: drug solubility and passage of drugs across body membranes, plasma concentration of drugs and various factors affecting it. Factors affecting absorption, distribution, biotransformation and excretion. (4) Pharmacodynamics: drug receptors and theories, mechanism of drug action, specify of drug action and factors modifying drug action,(5)Define following terms, bioavailability, bioequivalence, therapeutic index, potency, efficacy, risk benefit ratio, selective toxicity, plasma half-life, dose response curve, area under curve, volume of distribution.(6) Drug side effects/adverse reactions in humans (7) Pharmacology of specific systems; autonomic, blood, CVS, CNS ,GIT systems (8) chemotherapy, immunopharmacololgy , and Toxicology.(9) Drug discovery and use of drugs in research. (10) mechanisms, types, clinical significance, case studies, and patient management recommendations regarding drug interactions.

Title	*Code*	*Semester/Duration*	*Credits*
HUMAN ENDOCRINE AND DRUG METABOLISM	PA-METAB-214	3/Block 5 weeks	5

This review (done previously in Man and Environment) the relationship between the endocrine system and the nervous system in maintaining homeostatsis, general

anatomy and physiology of the endocrine system and the physiological function of each endocrine organs, etiology, pathophysiology, clinical manifestations or signs and symptoms of common endocrine diseases. Pharmacological aspects of drugs used in the treatment of these diseases (rationale, mechanism of action, structure-activity relationship and adverse effects.

Staff and student presentations and problem-solving sessions on human metabolism, its regulation and defects in common metabolic diseases. Introductory concepts in pharmaceutical chemistry and its application in area of drug metabolism, drug disposition and drug toxicity.

Title	*Code*	*Semester/Duration*	*Credits*
PHAMACOGNOSY AND PLANT SCIENCES-1 and (2)	PA-COG-215, (225)	3(4)/Block 5(3) weeks	5(4)

This is a study in the wide range of plants used in pharmacy, particularly in the rich tropical and subtropical environments. The course considers and utilizes local achievements in this field, provides primary knowledge of natural product drugs to the pharmacy student and gives a chance to students to explore traditional preparations tracing their scientific plant origin and guidance in the process of screening of medicinal plants. In this course, the student will study: history and importance of natural products, botanical characters of medicinal plants and study the different cell contents; natural health products as herbal medicines, homeopathy, complementary and alternative medicines and related substance; the student will also study selected examples to illustrate contemporary usage of natural products; production of natural drugs including their collection, preparation, storage conditions and their preparation for use either in the crude form or as extracts. The course will introduce the student to different biogenetic pathways of secondary metabolites formation and their classification. The study will include the active constituents of drugs containing: Carbohydrates, tannins, volatile oils, lipids, glycosides, alkaloids, and unorganized drugs. The course study some narcotic plants and toxic plant, aiming to provide the students with information about their identification and treatment of their poisoning. The course will also covers chromatographic principals and methodologies specially column and planner chromatography as well as their applications in evaluation of natural products.

Title	*Code*	*Semester/Duration*	*Credits*
PHAMACEUTICAL MICROBIOLOGY-1 and 2	PA-MIC-213, 316	4(5)/3 Block (3)weeks	3(3)

Provision of a basic understanding of the characteristics of the various types of microbial cell and their relevance to pharmacy. Basic instruction in the biology of microorganisms,

basic medical microbiology and infectious diseases. It includes especially bacteria, fungi and viruses, studied or presented under several aspects of their biology, mode of transmission, mechanism of disease production, methods of treatment and preventions. Microbial pathogenesis includes host-parasite relationships, infectious diseases, immunology and immunopathology, molecular genetics, as well as laboratory methods relevant to pharmacy disciplines such as the principles and basis of microorganisms control in the pharmaceuticals & medicinal products and in the hospital and manufacturing environment through physical and chemical agents through sterilization, disinfection and preservation processes. It also includes antimicrobial therapy. The emphasis here is on the principles of antimicrobial therapy and the clinical use of various antimicrobial agents in the therapeutic process of infectious diseases. knowledge about mechanism of action, efficacy & antimicrobial spectrum, common adverse effects or toxicity, pharmacokinetic characteristics, appropriate diagnostic test and appropriate dosing, monitoring of antimicrobial therapy.

Title	***Code***	***Semester/Duration***	***Credits***
MEDICINAL CHEMISTRY 1&2	PA-CHEM- 224 (518)	4(9)/Block 3(3)weeks	4(3)

To study the following with special reference to pharmaceutical applications: (1) Introduction to the fundamentals of medicinal chemistry and physicochemical properties of drugs relative to their biological effect (2) Classification of drugs on the basis of sources, structure, site of action and mode of action (3) Drug receptor interaction, structure activity relationship, physicochemical properties, chemical properties of the drugs, structural features of drugs. (3) Drug metabolism, inactive metabolites, biologically active metabolites, chemically reactive metabolites, phase I and phase II reactions.(4) preparation and properties of medicinally important heterocyclic compounds such as: pyrrol, furan, thiophene, pyridine, pyrimidine and pyrazine. (5) Preparation and properties of heterocyclic compounds in which benzene-ring fused with five and six membered ring containing one heteroatom: indol, quinolone and Isoquinolone (6) General properties, chemistry, biological action, structure activity relationship and therapeutic applications of Alicyclic compounds, Alkaloids, Vitamins and Hormones(7) Biological principles governing the properties of different drugs such as CNS depressants & stimulants, drugs acting on autonomic nervous system, antihistamines, analgesics & antipyretics , local anesthetics,, steroids drugs, cardiovascular agents, gastrointestinal drugs, respiratory drugs, diuretics, hypoglycemic agents, prostaglandins, antineoplastic& antimicrobial & anti-tubercular agents. It also includes topics on synthetic methods in organic and inorganic chemistry, and organic spectroscopic analysis.

Title	Code	Semester/Duration	Credits
UNIT PROCESS	PA-UNPR-226	4/3 Block (3) weeks	4

This course is introductory course to industrial pharmacy, the student study different unit process in pharmaceutical technology, starting from cleaning, weighting, to mixing, drying, flirtation and distillation, sterilization. The course also includes the storage design and conditions for raw materials and finished products. During this course the student will be introduced to (1) Mixing equipments used in liquid/solid and solid/solid mixing. Comminuting (size reduction), reasons for size reduction, factors affecting size reduction, size analysis. Sieving, energy mill, hammer mill (Ball mill, edge runer mill disintegrant, colloid mill, cutter mill, fluid energy mill, etc.,). (2) Drying: theory of drying, drying of solids, classification of dryers, general methods, fluidized bed systems, pneumatic systems, spray dryer, freeze drying.(3) Clarification and filtration theory, filter media, filter aids, filter selection, equipment used for filtration.(4) Evaporation, general principal of evaporation, evaporators, evaporation relationship, density, consolidation, granulation, friability, compression (dry method, wet method, slugging), physics of tableting. Tableting machines and other equipment required, problems involved in tableting, tablet coating. (6) Encapsulation: capsulation hard and soft gelatin capsules.

Title	Code	Semester/Duration	Credits
PHARMACEUTICAL ANALYSIS-1&2	PA-NAL- 312 (423)	5,7/3 Block (5)weeks	3(5)

This includes basic techniques and instrumentation applicable to pharmaceutical analysis: separation methods and quantitative analysis using chromatographic, titrametric, electrophotometric and spectroscopic methods. This course will introduce the student to the basic requirements common for drug analysis and or quality control for pharmaceuticals which concern with (1) General laboratory operations for development of analysis, assay of compounds based on chemical methods such as acid-base titration, oxidation-reduction titration, complexometric titration gravimetric, solvent extraction, and gasometric method (2) Potentiometric determination of pH of a solution and titration of an acid (3) Potentiometric determination of the strength of unknown solution of HCl with NaOH (4) Potentiometric determination of strength of acid in a mixture of HCl and CH_3COOH using standard alkali (5) Polarographic study (6) Conductemtric, refractometric and fluorimetric determination methods

(7) Spectroscopic methods ,ultraviolent spectrophotometry, visible spectrophotometry ,infrared spectrophotometry, atomic absorption spectroscopy, mass spectrometry, NMR spectroscopy, X-ray spectroscopy (8) Chromatographic methods e.g. thin layer , column chromatography, iron exchange chromatography, gas liquid chromatography , high performance liquid chromatography.

Title	*Code*	*Semester/Duration*	*Credits*
PHYSICAL PHARMACY	PA-PRAC- 317	5/Block 4 weeks	4

The overall objective of this course is to teach the student some of the most important basic physicochemical facts needed for studying and understanding the design and the preparation of dosage forms. It introduces the student to the basic facts related to information in particular on liquid and solid materials. It gives information of value to pharmaceutical systems, on properties of solutions and the principles underlying the formation of solutions (from solutes and solvents) and the factors that affect the dissolution process. The student will find out that the drug release and adsorption are strongly dependent on solution properties, such as solute dissociation and diffusion and flow properties. Micrometrics and particle size and shapes, distribution of particles methods, determination of particle size and importance of particle size in pharmacy. Study also the disperse system (e.g. colloids, suspensions, and emulsions). Rheological behaviour and some techniques of their measurement will be taught. Rate and order of reactions. Kinetic principles and stability testing. The course links the pharmacy orientation and calculation course (already taught) with the more applied courses (Industrial pharmacy, biopharmaceutics and pharmacokinetics to be taught as to yet).

Title	*Code*	*Semester/Duration*	*Credits*
POWDER TECHENOLOGY	PA-PWTEC-314	5/Block 3 weeks	4

The student will continue study in this course the rheology of powder with emphasized on the physical properties of powder, the methods and apparatus used in particle size reduction and analysis, also the methods of mixing and instruments used in measurements, the flow properties of the powder and its problems.

Title	*Code*	*Semester/Duration*	*Credits*
PHARMACEUTICAL TECHNOLOGY	PA-TEC-315	5/Block 4weeks	4

This course provides in-depth study of physical and chemical principles which are involved in the development, formation and stabilization of selected pharmaceutical dosage forms for optimization of drug bioavailability and therapeutic utility. The students learn about formulation, preparation of tablet and capsules, liquid and semisolid dosage forms. The study include powder technology (granulation and pelletuzation), tableting, coating, encapsulation and packing of pharmaceutical products, also this course involves the assessment of dosage forms according to pharmacopeias, problems of manufacturing process of each dosage form, non-conventional dosage forms and their delivery systems, novel drug delivery systems, active and passive drug delivery system, other novel GIT systems, novel topical drug delivery systems. Modified drug release dosage form, the concept of sustained release, first order release approximation, multiple dosing, implementation of designing, approaches based upon dosage form

modifications. Product evaluation and testing, matrices tablets, control release technology, method of particle coating, instrumentation in granule manufacturing. Stability of different dosage forms and packing materials.

Title	*Code*	*Semester/Duration*	*Credits*
PHARMACY PRACTICE-1 and (2)	PA-PRAC- 313 (323)	5/Block 4(3)weeks	3(4)

Pharmacy practice includes professional conduct, prescription laws, scope and authority of programmed which relate to legal and ethical practice of pharmacy, focus on conceptual understanding of regulatory agencies and how pharmacy practically and ethically interacts with them, patient interviewing and communication skills, therapeutics of non-prescription products, ethics and home laboratory testing, pharmacy practice environments (principles of preservation and sterilization, aseptic technique and sterile rooms in ophthalmic and parenteral products and infusion devices, contamination and integrity of package tests.

The practice involves knowledge and skills in health economics as it applies to pharmaceuticals, as well as management techniques used to develop innovative pharmaceutical services, from needs analysis to business case presentation. Students should be reminded also on career opportunities in pharmacy..

It should include organization and management concepts, in health system integration, inter-organizational linkages, strategies and plans, health service improvement of policies and regulations, financial management, alternative therapies, contemporary perspectives in organizational psychology and behaviour, leading or helping in leading the human resource potential of a health team or diverse specialty workforce.

Title	*Code*	*Semester/Duration*	*Credits*
INTRODUCTION TO CLINICAL PHARMACY	PA-CLIN-322	6/ Longitudinal	2

This is an introduction to clinical pharmacy and pharmaceutical care. In addition to the theoretical concepts, students will be exposed to patients and patient medical records, drug basic pathophysiology of common diseases (respiratory, cardiovascular, gastrointestinal, cancer, endocrine, metabolic and nervous), drug formulary, therapy choice, drug monitoring and concepts and practical experience (problem-based) sessions on poisoning and toxicity. Topics include clinical pharmacokinetics of some selected drugs. The course reviews the behavioural aspects of working as a member of complementary health team.

Title	Code	Semester/Duration	Credits
PHARMACO-EPIDEMOLOGY & ECONOMICS	PA-EPIC-327	6/Block 3 weeks	3

Because of growing pressure on the health care budget on the underdeveloped countries particularly in Sudan, appropriate justification of current expenditures and future investments' in public healthcare are becoming increasingly important. It is anticipated that international pharmaceutical companies will increasingly invest in pharmacoeconomics while government staff will become more experienced in appraising the dossiers, thus resulting in upward momentum in the quality and usability of pharmacoeconomic data.

This course shall make student understand the link between cost effectiveness and utility or quality of life and use appropriate different styles of analysis and came up with right decision to use or not to use the specific medicine.

Title	Code	Semester/Duration	Credits
DOSAGE FORM DESIGN	PA-DOS-326	6/Block 3 weeks	4

This course is about the fundamentals of pharmaceutical processing, formulation and biopharmaceutical considerations. It offers knowledge and skills on how drug dosage forms can be used as drug delivery systems, assuming that the student is introduced to routes of administration, pharmaceutics, biopharmaceutics, bioavailability, bioequivalency, rate and extent of availability, onset and duration of effect, getting to the site of absorption, dissolution, disintegration, first-pass effect, passive diffusion, and active transport. Emphasis includes stability, storage and packaging.

The student learns the major physical, chemical and biological factors which affect the design of dosage forms as drug delivery systems and the interactions among those factors. It emphasizes how to communicate knowledge of drug delivery systems to their clients (physicians and patients) to ensure proper handling and use.

The forms include tablet, capsule, liquid, dermatological and transdermal preparations, sustained release forms, aerosol, inhalation preparations and novel drug delivery systems.

Title	Code	Semester/Duration	Credits
BASIC THERAPEUTICS	PA-TREAT-325	6/Block 4 weeks	4

A four-week block for medical management of disease conditions, to include: (1) definition of a drug, (2) development of a drug, (3) drug absorption and dynamics, (4) rational use of drugs in the management of emergency and common problems, including drug prescription for rhinitis, sinusitis, laryngitis, bronchitis, pneumonia, pulmonary TB, (5) interaction between drugs and of genes. With drugs for example glucose-6 phosphate dehydrogenase deficiency and sulphonamides and antimalarials, (6) clarify interrelationship between bacterial infections, inflammatory mediators, anti-inflammatory drugs and antimicrobial drugs, (7) effects of morphine, (8) clinical uses and side effects of aspirin, paracetamol, and non-steroidal anti-inflammatory drugs, (9) outline the use and side effects of levodopa (in parkinson's disease), tricyclic antidepressants (in depression), benzodiazepines (in insomnia), antipsychotic drugs (in schizophrenia), antiepileptics (in seizures), muscarine antagonists, anticholinestrases, sympathomimetics, chemotherapeutic agents and beta blockers. The course taught as problem-based pharmacotherapy and includes also precautions in the proper selection, dosage monitoring of drug, and recognition of clinically significant, efficacious and/or toxic drug interactions.

Title	Code	Semester/Duration	Credits
PHARMACO-INFORMATICS	PA-INFO-324	6/Block 3 weeks	4

This is a course on the current and evolving information technologies, planning management and operational issues associated with information technology. It emphasizes building fundamental skills in healthcare informatics, database design and applications, pharmacy components of medical records, electronic medical records, clinical (pharmacy) systems, drug information systems, genome project and its clinical applications: pharmacogenomics, telemedicine, privacy and security for clinical and pharmacy data, informatics as applied in pharmacy robotics, survey and evaluation of online sources.

The course requires adequate orientation to clinical services including patient interview techniques, managing patient visits and records, actual experience in drug information retrieval, analysis and dissemination. Utilization of clinical drug literature

Phase 3 : Clerkships for Industrial and Clinical Rotation

Title	*Code*	*Semester/Duration*	*Credits*
DRUG ABUSE	PA-DAB-411	7/Longitudinal	2

This a longitudinal course introduced the students to forensic pharmacy and pharmacy laws and emphasis on the problems of drug abuse and intoxications could occur from such abuse such as ethanol intoxication and methanol intoxication and who are the groups vulnerable to intoxication. Also the course contains the poisonous gases and hair dye poisoning problems. The student also study the international control of narcotic and drugs of abuse

Title	*Code*	*Semester/Duration*	*Credits*
MEDICAL ETHICS & FORENSIC PHARMACY	ME-LAW-413	7/Longitudinal	2

The student should show an understanding of the (1) history of medicine; before and during the Islamic era, (2) the role of the Moslem scholars in the practice of medicine, research and medical ethics, (3) the milestones of medical education in the Islamic era, (4) the fight of illness and the sick, the religious regulations concerning treating the sick person, how does the sick person performs his rituals: cleanliness, prayers, fasting, pilgrimage? Also, (5) the visiting of sick person, (6) managing a death episode, (7) the religious conduct when males are managing female disease and vice versa, (8) the emerging controversial ties of vitro fertilization, transplantation, brain death, cloning, genetic engineering. Students should be aware of the (9) Fight of health preservation including cleanliness, sleep, moderation in eating and drinking, the jurisprudence of toxic substances and narcotics, infectious diseases, breast feeding, consanguity marriage, quarantine, death and funerals, dissection of human body for teaching and law, (10) medical behaviour, professional ethics, responsibility of a health professional, (11) issues in protection of acts of a health professional and (12) giving an expert witness at court. (13) identification of drug causes of death (14) description of postmortem changes from poisons and drug intoxications, and determination of the time of death, (15) identification common types of toxins, poisons and poisoning, and determination of the environmental and criminal causes of common poisoning incidents.

Title	*Code*	*Semester/Duration*	*Credits*
DRUG DESIDN	PA-DRUG-421	7/5 weeks	5

This a four weeks four credit hours course. The principal of Drug Design course aims to provide students with understanding of the process of drug discovery and development from identification of novel drug targets to the introduction of new drugs into clinical practice. It covers the basic principles of how new drugs are discovered with emphasis on lead identification and lead optimization, classification and kinetics of molecules targeting enzymes and receptors, prodrug design and applications, as well as structure-

based drug design methods. Recent advances in the use of computational and combinatorial chemistry in the drug design. This course builds upon the foundation of chemical knowledge on structure-function relationship of proteins, enzymes, peptides, carbohydrates and lipid biochemistry. Drug designing, discovery of lead structure (different approaches) . DNA recombinant technology/Genetic engineering (with reference to drug designing) structure- activity relationships of complex drug molecules specifically information on chemically important aspects of drug delivery, stability, receptor affinity and selectivity, metabolic vulnerability and distribution.

Title	*Code*	*Semester/Duration*	*Credits*
PACKING TECHENOLOGY	PA-PAC-424	7/2 weeks	2

This a four weeks four credit hours course. In this course the student study the packing materials and packing design. The student introduced to different type of packing materials come in contact and outer packs and the advantage and disadvantage of each type. The student can differentiate between Aluminum foil pack, PVC pack. Plastic pack and paper pack, also the method of synthesis of each type.

Title	*Code*	*Semester/Duration*	*Credits*
QUALITY ASSURANCE-1and (2)	PA-QUAL -422 (426)	7/Block 2 (2)weeks	2(2)

This starts with an introduction to the general concepts of quality assurance, specific application to pharmaceutical and pharmacy practice in environmental control, scrutiny of raw materials, control of solid and liquid dosage forms, packaging, storage, distribution, and statistics of stocks and methods of process control. Validation of pharmaceutical processes, control of components and drug product containers and doses. Production and processes controls. Packing and labeling controls, holding and distribution, repacking and relabeling. Regulating basis for person validation, sterilization validation of sterile products. Validation of solid dosage form. process of validation and quality assurance. Prospective process validation, validation of water system for sterile and nonsterile products, cleaning validation, equipment validation, process validation of raw materials. Analytical method validation. It also include different tests of liquid, emulsion, solid state and release product, general knowledge of B.P, USP etc.

Title	*Code*	*Semester/Duration*	*Credits*
ARCHITECTURAL DESIGN OF DRUG FACTORY	PA-FAC-425	7/Block 3 weeks	3

After completion basic theoretical lectures and practical hours in the college about pharmaceutical technology and quality assurance the students have to visit a

pharmaceutical factory in Sudan as three weeks three credit hours field work to come over the GMP requirements for architectural design, documentary system during each production process, also to understand the concept of Standard Operating Procedures (SOP) in different lines of production units (Tablet, Capsules, Liquid and Semisolid lines), Also the students have the chance to make a visit to premises outside Sudan as an elective course during mid-semester vacation period to get some experience aboard.

Title	*Code*	*Semester/Duration*	*Credits*
PRINCIPLES OF MARKETING & MANAGEMENT IN PHARMACY	PA-MARK-414	7/Block 2weeks	2

The student shall enter the market of employment facing different challenges. This course will extend the circle of consciousness of students beyond their recent environment, and will highlight the different aspects of market supply them with excellent understand of different patterns and forces harmonizing the market locally and internationally to master their own road and dealing with different situations, and how to overcome problems, and convince other people and know how to organize themselves, their work and acquire self-confidence. The student should be able (1) understand the right concept of marketing (2) understand the structure of market (3) Understand the different behaviours of market & market orientation (4) understand the global activities of market (5) understand the need of market and customer and how to satisfy them profitably (6) understand the customer behaviours and handle them in right way.(6) Understand nature and principles of management, types and functions of managers (7) production management, marketing management, sales management, (8) Planning, purpose and types of planning, steps in planning,. Organizing management control systems. Requirements for adequate control. Critical control points and standards. Motivation, innovation and creativity, communication.

Title	*Code*	*Semester/Duration*	*Credits*
RATIONAL DRUG USE	PA-RDU-427	8/Longitudinal	2

Irrational use of medicines is a major problem worldwide. WHO estimates that more than half of all medicines are prescribed, dispensed or sold inappropriately, and that half of patients failed to take them correctly. In this longitudinal course the student s (1) discuss the concept of rational use of medicines (2) familiarize themselves with the concept of essential drugs and understand it importance in promotion drug use (3) identify the major causative factors underlining irrational use of medicines, its various forms and provide clinically significant examples. (4) Discuss the current trends of polypharmacy. (5) Recognize the advantages and potential benefits of therapeutic guidelines and standards treatment protocols on promoting appropriate use (6) reviews

different intervention strategies and assess their potentials in promoting rational use of medicines. (7) Asses rationality of drug prescribing, dispensing use and health care provision of services. (8) Recognize the important interactions between health care providers (medical doctor as prescribers and pharmacist as dispensers). (9) Acquire pharmacotherapeutic knowledge essential to development of the scientific basis of the concept of rationality (e.g. the outcome of triple interactions, drug, diet, disease DDDIs).

Title	*Code*	*Semester/Duration*	*Credits*
INTERNAL MEDICINE	PA-MED-411	8/ Block 3 weeks	3

This is a 3-week continuous block, clerkship and bed side training in hospitals. During this 3-week clerkship, the student (1) demonstrate good attitudes, ethics and professional behaviour in the pharmacy practice in internal medicine (2) general knowledge of obtaining history relevant to the medical problem in general practice, develop an idea on physical examination and the requesting suitable investigations, not requested to suggest differential or provide diagnosis. He has to select (or suggest) proper treatment, for the condition and advice both physician and patient on drugs used, with special emphasis on essential drugs used in common medical problems (headache/migraine and various types of pains and colics, seizures, meningitis/encephalitis, malaria, typhoid fever, schistosomiasis, leishmaniasis, hypertension, stroke, dementia, disorders of the motor systems. coronary heart disease, congestive heart failure, arrhythmias, pneumonia, asthma, causes of dyspepsia, nephrosis, nephritis and renal failure, diabetes, worm infestations, vomiting diarrhea, constipation, dehydration, nutritional deficiencies, anemias, hematological malignancy, bleeding disorders, thyroid disease, obesity, adrenal insufficiency, Cushing syndrome, osteoarthritis, rheumatoid arthritis, SLE, gout.

Title	*Code*	*Semester/Duration*	*Credits*
GENERAL SURGERY (including anaesthesia)	PA-SURG-414	8/ Block 2weeks	2

A two-week continuous block, interrupted clerkship and bed side training in hospitals, to include: (1) demonstrating good attitudes, ethics and professional behaviour in the department of surgery (2) demonstrating knowledge of basic pharmacy sciences relevant to the practice of surgery, (3) Acting promptly in urgent and emergency surgical conditions, e.g. burns, acute abdomen, head injury, (see also ERM-407, (4) outline drug management of cardiac surgical problems, brain tumors, abdominal masses, (5) anesthetics for preoperative and postoperative drug management, (6) detail essential drugs used in general surgery.

Title	Code	Semester/Duration	Credits
EMERGENCY MEDICINE	PA-MER-412	8/ Block 2 weeks	2

A two-week block clerkship and bed side training in hospitals designed to contain common medical and surgical emergencies seen in Emergency Department, mostly undifferentiated cases, that require life-saving management (drugs and preparations used) including prioritization, resuscitation and stabilization, simultaneous management of more than one patient, focus on relevant treatment history and terminology of working differential diagnosis and quick courageous attitude, and documentation of drug records of the patient, psychological care, and ethical issues in emergency. Emergency conditions include: trauma resuscitation, poisoning, cardiac dysrythmias, myocardial infarction, epilepsy and seizures, coma, status asthmaticus, urine retention, acute abdomen.

Title	Code	Semester/Duration	Credits
CHEST & CARDIOLOGY	PA-CVRS-413	8/ Block 2 weeks	2

A two-week block, clerkship and bed side training in hospitals to include: (1) reviewing the pharmacy sciences relevant to cardiology (2) outline drug management of cardiac problems such as congestive heart failure, hypertension etc……. (3) reviewing the pharmacy sciences relevant to chest (4) outline drug management of problems such as asthma and COPD (5) drug management of emergency in cardiac& chest problem.

Title	Code	Semester/Duration	Credits
ORTHOPEDIC SURGERY	PA-ORTOP-415	8/ Block 2 weeks	2

A two-week block, after or in integration with the general surgery clerkship & surgery to include: (1) reviewing the pharmacy sciences relevant to orthopedic practices (3) outline drug management of emergency and trauma in orthopedics (multiple injuries after road traffic and other accidents, (4) principles of fracture pain management,
(5) management of pain in common pyogenic and chronic bone and joint infections, rheumatoid arthritis and osteoarthritis, (6) recognizing, diagnose and outline subsequent steps in the management of back pain, congenital dislocation of hip, and (7) detail essential drugs used in orthopedic problems.

Title	Code	Semester/Duration	Credits
DERMATOLOGY	PA-DERM-417	8/ Block 2 week	2

A two-week block, clerkship and bed side training in hospitals, to include: (1) outlining the basics of dermatologic terminology, (3) presented with any of the following real, verbal or written dermatologic problems/conditions (already diagnosed) suggest drug management and anticipate main and side or toxic effects: the conditions are (a) acne and related disorders: acne, rosacea and perioral dermatitis, (b) eczema (endogenous and exogenous) and atopic and seborrheic dermatitis, (c) papulosquamous diseases: psoriasis, lichen planus, pityriasis rosea, (d) pigmentary disorders: vitiligo, melasma, (e) common skin infections: fruncle, carbuncle, impetigo, cellulites, dermatophytosis, candidiasis, viral wart, herpetic infections, molluscum, scabies, leishmaniasis, (f) bullous diseases: pemphigus, bullous pemphigoid, dermatitis herpetiformis, (g) connective tissue diseases: lupus, dermatomyositis, scleroderma, (h) drug reactions.

Title	Code	Semester/Duration	Credits
OPHTHALMOLOGY	PA-OPTAL-416	8/ Block 1 weeks	1

A one-week block, clerkship to include: (1) recognize the critical role of the primary care pharmacist in preventing visual loss through prompt and appropriate treatment and timely referral, (2) drug management of ocular emergencies and trauma, (3) outline subsequent steps in drug management of the common ocular conditions: red eye, impaired vision, painful eye, cataract, glaucoma, exophthalmos, retinopathy or eye manifestations of systemic disease, abnormal ocular mobility, (5) detail essential drugs used in ophthalmology.

Title	*Code*	*Semester/Duration*	*Credits*
RESEARCH METHEDOLOGY	PA-REC-429	8/2 Block 2weeks	2

A two-week block of two credit hours, the student before graduation have to conduct a research as a graduation project, so he have to be acquired about the method of research. This road map course learns how to conduct a research. It includes (1) Introduction to research methodology and identification of research problems (2) Types of data (3) Formulation of research objectives (4) Types of studies and research designs (6) Sampling and sample size calculation (7) Data collection (8) Data processing and analysis (9) proposal and research writing. By the end of this course the student could be able to clarify the way a research is conducted so as to perform their own researches, and to explain research terminology and process and also differentiate between different types of research studies and understand published scientific papers and gain ability to perform research.

Title	*Code*	*Semester/Duration*	*Credits*
PSYCHIATRY	PA-SYC-522	9 / Block 3 weeks	3

A three-week block, anytime during semester 9, clerkship and bed side training in hospitals to include: (1) demonstrating professional ethics and attitudes appropriate for mental health practice, (2) establishing a rapport with a variety of patients and families, being aware of own emotional responses and family concerns on raising certain in appropriate questions, to help in compliance of drug treatment (3) being aware of the various relevant biological, psychological and social factors related to the etiology and management and rehabilitation of a psychiatric patient, (4) drug management of psychiatric emergencies (e.g. hostile or aggressive patient), depression, schizophrenia (5) drug management of) mood disorders (e.g. mania), anxiety (e.g. panic, obsessive compulsive, phobias), personality disorders, cognitive impairment and substance (chemical. alcohol, drug) use disorders, dementia, delirium, psychoses, human sexuality problems, and (6) detail essential drugs used in psychiatric practice.

Title	Code	Semester/Duration	Credits
PEDIATRICS	PA-PED-524	9 / Block 3 weeks	3

A three-week continuous block, some of the contents is more relevant to include: (1) demonstrate professional ethics and attitudes appropriate for pediatric practice, (2) review the pharmacy sciences relevant to child/ adolescent problems, (3) suggest drug management of emergency pediatric conditions (convulsions, fever, dehydration, respiratory distress, etc..), common neonatal problems, child nutritional problems, (4) suggest drug management of nephritis, nephritis, renal failure, obstructive uropathy, IDDM and other endocrine disorders in childhood, congenital and acquired heart disease, childhood malignancies (6) analyzing community problems related to child health, immunization and disorders of immunity, and (7) essential drugs used in pediatric practice.

Title	Code	Semester/Duration	Credits
EAR, NOSE AND THROAT	PA-ENT-517	9 / Block 3 weeks	3

A three-week block, clerkship and bed side training in hospitals, addressing clinical activities in the ENT department, using knowledge of basic pharmacy sciences in recommending drug management done by senior members of the ENT health team. Details of medications in the following disorders:, common cold, sinusitis, tonsillitis, laryngitis, otitis media, and neoplasia, and detail essential drugs used in ENT practice.

Title	Code	Semester/Duration	Credits
OBSTETRICS AND GYNECOLOGY	PA-OBGYN-521	9 / Block 3 weeks	3

During the three-week clerkship, the student (1) demonstrate good attitudes, ethics and professional behaviour in the practice of OB/GYN, (2) recognize the terminology and basic presentations of problems seen in antenatal care (contraception, infertility, bleeding in early or late pregnancy, pregnancy complicated with systemic disease, high risk pregnancy, disorders of menstrual cycle and outline their drug management) and in urgent and emergency obse/gyn conditions, (3) drug management of in community problems related to women health, (6) drugs indicated labor progress, monitoring and control, genital infections, and (4) detail essential drugs used in obse/gyn problems, including male and female sexual lives.

Title	Code	Semester/Duration	Credits
FAMILY MEDICINE	PA-FAM-523	9 / Block 3 weeks	3

This three-week block ,ideally the student should be attached to a known family in the vicinity of the University early on in the curriculum the last four week consolidate his/her activity during the attachment. Alternatively the following components should be covered: basic interviewing, communication skills and nutritional counseling, approach to drug management of headache, backache, dyspepsia, a febrile child, vaccination, bronchial asthma, hypertension, diabetes mellitus, sore throat, iron deficiency anemia, irritable bowel syndrome, intestinal worms, otitis media, depression, anxiety and other psychiatric problems, obesity, smoking habit, alcoholism, drug addiction, ischemic heart disease, arthritis.

Title	Code	Semester/Duration	Credits
PHARMACEUTICAL BIOTECHENOLOGY	PA-BIOTEC-526	9 / Block 3 weeks	2

This course includes an extensive study of the biotechnological approaches that have a great value in production of human useful compounds. During this course, the student will learn many different techniques that help us to produce clinically useful compound like drugs produced via fermentation and plant tissue culturing, furthermore, production of clinically and scientifically implicated products through recombinant DNA technology. The course is covering many important topics including cell culture, composition, and function. The methods that help the scientist to produce and improve the recombinant DNA will be discussed, including restriction enzymes, plasmids, polymerase chain reactions, DNA sequencing, and quantification of DNA via southern blot analysis. Gene therapy and the production of transgenic and knockout animal, monoclonal antibodies and vaccines will be discusses.

The course will also cover the method and techniques employed for screening medicinal plants for their bioactive constituents such as photochemical screening. It also discusses recent developments regarding methods of extraction, isolation, purification and application of the spectroscopic techniques for the identification and interpretation of their spectral data.

Title	Code	Semester/Duration	Credits
DRUG STABILITY & SHELF LIFE STUDY	PA-STAB-527	10/ Block 3 weeks	4

These three weeks of four credit hours course. In this course the student study different factors affecting stability of different pharmaceutical dosage forms such as temperature,

light, humidity, etc,,,. It includes the study of physical and chemical stability, accelerated and real time stability, problems of stability. The student could be able to know how to calculate the shelf-life of drug.

Title	Code	Semester/Duration	Credits
BIOPHARMACEUTICS & PHARMACOKINETICS	PA-BIOCEU-525	10/ Block 3 weeks	3

This a three weeks three credit hours course. In this course the student study the mathematical characterization of the process of absorption, distribution, elimination of drugs, know about body compartments (One compartments and two compartments), pharmacokinetics parameters such as half-life of the drug, T max and C max, bioavailability of the drug etc…,

Title	Code	Semester/Duration	Credits
HERBAL & ALTERNATIVE MEDICINE & PHYTOCHEMICAL SCREENING	PA-HERB-528	9 / Block 3 weeks	3

This course addresses the rapid growth of nonprescription herbal products marketed in pharmacy herbal and food supplement stores and therefore it is designed to assist the student in selection of nonprescription products for patients whose choose self-medication, the course will discuss mechanisms of actions, adverse effects, contraindications precautions, drug-drug interactions and drug herbal interactions of nonprescription drugs to help class participants to be better informed of health care providers. The pharmacopeia standards and quality control methods for herbal methods will be also covered. At the conclusion of this course, the students will be able to: (1) Understand the use and side effects of natural products and over-the-counter drugs used to treat common disease states, (2) Determine possible contraindication and interactions (3) Select appropriate nonprescription products and/or natural products if indicated (4) consult the patient on the proper dosage and use of the product, (5) Monitor the patients' response to the recommended therapy.

Title	Code	Semester/Duration	Credits
COLLEGE DRUG MINI FACTORY DESIGN	PA-COLLB-529	10/ Block 2 weeks	2

This a three weeks two credit hours course. In this course the student study of principles of drug mini factory design and examples of dosage forms application in the mini factory also the location importance and necessity of architectural design to meet the GMP requirements

Title	*Code*	*Semester/Duration*	*Credits*
HOME DRUG STORGE	PA-HDSTOT-530	10/ Block 1 weeks	2

This one week two credit hours course. In this course the student introduced to the home drug concept, also the chronic and acute disease home drug storage and emergency drugs home drug storage and first aid services could be offered by pharmacist,

Title	*Code*	*Semester/Duration*	*Credits*
GRADUATION PROJECT	PA-REC-531	10/Block 4 weeks	4

Pharmacy sciences are rich areas in research topics. As the student learned a research methodology in semester 8 the student required to fulfill his study by doing a graduation project in any field of pharmacy sciences. The student is given the choice of one project from the following areas: pharmaceutics (formulation and development of suspension, emulsions, tablet, semi-solid preparations, microcapsules, sustained release tablet and determinations of stability, storage time and expiry date). Pharmacology (Experimental, applied pharmacology), Clinical pharmacy or Industrial pharmacy (pharmaceutical technology or quality assurance), pharmacognosy, pharmaceutical chemistry etc….